Leprosy in individuals under the age of fifteen in priority cities, Mato Grosso, Brazil

Hanseníase em menores de quinze anos em municípios prioritários, Mato Grosso, Brasil

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ABSTRACT: *Objectives:* We aimed to compare the sociodemographic, clinical and epidemiological characteristics of individuals under the age of 15, reported to have leprosy, and who lived in priority and non-priority cities, as well as to compare the spatial distribution of these reported cases in such cities. This is a cross-sectional study of new leprosy cases in individuals under the age of 15 (n=429) registered in the Information System for Notifiable Diseases from the State of Mato Grosso, Brazil, between 2011 and 2013. The diagnosed cases were compared regarding sociodemographic, clinical and epidemiological aspects using the chi-square test at a 5% significance level. The spatial distribution was made through ArcGIS 10.2 software. *Results:* Of the 141 assessed cities in the state, according to the spatial distribution, 58.1% (n=82) showed a high, very high and hyper-endemic mean incidence coefficient, and, of these, 34.1% (n=28) include the group of priority municipalities. Of the new cases included in the study, 73.9% (n=317) were reported in priority cities. We observed a difference in the proportion of cases registered among the cities, with a greater proportion in priority cities, in the age group from five to nine years old (χ^2=4.09; p=0.043), in the white race (χ^2=7.01; p=0.008) and in the tuberculoid clinical form (χ^2=3.89; p=0.048). There was a greater proportion in non-priority cases with regard to non-urban areas (χ^2=24.23; p<0.001), two to five skin lesions (χ^2=5.93; p=0.014) and spontaneous demand (χ^2=6.16; p=0.013). *Conclusion:* The differences highlighted regarding clinical and epidemiological characteristics between the cities demonstrate the difficulty of endemic control in both municipality groups.

Keywords: Leprosy. Epidemiology. Epidemiological Surveillance. Residence Characteristics. Child. Adolescent.

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RESUMO: *Objetivos:* Comparar as características sociodemográficas, clínicas e epidemiológicas de indivíduos menores de 15 anos notificados com hanseníase entre os municípios prioritários e os não prioritários, bem como a distribuição espacial destes casos registrados em tais municípios. Trata-se de um estudo transversal a partir de casos novos de hanseníase em menores de 15 anos (n=429) registrados no Sistema de Informação de Agravos de Notificação do estado de Mato Grosso, entre 2011 e 2013. Os casos diagnosticados foram comparados quanto aos aspectos sociodemográficos, clínicos e epidemiológico por meio do teste do qui-quadrado ao nível de significância de 5%. A distribuição espacial foi feita por meio do software ArcGis 10.2. *Resultados:* Dos 141 municípios do estado avaliados segundo a distribuição espacial, 58,1% (n=82) apresentaram coeficiente médio de incidência alto, muito alto e hiperendêmico, sendo que, destes, 34,1% (n=28) contemplam o grupo dos prioritários. Dos casos novos incluídos no estudo, 73,9% (n=317) foram notificados em municípios prioritários. Observou-se diferença na proporção de casos registrados entre os municípios, com maior proporção nos prioritários quanto à idade de 5 a 9 anos (χ^2=4,09; p=0,043), raça branca (χ^2=7,01; p=0,008) e forma clínica tuberculoide (χ^2=3,89; p=0,048), e maior proporção nos não prioritários quanto à zona não urbana (χ^2=24,23; p<0,001), duas a cinco lesões (χ^2=5,93; p=0,014) e demanda espontânea (χ^2=6,16; p=0,013). *Conclusão:* As diferenças evidenciadas em relação às características clínicas e epidemiológicas entre os municípios demonstram a dificuldade de controle da endemia em ambos os grupos de municípios.

Palavras-chave: Hanseníase. Epidemiologia. Vigilância Epidemiológica. Distribuição Espacial. Criança. Adolescente.

INTRODUCTION

Leprosy is considered to be a public health problem in Brazil and, although it is more evident in adults, children under 15 years old are also susceptible to the infection if they come into contact with bacilliferous individuals. As such, they are considered more vulnerable[1].

When leprosy is detected in children under 15 years old, it indicates the presence of an endemic disease and suggests the intense circulation of Mycobacterium leprae, which includes active and recent transmission of the disease[2]. The prevalence of the disease in this population depends on the degree of their exposure to bacillus, which is higher in endemic regions and reflects a deficit with regard to surveillance and disease control[3].

The time between the onset of signs and symptoms of the disease and the making of a diagnosis is one of the factors associated with the presence of physical disability. That is, the longer the diagnosis is delayed, the greater the chances of physical deformities, disabilities, and transmission[4].

Records of leprosy cases in children under 15 in the country showed that one third of these individuals were centralized in 43 Brazilian cities, and that the disease burden was concentrated in 15 Federal Units, including Mato Grosso[5].

In view of the heterogeneous distribution of the disease in Brazil, the Ministry of Health (MS), with the aim of eliminating leprosy as a public health problem throughout the country, prioritized 258 municipalities with a higher concentration of the endemic disease. Of these, 29 were located in the state of Mato Grosso, which received financial incentives

for the reorganization of care services and for the strengthening of epidemiological surveillance measures starting in 2011[6].

A municipality was labeled a priority in 2010 when it had a detection coefficient greater than 20 per 100,000 inhabitants, a minimum number of 10 cases in the general population, and 1 case in children under 15 years old in areas at risk; 50 new cases in metropolitan areas and out of risk areas, with at least 5 cases in children under 15 years old and all capital cities[6].

The municipalities received a financial incentive when the epidemiological surveillance measures were adhered to and verified. Furthermore, it implied the municipalities' commitment with regard to the fulfillment of certain goals, such as the active search for cases, intra-domiciliary contact surveys for early detection, and treatment available until the patient is fully cured[7].

The MS started a campaign to detect cases of leprosy in children under 15 years of age through an active search for cases in school environments. Schools are institutional areas that provide health education and allow for the detection of leprosy early on, thus giving a greater incentive to priority areas[8].

The MS, when it prioritized municipalities, committed to eliminate leprosy as a public health problem by 2015, for which a drastic reduction in the disease burden was necessary. However, a recent study in Mato Grosso identified a hyperendemicity average between 2001 and 2013, a low number of cured patients, and an increasing tendency of multibacillary cases with a physical disability grade of 2, demonstrating the difficulty in controlling and eliminating this disease[9].

It is possible to achieve this commitment by increasing the proportion of intradomiciliary contacts examined and the proportion of cured patients, which enables the early detection and timely treatment, thus interrupting the diseases' chain of transmission.

Studies that analyze epidemiological profiles in endemic areas are essential for verifying if priority policies are actually being implemented to control and prevent the the disease in the country. Furthermore, they assist in health planning and the reorganization of policies, in order to reduce the incidence coefficient of the disease[10].

Thus, the objective of this study was to compare the sociodemographic, clinical and epidemiological characteristics of individuals under 15 years of age with leprosy among priority and non-priority municipalities, as well as the spatial distribution of the cases recorded in these municipalities.

METHODS

The present research was a cross-sectional study based on new cases of leprosy registered in children under 15 years of age, and reported in the Information System for Notifiable Diseases (*Sistema de Informação de Agravos de Notificação* - SINAN) from priority and non-priority municipalities in the State of Mato Grosso between 2011 and 2013. The analysis included cases of people diagnosed with leprosy that had one or more of the following cardinal signs:

- lesion(s) and / or area(s) of the skin with altered sensitivity;
- involvement of the peripheral nerve(s), with or without thickening, associated with sensory and / or motor and / or autonomic alterations; and
- positive smear microscopy of the intradermal smear[11].

Cases with a diagnostic error, where the patient was transferred to another state or country, and duplicity and inconsistency of data were excluded.

Information on children under 15 years old and who were reported to have leprosy was obtained through the SINAN / MT database, provided by the epidemiological surveillance department of the State Health Department of Mato Grosso (SES / MT-2014).

Mato Grosso has 141 municipalities. The comparative analysis included cases diagnosed in priority and non-priority municipalities of the state. The municipalities designated as priorities — 29 of them — were aggregated according to Decree No. 2,556, dated on October 2011[7]. Because this decree came into force as of 2011, the period from 2011 to 2013 was determined for this study.

The variable of interest is the frequency of cases of leprosy in children under 15 years old, reported in priority and non-priority municipalities. The cases were compared for sociodemographic, clinical and epidemiological aspects, by means of the following variables: gender, age, race / skin color, housing, operational classification, clinical form, physical disability, number of lesions, mode of detection, a skin smear on diagnosis, and a reaction episode.

For data management and analysis, the software Excel 2007 (Microsoft®) and Epi-Info 7.1.5 were used. A descriptive analysis was carried out using frequency tables and the differences in proportions were verified by a bivariate analysis and the χ^2 test. Where appropriate, Fisher›s Exact Test was used. In all of the tests, a 95% confidence interval was considered.

The maps were designed using the geographic projection system latitude / longitude, and SAD69 (South America Datum) was obtained through the Brazilian Institute of Geography and Statistics (*Instituto Brasileiro de Geografia e Estatística* - IBGE) and ArcGis 10.2 software. The classes in the maps were constructed through the natural breaks method, which determines the best arrangement of the values into classes by reducing the variation within them and maximizing the variance between them[12].

The present study presents no conflicts of interest and was approved by the Research Ethics Committee (*Comitê de Ética em Pesquisa* - CEP) of the SES / MT, in accordance with Resolution 466 / 12.

RESULTS

In Mato Grosso, the average incidence rate of leprosy in children under 15 years old was 18.7 per 100 thousand inhabitants in the period from 2011 to 2013. In the state, 29 municipalities are considered priority and 112 are non-priority, in terms of attention to and strengthening of epidemiological surveillance for leprosy. Among the municipalities, 58.1% reported a case of leprosy in children under 15 years of age, and the municipality of Cuiabá had the highest percentage, with 11% of the cases.

A total of 429 new cases of leprosy were identified in eligible children under 15 years of age and recorded in the SINAN / MT. However, 11 cases were excluded due to diagnostic errors, 4 cases due to state transfers, and 3 cases due to duplicate registration.

Among the 141 municipalities, 70 (49.6%) presented hyper-endemicity, 11 (7.8%) presented very high endemicity and 1 (0.7%) had high endemicity (Figure 1). Of these 82 municipalities, 65.9% are considered non-priority. Only 1 (3.4%) city of the 29 that are considered priority had a low average incidence coefficient in the study period, since there was no record of the disease in this population. Some priority municipalities had a higher proportion of multibacillary cases when compared to paucibacillary cases. Others, however, maintained hyperendemicity for both paucibacillary and multibacillary cases.

Figure 2 shows the presence of physical incapacity in the diagnosis in children under 15 years of age, detected in priority municipalities, some of which presented above 3 new cases during the period. The presence of physical incapacity in non-priority municipalities was also verified.
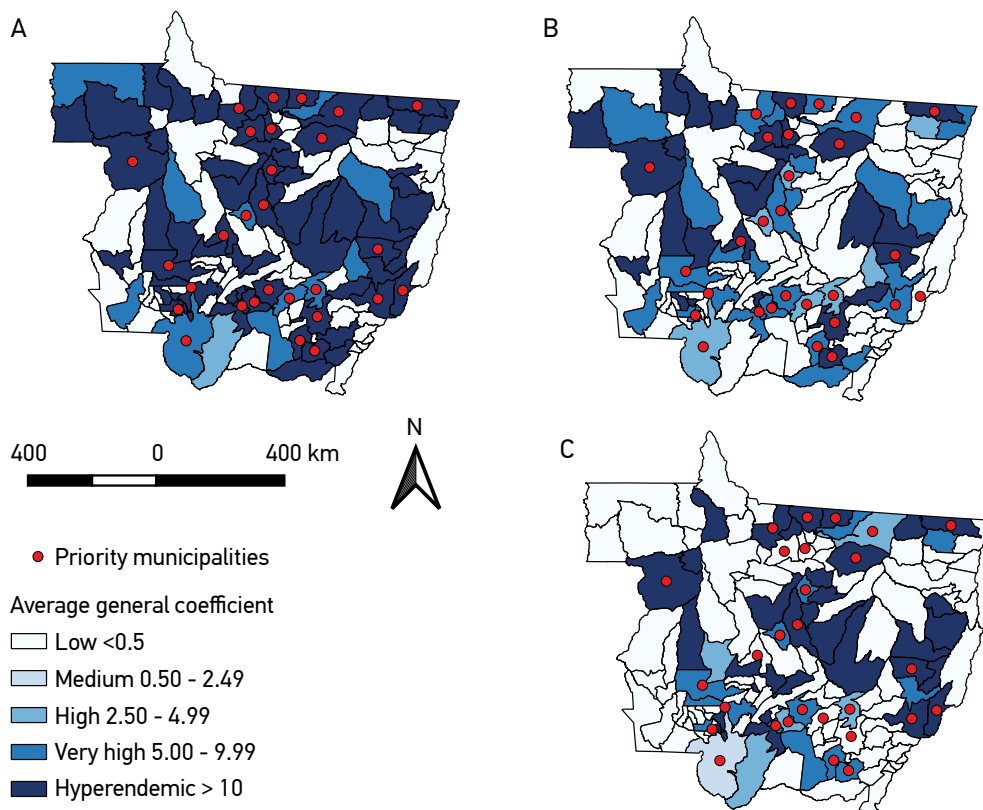

Figure 1. Geographic distribution of the mean incidence rate of leprosy in children under 15 years of age in priority and non-priority municipalities, general (A), paucibacillary operational classification (B) and multibacillary secondary operational classification (C). Mato Grosso, Brazil, 2011-2013.

The number of cases detected by contact survey was higher in priority municipalities than in non-priority ones. Some priority municipalities did not have cases registered using this mode of detection (Figure 2).

The majority (n = 317; 73.9%) of the cases were confirmed in priority municipalities (Table 1). The mean age was 10.6 years old (SD = ± 2.8), with minimum and maximum ages observed at 2 and 14 years, respectively. There was a difference in the proportion of diagnosed cases among municipalities when compared to the age groups of 10 to 14 years old and 5 to 10 years old (χ^2 = 4.09, p = 0.043). In priority municipalities, and for the age group of 5 to 10 years old, a greater proportion of leprosy cases were observed.

The presence of white individuals in priority municipalities was higher in relation to those present in non-priority municipalities (χ^2=7.01, p=0.008). Non-priority municipalities presented a higher proportion of leprosy cases in non-urban dwellings when compared to those diagnosed in priority municipalities (χ^2 = 24.23, p <0.001).

A higher proportion of individuals diagnosed with the tuberculoid clinical form was found in priority municipalities when compared to those diagnosed in non-priority municipalities. These non-priority municipalities presented a higher proportion of cases diagnosed with an undetermined clinical form in relation to priority municipalities (χ^2 = 3.89, p = 0.048) (Table 2).

Priority municipalities presented a higher proportion of cases diagnosed with a single lesion when compared to non-priority municipalities. On the other hand, they presented a higher proportion of cases diagnosed with a greater number of lesions in relation to the priority municipalities (χ^2=5.93; p=0.014).
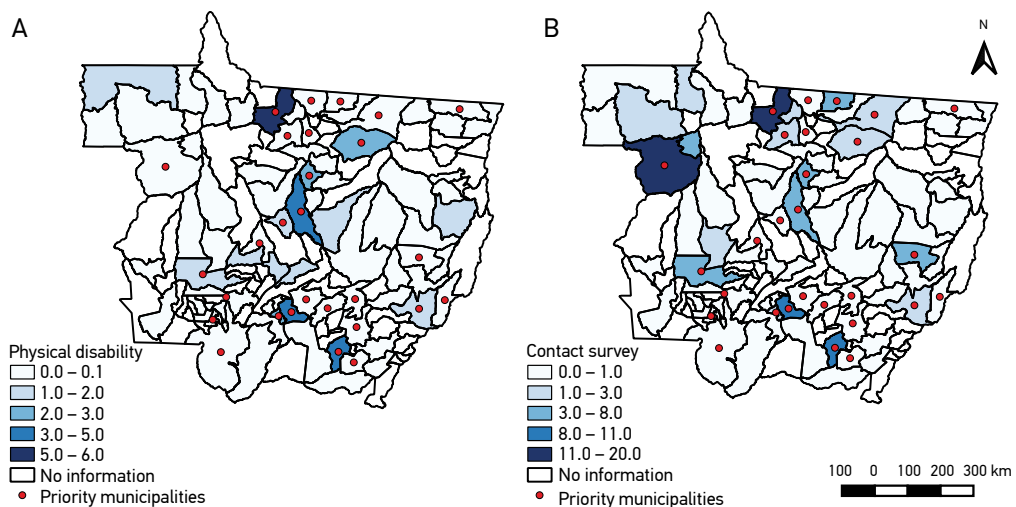

Figure 2. Geographic distribution of new cases of leprosy in children under 15 years of age in priority and non-priority municipalities from the State of Mato Grosso according to the following variables: physical disability (A) and detection mode by contact survey (B). Mato Grosso, Brazil, 2011-2013.

While priority municipalities had a higher proportion of cases diagnosed by means of contact surveys when compared to non-priority ones, there was a higher proportion of cases diagnosed by spontaneous demand in non-priority municipalities (χ^2=6.16; p=0.013).

DISCUSSION

In recent years, studies have indicated a reduction in the prevalence of leprosy in several countries, but in Brazil, the disease persists as a public health problem[13]. The findings of this study corroborate this information, since the average incidence of leprosy in children under 15 years of age in the period studied was hyper-endemic, demonstrating the potential for recent transmission of the endemic disease in the state of Mato Grosso.

Table 1. Distribution of new cases of leprosy according to sociodemographic variables. Mato Grosso, Brazil, 2011-2013.

Variable	Priority Municipalities				Total		χ^{2*}	p-value
	Yes		No					
	n	%	n	%	n	%		
Gender								
Female	168	53.0	57	50.9	225	52.4	0.15	0.701
Male	149	47.0	55	49.1	204	47.6	1	
Age range (years)								
1 to 4	9	2.8	4	3.6	13	3.0	0.54	1.000
5 to 9	94	29.7	22	19.6	116	27.0	4.09	0.043
10 to14	214	67.5	86	76.8	300	70.0	1	
Race/skin color[a]								
White	89	28.3	17	15.3	106	24.9	7.01	0.008
Black, dark skin	42	13.4	17	15.3	59	13.9	0.01	0.924
Yellow	7	2.2	2	1.8	9	2.1	0.48	1.000
Indigenous	1	0.3	2	1.8	3	0.7	0.21	0.213
Black, light skin	175	55.8	73	65.8	248	58.4	1	
Housing[a]								
Urban	283	91.3	79	72.5	362	86.4	1	<0.001
Non-urban	27	8.7	30	27.5	57	13.6	24.23	
Total[b]	317	73.9	112	26.1	429	100.0		

Source: Information System for Notifiable Diseases. State Secretary of Health of Mato Grosso, 2011–2013.
*Fischer's test, used for variables with values under 5; [a]Exlcuded, ignored, or not filled in; [b]Value calculated on the line.

Table 2. Distribution of new cases of leprosy according to clinical and epidemiological variables. Mato Grosso, Brazil, 2011-2013.

Variable	Priority Municipalities				Total		χ^{2*}	p-value
	Yes		No					
	n	%	n	%	n	%		
Operational classification[a]								
Paucibacillary	166	53.9	60	57.7	226	54.9	1	0.501
Multibacillary	142	46.1	44	42.3	186	45.1	0.45	
Clinical form[a]								
Undetermined	89	28.9	41	39.4	130	31.6	1	
Tiberculoid	77	25.0	19	18.3	96	23.3	3.89	0.048
Dimorph	136	44.2	42	40.4	178	43.2	2.40	0.121
Virchowiana	7	1.9	2	1.9	8	1.9	0.43	0.720
Physical disability[a]								
No	240	86.0	83	82.2	323	85.0	1	0.314
Yes	39	14.0	18	17.8	57	15.0	1.01	
Number of lesions[a]								
No lesions	12	3.8	6	5.6	18	4.3	1.73	0.188
One lesion	144	46.5	36	33.6	180	43.2	1	
2 to 5 lesions	96	31.0	45	42.1	141	33.8	5.93	0.014
> 5 lesions	58	18.7	20	18.7	78	18.7	1.01	0.313
Mode of detection[a]								
Referral	72	22.7	21	18.8	93	21.7	0.24	0.623
Spontaneous demand	119	37.7	58	51.7	177	41.4	6.16	0.013
Collective survey	20	6.3	5	4.5	25	5.8	0.00	0.985
Contact survey	101	32.0	28	25.0	129	30.1	1	
Other modes	4	1.3	-	-	4	1.0	0.42	1.000
Smear[a]								
Negative	85	78.0	42	75.0	127	77.0	1	0.667
Positive	24	22.0	14	25.0	38	23.0	0.18	
Reaction episode[a]								
No	254	91.7	78	90.7	332	91.5	1	0.772
Yes	23	8.3	8	9.3	31	8.5	0.08	
Total[b]	317	73.9	112	26.1	429	100.0		

Source: Information System for Notifiable Diseases. State Secretary of Health of Mato Grosso, 2011-2013.
*Fischer's test, used for variables with values under 5; [a]Exlcuded, ignored, or not filled in; [b]Value calculated on the line.

Although only 29 municipalities are considered to be priorities for leprosy control measures in the state, another 54 municipalities that are considered to be non-priority had a high, very high and hyperendemic coefficient. Additionally, non-priority municipalities for strategic disease control as a public health problem presented a higher proportion of cases diagnosed with multiple lesions and a higher proportion of cases diagnosed by spontaneous demand in relation to priority municipalities.

The diagnosis of leprosy by spontaneous demand reflects the concern and the interest of individuals in taking care of their personal health needs. Health education programs aimed at early diagnosis and the expansion of leprosy awareness throughout the community, which has been encouraged by the federal government and state administrators, may have contributed to these results in non-priority municipalities. The fact that a municipality is not considered a priority in an endemic state may influence health services in the search for new cases by contact surveys. In this study, the non-priority municipalities had a lower proportion of cases detected by contact surveys than the priority ones, suggesting that health services was less involved, and that cases were detected because of demands from the community.

It is possible that a revision of the criteria for defining specific priority municipalities in the Federation Units could contribute to an increase in the diagnosis of leprosy cases in children under 15 years of age in non-priority municipalities, since contact surveys strengthen the control strategy of the endemic disease, as recommended by the MS.

Some priority municipalities presented a higher proportion of multibacillary cases when compared to paucibacillary cases, which was verified through the geographic distribution, reflecting a failure in epidemiological surveillance measures. It is known that the time between the onset of symptoms and diagnosis is one of the factors associated with the presence of physical disability, therefore, it is necessary for priority municipalities to develop active detection measures[11].

There is a need to expand epidemiological surveillance measures to non-priority municipalities in order to eliminate the disease and to include strategies aimed at the early diagnosis of leprosy. As observed, multibacillary cases and cases of individuals with physical disabilities were identified in these municipalities, suggesting the presence of active transmissibility in this population, which, if not treated, may increase local indexes.

Active detection is performed through the systematic search of intradomiciliary and community contacts, and allows for the diagnosis and early treatment of the disease, minimizing its transmissibility[11]. Otherwise, it is up to the individual to seek health services when signs and symptoms of the disease appear, which results in late detection, as demonstrated in the present study.

Although detection from contact surveys depicted in the spatial distribution was higher in priority municipalities, some cases were not detected through this search means. This shows the difficulty of controlling the disease, as regards the priority policy, since there is a greater risk of illness among the intradomiciliary contacts of new cases diagnosed[7]. Surveillance is one of the recommended strategies for the prevention of disease transmission and for decreasing the number of people diagnosed with physical disabilities.

In the study, cases of people diagnosed with a physical disability in non-priority municipalities were observed, although they were not statistically significant.

The priority municipalities did in fact present a higher concentration of the disease. Most of the cases were identified in urban area homes, as observed in other studies, in which a large grouping of people and a greater possibility of contact between index cases and susceptible cases were found[14-15]. It is likely that this behavior occurs due to the greater population density and the larger concentration of housing in urban areas. In Mato Grosso, according to the last Demographic Census, 2,484,801 inhabitants were identified in the urban area and 552,321 inhabitants in the rural area[16].

Leprosy is recognized as a neglected disease, making residents of non-urban areas more vulnerable to illness because of their poor access to health services and precarious socioeconomic conditions. This requires administrators of places where the disease is a relevant public health problem, to make more efforts.

Strengthening the need for a greater reflection on the definition of priority municipalities, it can be observed that non-priority municipalities have a higher proportion of children under 15 living in non-urban housing and diagnosed with leprosy in relation to the priority municipalities. These results may be related to the difficulty of non-priority municipalities to reach non-urban zones in order to perform epidemiological surveillance measures and active early detection of the disease throughout its coverage area, suggesting the need for incentives for such strategies to be developed.

The findings from this study indicated an almost homogeneous distribution in the cities of analysis when the gender variable was considered, which is similar to what was observed in other studies[17,18]. The age group most affected in this population was aged 10 to 14 years old, probably due to the incubation period of the bacillus, which varies from two to seven years, thus delaying the immunological response that determines the clinical phenotype of the disease[17,19-21].

The prevalence of paucibacillary cases demonstrated in this study is similar to what has been found in other studies, as it is the non-contagious form of the disease[17,22]. However, there was a higher proportion of dimorphic clinical form cases, which is considered multibacillary (the contagious form), and 15% of the cases had a physical disability at the time of diagnosis. Both results are related to delayed diagnoses and the presence of active cases in the community, favoring complications and the evolution of the disease[14].

Because these individuals are in the process of growth and development, these events negatively influence their quality of life, causing changes in their social relationships and behavior, which may in turn affect their income and even lead to them dropping out of school[23].

There was a significant difference between the analyzed municipalities, the age group of five to nine years old, white people, and the clinical tuberculoid form, with a higher proportion of them in the priority municipalities. As such, this age group represents the presence of early transmission of the disease in these municipalities, with active foci – being white is probably associated with the most populous municipalities, which are priorities[7]. The proportion of the tuberculoid clinical form found in the priority municipalities in relation to the non-priority ones, with an undetermined form as reference, demonstrates difficulties

for early diagnosis in these municipalities, which receive incentives for such measures, in comparison to those that do not receive it.

Children under 15 years of age with leprosy most often demonstrated a single lesion, which is similar to other studies[17,24]. However, as described, there was a significant difference between the analyzed municipalities, with a higher proportion in non-priority ones. Cases occurred in non-urban zones, with two to five lesions and detection by spontaneous demand.

The detection mode is considered to be passive when it is done after the person has already sought out services. This is not the best way to do this, especially with regard to priority municipalities, which have a commitment to implement more promising interventions in actively detecting cases, reducing the hidden prevalence and the transmissibility of the disease[15].

A recent study indicates the heterogeneity of leprosy cases recorded in children under 15 yeas old in Brazil[5]. Previously recognizing this situation, the MS prioritized municipalities where there was a greater concentration of the disease, in order to strengthen measures against it, by means of a financial transfer starting in 2011[6]. When municipalities received this financial incentive, it meant that they assumed a greater commitment to eradicate the disease as a public health problem, developing measures such as active searches, intradomiciliary contact surveys, diagnoses, and early treatment. However, the results of this study identified that both priority and non-priority municipalities presented active transmission and late diagnosis of the disease.

CONCLUSION

Priority municipalities recorded a higher proportion of cases diagnosed through contact surveys, in the age group of 5 to 9 years old and cases with the clinical tuberculoid form. Non-priority municipalities presented a higher proportion of cases diagnosed by spontaneous demand, cases with multiple lesions, and cases diagnosed in non-urban housing. The geographical distribution reveals the presence of hyperendemicity in priority and non-priority municipalities, suggesting the presence of active transmissibility and late diagnosis of the disease in both of them.

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