







ORIGINAL ARTICLE

EPIDEMIOLOGICAL PROFILE OF LEPROSY CASES AND DEATHS IN MATO GROSSO: 2011-2020

HIGHLIGHTS

1. The trend of new leprosy cases increased between 2011 and 2020.
2. Higher incidence of cases and deaths among multibacillary patients.
3. The disease is spreading in the state of Mato Grosso, and diagnosis is delayed.
4. Control and prevention actions must be more effective.

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ABSTRACT

Objective: To characterize the epidemiological profile of leprosy cases and deaths in Mato Grosso - Brazil, from 2011 to 2020. **Method:** A population-based observational study of all leprosy cases and deaths reported between 2011 and 2020. Subsequently, the reported individuals were matched, and the trend was estimated using the Prais-Winsten regression. **Results:** 37,623 new cases were registered in the study years, with an average rate of 114.7/100,000 inhabitants, with higher incidence rates in multibacillary cases and males, and in the proportion of deaths (58%; 88.2%), respectively. As for the trend, it has increased over the years and among women. **Conclusion:** The results suggest a profile of more incident cases, possible areas with the spread of the disease, and delayed diagnosis, highlighting the need to use indicators to monitor the endemic and strengthen comprehensive care and surveillance of leprosy.

KEYWORDS: Leprosy; Epidemiology; Mortality; Neglected Disease; Transmissible Disease.

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INTRODUCTION

Neglected Tropical Diseases (NTDs) occur mainly in developing countries, where populations are economically, socially, and politically vulnerable¹. Among the NTDs, leprosy stands out in our country due to its high transmissibility and the social determinants of health that are related to the disease. Leprosy is a chronic infectious disease caused by *Mycobacterium leprae*, which commonly affects the skin and nerves but can also affect other organs and tissues².

Despite reducing the incidence of new cases, the disease persists as a public health problem³. In 2021, there was a 10.2% increase in the detection rate of new leprosy cases compared to 2020. Brazil maintained its high endemicity in the same period, ranking second globally and first in the Americas, with 92.4% of cases⁴. In the same period, the state of Mato Grosso had the highest detection rate in the country, corresponding to 58.76 new cases per 100,000 inhabitants³.

Leprosy is treatable and curable, but when diagnosed late, it can cause serious damage to health, such as the appearance of physical disabilities and deformities, adverse reactions to multidrug therapy (MDT), reactional episodes associated with secondary infections that contribute to systemic complications, progressing to more serious forms, including death^{5,6,7,8}.

Among the NTDs, leprosy was the fifth leading cause of death between 2000 and 2011⁹. Despite being considered to have a low lethality rate, these data show disparities between the country's regions^{7,8,10}, indicating weaknesses in the health care network and policies, in surveillance and monitoring of cases, as well as a reduction in the quality of life of this vulnerable population^{7,10}.

Despite its relevance to public health, death from leprosy has been a little-studied topic in endemic countries, and its evolution is often neglected^{11,12}. Although the disease is endemic in Mato Grosso, no studies better understand leprosy mortality. Identifying the epidemiological profile of the disease generates indicators that serve as an essential tool for predicting its behavior and directing strategic investments toward control and prevention^{8,13}. This study aims to characterize the profile of leprosy cases and deaths in Mato Grosso - Brazil, from 2011 to 2020.

METHOD

This is an observational, population-based study of all leprosy cases and deaths reported between 2011 and 2020 in Mato Grosso. The Brazilian state has 141 municipalities, a territorial extension of 903,357 km², a population density in 2022 of 4.05 inhabitants/km², a Human Development Index (HDI) of 0.773, and a Gini Index of 0.461¹⁴.

The data was obtained from the Notifiable Diseases Information System (SINAN) and the Mortality Information System (SIM), provided by the Epidemiological Surveillance of the Mato Grosso State Health Department. The demographic information and digital meshes were obtained from the Information Bank of the Brazilian Institute of Geography and Statistics (IBGE).

The variables of interest were the year of notification (2011 to 2020), age group (0 to 9 years; 10 to 19 years; 20 to 59 years; 59 to 80 years), sex (Female; male), race/color (Brown; black; white; yellow; Indigenous), and schooling (Illiterate/no schooling; elementary school; high school; complete higher education).

The database was built in a Microsoft Excel® version 10 spreadsheet. Subsequently, a technique known as linkage was used to merge the databases using the Link Plus software. The linkage technique consists of pairing individuals who were notified on SINAN and SIM to identify those who had leprosy and died during the period analyzed.

To carry out the linkage, the following procedures were carried out: 1) automatic search in the Mato Grosso state database, using fields common to the notification form and the death certificate (DC) (searching for date of birth, sex, and mother's name); 2) manual search using fragments of the mother's name on the DC (seeking to locate her on the notification form paired with date of birth and sex, for cases not detected in the automatic search); 3) manual search in the SINAN files, seeking to confirm the record(s) identified in the automatic search procedure, using the variable mother's name, sex and date of birth.

After this stage, a descriptive analysis of epidemiological indicators was presented to characterize the population and estimate leprosy mortality rates. The mortality rate was calculated using the number of deaths from leprosy as the numerator and the population living in Mato Grosso during the period studied as the denominator, multiplied by 100,000. Deaths were characterized according to sociodemographic and economic variables.

The trend analysis was carried out using the *Prais-Winsten* regression to calculate the annual percentage change (APC) in rates, with the dependent variable being the incidence rate per confidence interval (CI) and the independent variable being the years of the historical series. The quantitative estimation of the trend is calculated using the following expression: $VAP = [-1 + 10b] * 100\%$. When the rate is positive, the time series is considered to be increasing; when it is negative, it decreases; and stationary when there is no significant difference between its value and zero ($p > 0.05$)¹⁵.

Maps were created to identify the areas with the highest coefficients, according to the municipality of residence, to illustrate the geographical distribution of notified leprosy cases in Mato Grosso. The spatial distribution was calculated by mapping the annual prevalence rates in Mato Grosso. The results were presented in thematic maps drawn up using TabWin software.

This study is part of the project entitled "Epidemiological study of infectious diseases in the state of Mato Grosso, 2011-2020," which was approved by the Ethics Committee for Research with Human Beings in the Health Area of the Universidade Federal de Mato Grosso under opinion No. 4.915.563.

RESULTS

Between 2011 and 2020, 37,623 new cases of leprosy were recorded in Mato Grosso. In the period, the average rate was 114.7 new cases per 100,000 inhabitants.

Regarding the characterization of leprosy cases, it can be seen that in all the years analyzed, the highest incidence rates occurred in males and in individuals who call themselves brown, the highest being found in 2018, corresponding to 152.4 new cases/100,000 inhabitants and 88.5 new cases/100,000 inhabitants, respectively. In the same year, the rate increased with age, with a higher occurrence in individuals aged 59 or over ($n=1096$, incidence rate 320.8 new cases/100,000 inhabitants) and those with no schooling ($n=2648$, incidence rate 78.2 cases/100,000 inhabitants) (Table 1).

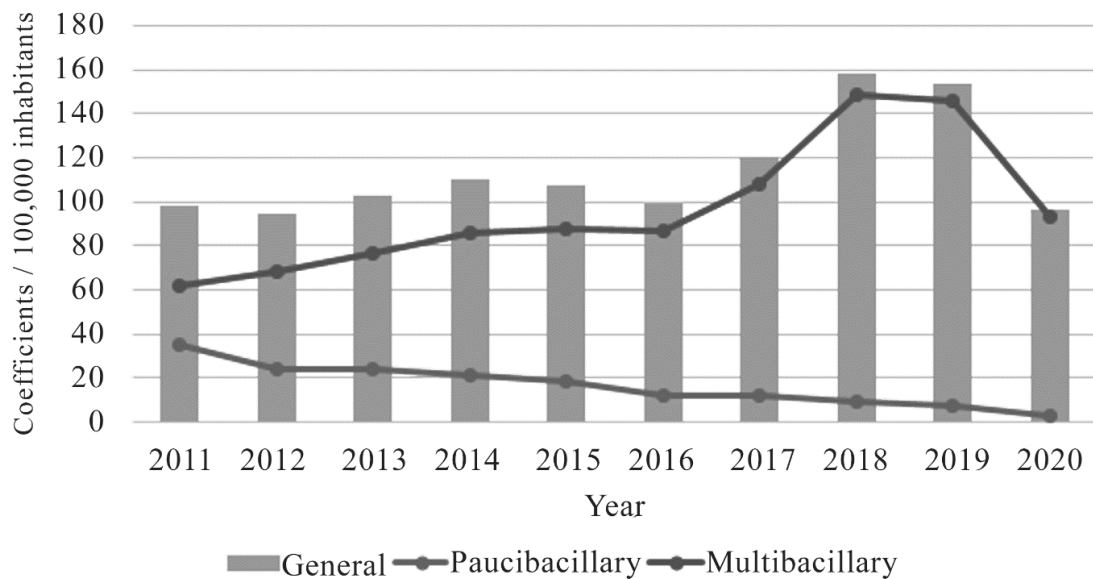
Table 1 - Absolute number of new leprosy cases and incidence rate per 100,000 inhabitants in the state of Mato Grosso, Brazil, 2011-2020.

Variables	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Sex										
Female	1294 (85.9)	1239 (81)	1474 (95)	1598 (101.5)	1591 (99.7)	1578 (97.7)	1939 (118.5)	2718 (164.2)	2677 (159.8)	1597 (94.3)
Male	1754 (110.4)	1730 (107.4)	1807 (110.8)	1947 (117.9)	1921 (114.9)	1711 (101.2)	2097 (122.7)	2633 (152.4)	2574 (147.5)	1744 (99)
Race/Color										
Yellow	40 (1.2)	16 (0.5)	28 (0.8)	31 (0.9)	22 (0.6)	24 (0.7)	34 (1)	37 (1)	44 (1.2)	21 (0.6)
White	1066 (34.4)	975 (31)	1059 (33.2)	1101 (34.1)	1041 (31.8)	1027 (31)	1222 (36.5)	1684 (49.7)	1702 (49.7)	1073 (31)
Indigenous	17 (0.5)	16 (0.5)	8 (0.2)	22 (0.6)	20 (0.6)	3 (0)	22 (0.6)	16 (0.4)	26 (0.7)	9 (0.2)
Brown	1489 (48.1)	1501 (47.8)	1724 (54.1)	1900 (58.9)	1973 (60.4)	1826 (55.2)	2241 (67.0)	2995 (88.5)	2920 (85.4)	1871 (54.1)
Black	423 (13.6)	439 (13.9)	437 (13.7)	469 (14.5)	428 (13.1)	386 (11.6)	482 (14.4)	555 (16.4)	518 (15.1)	340 (9.8)
Age group										
0-9	55 (10)	43 (7.9)	57 (10.5)	84 (15.6)	69 (12.9)	57 (10.8)	61 (11.7)	56 (10.8)	48 (9.4)	45 (8.92)
10-19	237 (42.4)	222 (39.7)	290 (51.9)	270 (48.3)	277 (49.6)	263 (47.1)	298 (53.4)	337 (60.3)	308 (55.1)	183 (32.6)
20-59	2264 (129.2)	2218 (124.1)	2362 (129.7)	2581 (139.2)	2524 (133.9)	2366 (123.6)	2903 (149.5)	3892 (197.8)	3813 (191.5)	2407 (119.7)
59-80	492 (208.2)	486 (195.3)	572 (218.2)	610 (220.8)	640 (219.7)	603 (196.3)	774 (238.9)	1096 (320.8)	1083 (300.6)	706 (186)
Education										
Illiterate/No schooling	2040 (65.9)	2549 (81.2)	2042 (64.1)	2209 (68.5)	2108 (64.5)	1807 (54.6)	2157 (64.4)	2648 (78.2)	2732 (79.9)	1579 (45.7)
Elementary School Completed	429 (13.8)	420 (13.3)	496 (15.5)	494 (15.3)	522 (15.9)	496 (15)	643 (19.2)	849 (25.1)	862 (25.2)	535 (15.4)
Completed high school	377 (12.1)	394 (12.5)	486 (15.2)	574 (17.8)	538 (16.4)	534 (16.1)	650 (19.4)	1011 (29.8)	985 (28.8)	707 (20.4)
Higher education completed	73 (2.3)	79 (2.5)	107 (3.3)	100 (3.1)	144 (4.4)	151 (4.5)	224 (6.7)	364 (10.7)	326 (9.53)	258 (7.47)

Source: the authors (2020), based on SINAN and IBGE/PNAD data.

In Mato Grosso, the highest overall coefficient analyzed was in 2018, with 158.2 cases per 100,000 inhabitants, an increase of 40.2% compared to 2012, the year with the lowest coefficient (94.5 new cases/100,000 inhabitants). As for the operational classification, a higher number of multibacillary cases (MCs) was observed, with a greater variation in amplitude over a shorter period in 2019 and 2020 (146.1 and 93.4 new cases/100,000 inhabitants, respectively (Figure 1).

Figure 1 - Overall coefficient and according to the operational classification of notified leprosy cases in Mato Grosso, Brazil, 2011 to 2020.



Source: the authors (2023).

Over the period studied, the trend in leprosy cases was upward for females (APC: 5.59; 95%CI: 0.78-10.64), in the brown race (APC: 5.10; 95%CI: 5.1 - 9.51), in people with complete primary education (APC: 5.31 95%CI: 0.85 - 9.96), completed high school (APC: 8.89; 95%CI: 4.26 - 13.72) and complete higher education (APC: 18.20 95%CI: 11.98 - 24.77). The only decrease was in the 0-9 age group (APC: -0.69; 95%CI: -7.06 - 5.76) (Table 2).

Table 2 - Number of newly notified cases, the average rate per 100,000 inhabitants, and the leprosy trend in Mato Grosso, Brazil, from 2011 to 2020.

Variables	Notifications	Average rate	VPA ^a	IC95% ^b	Interpretation
	N				
Sex					
Female	17705	110.5	5.59	0.78 – 10.64	Growing
Male	19918	118.7	1.96	-1.44 – 5.49	Stationary
Race/Color					
Yellow	297	0.9	2.64	-3.12 – 8.74	Stationary
White	11950	36.4	2.60	-2.21 – 7.64	Stationary
Indigenous	159	0.5	-0.35	-11.93 – 12.75	Stationary
Brown	20440	62.3	5.10	5.10 – 9.51	Growing
Black	4477	13.6	-1.15	-4.93 – 2.80	Stationary
Age group					
0-9	575	10.9	-0.69	-7.06 --5.76	Decreasing
10-19	2685	48.1	0.46	-4.30 – 5.45	Stationary
20-59	27330	144.4	0.46	-4.30 – 5.45	Stationary
59-80	7062	233.3	2.57	-1.94 – 7.28	Stationary

Education					
Illiterate/No schooling	21871	66.7	-1.43	-5.00 – 2.27	Stationary
Complete primary education	5746	17.5	5.31	0.85 – 9.96	Growing
Completed high school	6256	19.1	8.89	4.26 – 13.72	Growing
Higher education completed	1826	5.6	18.20	11.98 – 24.77	Growing

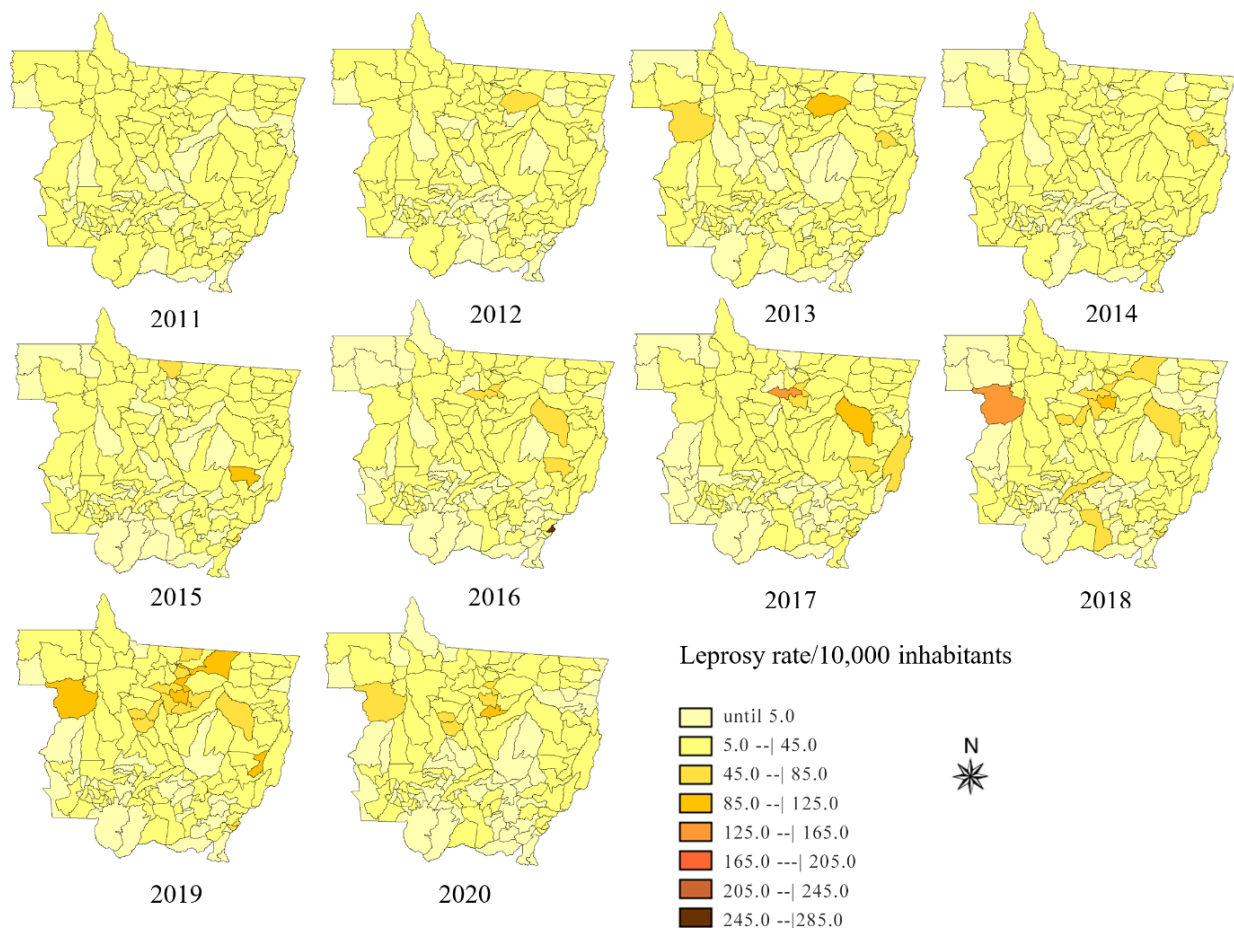
a Annual Percentage Change

b 95% Confidence Interval

Source: the authors (2023).

Figure 2 shows the distribution of the leprosy incidence rate in the municipalities of the state of Mato Grosso. There is a change in the distribution of new cases over the period. In 2018, the municipality of Juína had an incidence rate of 158 new cases/10,000 inhabitants. In 2019, there was an increase in municipalities with an incidence rate above 85 new cases/10,000 inhabitants, decreasing the following year.

Figure 2 - Distribution of the leprosy incidence rate, according to the municipality of residence, in the state of Mato Grosso, Brazil, from 2011 to 2020.



Source: the authors (2023).

Among the total number of deaths recorded in the SIM, men predominated (88.2%), people aged 15 or over (100%), and white and brown people (41.2%). As for schooling, for all deaths, the highest frequency was in the no schooling category (50.0%), followed by incomplete primary education (33.3%). Regarding operational classification, 100% of the dead cases had been classified as multibacillary, and 58% had the dimorphic clinical form (Table 3).

Table 3 - Characterization of notified leprosy cases and deaths in the state of Mato Grosso, Brazil, from 2011 to 2020.

Variables	Death			
	Yes		No	
	n	%	n	%
Sex				
Male	15	88.2	19903	52.9
Female	2	11.8	17703	47.1
Age group				
0 to 14 years	0	0	1843	4.9
15 years and older	17	100	35763	95.1
Race/Color				
Yellow	0	0	297	0.8
White	7	41.2	11943	31.8
Indigenous	0	0	159	0.4
Brown	7	41.2	20433	54.3
Black	2	11.8	4475	11.9
Education				
Illiterate/No schooling	10	88.3	18367	52.9
Complete primary education	0	0	5776	16.6
Complete high school	1	8.3	6255	18
Complete university degree	0	0	1826	5.3
Operational classification				
PB	0	0	5409	14.5
MC	17	100	31843	85.5
Degree of physical disability				
Grade 0	4	23.5	18906	52.7
Grade 1	6	35.3	10745	29.9
Grade 2	6	35.3	2171	6
Not evaluated	1	5.9	4065	11.3
Clinical form				
Undetermined	0	0	3293	9
Tuberculoid	0	0	2911	8
Dimorphic	10	58.8	25474	69.6
Virchowiana	7	41.2	3416	9.3
Not classified	0	0	1521	4.2

Source: the authors (2020) based on SIM data.

DISCUSSION

This study made it possible to analyze the epidemiological distribution of leprosy cases and deaths in Mato Grosso from 2011 to 2020. The trend in the detection rate of new leprosy cases has increased over the ten years, with a higher incidence of cases among men. About deaths all occurred among those operationally classified as multibacillary.

Multibacillary cases also accounted for the largest reported cases in the period analyzed. This result reveals areas of intense leprosy spread and suggests late diagnosis, increasing the incidence of physical disabilities and serious complications, and also suggests flaws in the surveillance of cases¹⁶. These facts also increase the likelihood of leprosy reactions and post-treatment complications^{7,17}.

Among the clinical forms, Virchowian patients have a higher reactional potential and, consequently, a higher degree of disability and a lower survival rate, 6.3 years per patient, compared to other carriers¹⁸.

In this study, the higher occurrence of deaths in males may be related to cultural, behavioral, and personal self-care factors, as well as the low demand for health services^{7,17,18}. A study carried out in Colombia regarding the delay in diagnosis showed that men were more likely to be diagnosed with leprosy, with an average delay of 33.5 months, most often with grade 2 physical disability and the multibacillary form¹⁹.

Disabilities and physical deformities can have irreparable consequences for those affected, ranging from stigma and functional limitations to an undesirable prognosis. The leprosy reaction causes functional disabilities that lead to loss of protective sensitivity and/or deformities, which, combined with other problems, can lead to death¹⁰.

The elderly had the highest number of deaths, in line with a study carried out in Brazil¹², which showed that this was the age group most affected between 1999 and 2014. In contrast to the increase in life expectancy and the importance of health policies prioritizing this population, it was also pointed out that greater vulnerability in this age group is associated with the severity of the disease and pre-existing comorbidities.

It is a fact that mortality in the elderly is related to the chronic aspects of the disease. What is striking is the magnitude of the potential years lost, with 100% of deaths occurring in the economically active age group, impacting the social and economic spheres¹⁷.

In this study, it was possible to see a growing trend in the occurrence of new cases in the brown race/color and a higher prevalence for the same population. These findings highlight the neglected nature of the disease in socially vulnerable populations, as do other studies^{11,12}. The result found differs from some of the literature analyzed, such as the study from southern Brazil, in which 81.7% of cases occurred in white individuals, a fact which, according to the author, can be justified by the fact that this is the most predominant skin color in the state¹⁶. In another study²⁰, there was also a higher prevalence among individuals who declared themselves white (77.78%). However, many studies do not consider this variable significant, as there is not much evidence linking skin color to the prevalence of the disease.

Regarding the time trend, a significant increase in the leprosy mortality coefficient was found among illiterate individuals and those with no schooling. This result indicates that there may be an association between social determinants and the worsening of the disease. Schooling can directly influence people's understanding of their health-disease process and self-care¹⁷.

Spatial analysis of incidence rates according to municipality of residence showed heterogeneity in detecting new cases. Furthermore, the most significant finding in all the years analyzed was in 2018 in Juína. It can be seen that there were more cases in a small town. According to the last census²¹, the city of Juína had less than 50,000 inhabitants, with poverty being a determining factor in the occurrence and transmission of leprosy. This result may also be related to the better or worse operational capacity of the health services in each location^{17,18} and even to the intensified active search in a specific period due to specific investments by the Ministry of Health.

This study has limitations related to the use of secondary databases. It is well known that the disease is underreported and that errors can occur in national records. However, we emphasize that leprosy should not be a cause of death, as it is a curable disease. Thus, this study is relevant even with its limitations. Leprosy control measures must be strengthened, especially with a view to early diagnosis for immediate treatment. This is possible through surveillance and systematic monitoring.

CONCLUSION

We concluded that the trend in the detection rate of new leprosy cases increased over the ten years, with a higher incidence of cases and deaths among multibacillary cases.

This finding demonstrates the importance of new analytical studies that characterize the factors associated with cases and deaths and strengthen control and surveillance actions. Therefore, the state must achieve acceptable indicators by implementing control measures and appropriate management.

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