**Original Research Article**

**EPIDEMIOLOGICAL PROFILE OF LEPROSY IN THE STATE OF PARÁ BETWEEN THE YEARS 2019 AND 2023**

**ABSTRACT**

**Objective:** This study aims to analyze the epidemiological profile of reported leprosy cases in the state of Pará between the years 2019 and 2023. **Methods:** Regarding methodological aspects, this is an epidemiological, retrospective, quantitative, cross-sectional, observational, and descriptive study. Data were collected from the Notifiable Diseases Information System of the Department of Health Information (SINAN/DATASUS). The following variables were obtained: age group, sex, education level, self-declared race/color, reported clinical form, reported disability assessment, diagnosed operational classification, and municipality of notification. **Results:** The results showed that, during the analyzed period, there was a predominance of leprosy cases in patients of mixed race, accounting for 73.4% of the total cases, and in males, with 65% of cases. The dimorphic clinical form was the most common (55.3%), and most patients were diagnosed in the multibacillary phase (82.8%), with a physical disability grade of 0 (53.4%). In terms of sociodemographic distribution, the municipality of Marituba had the highest number of reported cases, representing 13.4% of the total. **Conclusion:** The analysis indicated a relationship between socioeconomic factors, low education levels, and the prevalence of leprosy, especially among men. The COVID-19 pandemic possibly affected case reporting between 2020 and 2021, leading to potential underreporting. The predominance of the multibacillary form and the high percentage of cases in men may suggest limitations in early diagnosis and health policies aimed at controlling leprosy in the state.

**Keywords:** Endemic; Epidemiology; Rosk factors; Leprosy

INTRODUCTION

Leprosy is a chronic infectious disease caused by the etiological agent *Mycobacterium leprae*, also known as Hansen's bacillus, which primarily affects the skin and peripheral nerves, leading to sensory impairment. If not treated early, the disease can progress to a more severe form, potentially causing deformities and functional disabilities, which are often irreversible. In response to this, the Clinical Protocol and Therapeutic Guidelines for Leprosy (PCDT) were established in 2022, aiming to promote early diagnosis by recognizing characteristic signs and symptoms of the disease and conducting complementary examinations, whether physical or laboratory-based.1

The clinical diagnosis is usually confirmed in Primary Health Care and considers aspects that distinguish infectious leprosy cases, which are classified into paucibacillary (PB) and multibacillary (MB) forms. The paucibacillary form is the less severe type, in which the individual's cellular immunity is preserved, the number of skin lesions is equal to or fewer than five, and it is subdivided into indeterminate and tuberculoid forms. The multibacillary form, on the other hand, is the more severe type, characterized by reduced or absent cellular immunity to the bacillus, more than five lesions, and subdivision into lepromatous and borderline forms.1 The highest transmissibility occurs in the multibacillary form, where untreated infected patients spread the disease through saliva droplets released via the airways. Susceptible individuals with prolonged direct contact become more vulnerable to infection.2

Leprosy was reported in 184 countries in 2023, highlighting its relevance as a global public health issue. According to the epidemiological bulletin, Brazil ranked second among countries with the highest incidence of leprosy, with 22,773 new cases reported, of which 4.2% were detected in individuals under 15 years old and 0.15% in individuals with grade 2 disability (DG2)3. Furthermore, due to its epidemiological relevance, in Brazil, the compulsory notification of leprosy was formalized by a Ministry of Health ordinance in 2017, which further encouraged the completion of information in the Unified Health System (SUS) databases.1,4

At the regional level, the distribution of the disease in Brazil occurs unevenly, reflecting different social, environmental, economic, and demographic factors 5. Between 2017 and 2022, the regions with the highest prevalence recorded diagnoses of 76,430 in the Northeast, 38,331 in the Central-West, and 33,982 in the North. Prevalence is considered acceptable if it is less than 1 case per 10,000 inhabitants; however, in 2018, the Central-West and North regions exceeded this threshold, with prevalences close to 5 and 4, respectively, classifying them as endemic. When compared to the lower indices in the South and Southeast regions, studies suggest an association between lower socioeconomic levels and higher rates of *M. leprae* transmission. 2,6,7

In the state of Pará, between 2017 and 2021, 14,339 cases of leprosy were reported, with an average of 3,483 notifications from 2017 to 2019. However, from 2020 to 2021, the number of cases significantly deviated from this average, with 2,307 and 1,581 records, respectively. The research suggests that this significant reduction is mainly due to the pandemic. In 2019, the incidence of the disease in the state reached its highest level, with 41.3 cases per 100,000 inhabitants. There was also a predominance of the multibacillary form of leprosy, accounting for 80.5% of the individuals affected by the condition.8 Thus, the high circulation of the most infectious form of the disease is concerning due to its association with a greater likelihood of developing physical disability in the affected population. Despite the availability of free treatment through the Unified Health System (SUS), leprosy remains endemic in most regions of the country, particularly in Pará. This underscores the need for studies analyzing the epidemiological profile of leprosy in the state's macro and micro-regions. Such an analysis will help identify multivariate indicators contributing to the persistence of the problem. Additionally, it will help assess the impacts of global goals and their application in the national context, adapted to the local level. This study aims to analyze the epidemiological profile of leprosy in the state of Pará between 2019 and 2023, based on quantitative data, aiming to identify patterns, trends, geographical distribution, and demographic characteristics of the reported cases.

METHODS

## Study type

This research is characterized as a descriptive epidemiological study, with a quantitative nature, aiming to analyze the characteristics of a specific population to establish relationships between variables. The descriptive study was chosen as it allows a detailed assessment of the disease's distribution, considering different variables such as age group, sex, clinical form, disability grade, and municipality of notification. This approach is crucial for identifying occurrence patterns and risk groups, as well as understanding the dynamics of leprosy in the region over the analyzed period. 9

The choice of this study type is justified by the relevance of leprosy as a public health issue in Brazil, particularly in Pará, where the incidence rate remains high. The collection of detailed epidemiological data allows for directing prevention and control interventions, as well as monitoring the evolution of the disease and the impact of public health policies in the region.

**Data source**

he study was conducted using data from individuals diagnosed with leprosy between 2019 and 2023, obtained from the Department of Informatics of the Unified Health System (DATASUS). DATASUS provides relevant information that can contribute to objective analyses of the current health situation, guiding decision-making and the development of health action programs.10

## Data collection

The data were collected through the Notifiable Diseases Information System of the Unified Health System (SINAN/DATASUS). Access was made to DATASUS via the website <datasus.saude.gov.br>, entering the sections Health Information (TABNET), "Epidemiological and Morbidity" and "Leprosy Cases – Since 2001 (SINAN)". The geographic scope was specifically selected for Pará. Finally, the relevant variables were chosen to obtain the necessary data for the creation of the tables.

**Sample**

## The sample consisted of all the leprosy records available in DATASUS, which were planned to verify the legality and regularity of the data between 2019 and 2023 for the state of Pará.

## Inclusion and exclusion criteria

The variables included are: municipality of notification, age group (10-14 years, 15-19 years, 20-29 years, 30-39 years, 40-49 years, 50-59 years, 60-69 years); sex (Male, Female, Ignored/Blank); education level (Illiterate, Incomplete 1st to 4th grade of Elementary School, Complete 4th grade of Elementary School, Incomplete 5th to 8th grade of Elementary School, Complete Elementary School, Incomplete High School, Complete High School, Incomplete Higher Education, Complete Higher Education, Ignored/Blank); self-declared ethnicity (White, Black, Yellow, Brown, Indigenous, and "Ignored/Blank"); notified clinical form (indeterminate, tuberculoid, dimorphic, virchowian, and unclassified); notified disability assessment (Grade 0, Grade I, Grade II, and not assessed); diagnosed operational classification (paucibacillary, multibacillary, and Ignored/Blank). As for the exclusion criteria, all data prior to 2019 were excluded.

**Variables**

## The variables investigated in the study were: sex, age group, education level, municipality of notification, year of notification, notified clinical form, ethnicity, disability assessment, and operational class diagnosed in the publicly accessible secondary data from DATASUS, Ministry of Health (MH).

## Procedures for data collection and analysis

# The data were organized through the Notifiable Diseases Information System (SINAN), accessed via the DATASUS platform, and exported to the spreadsheet software, Microsoft Excel | Microsoft 365, for descriptive analysis.

# Risks and benefits

The research on the epidemiological profile of leprosy cases in the state of Pará offers several benefits for researchers. By exploring in detail the data on incidence, clinical forms, and geographical distribution of the disease, researchers can expand their knowledge about transmission patterns, identify risk factors, and assess the effectiveness of control strategies. Additionally, this research can contribute to the academic development of those involved, opening doors for future investigations and scientific publications.

For society, this research can have a positive impact by providing support for the creation of more effective public health policies to control leprosy, especially in endemic regions like Pará. By mapping the most affected areas and identifying risk groups, the results can guide more targeted health campaigns and preventive interventions. However, there is a risk of stigmatizing affected populations, as leprosy still carries significant social stigma. Therefore, it is crucial that the dissemination of results is done carefully, focusing on awareness and combating prejudice rather than reinforcing stereotypes.

From a scientific perspective, this research has the potential to advance the understanding of leprosy, a neglected disease of great relevance to public health. The collection and analysis of epidemiological data are essential for improving strategies for early diagnosis, treatment, and patient rehabilitation, as well as enabling comparisons with other regions of Brazil and the world. The results may provide a solid foundation for new scientific investigations and the development of more effective interventions. However, researchers must be mindful of methodological challenges, such as data quality and accuracy, to avoid biased conclusions that could compromise the scientific rigor of the research.

# RESULTS

Between the years 2019 and 2023, 12,231 cases of leprosy were identified in Pará, with annual records of 3,554, 2,199, 2,233, 2,066, and 2,179 cases, respectively (Figure 1).

**Figure 1. Total number of leprosy cases in the State of Pará between 2019 and 2023 - SINAN**

The municipality of Marituba reported the highest number of notified cases, with 1,645 cases and a percentage of 13.4% of the total cases, followed by Belém with 792 cases and a percentage of 6.4%, and Parauapebas with 623 cases and a percentage of 5% (Figure 2).

**Figure 2. Municipalities with the highest number of cases between 2019 and 2023 - SINAN**

Table 1 presents the sociodemographic variables of the 12,231 leprosy cases. It is observed that there is a higher frequency of male cases, with 7,952 cases, accounting for approximately 65% of the total notified cases; the "parda" ethnicity, with 8,987 cases and a percentage of 73.4%; the age group of 40 to 49 years, with 2,371 cases and a percentage of 19.3%; and the education level of incomplete 1st to 4th grade of Elementary School, with 2,723 cases and a percentage of 22.2%.

**Table 1. Sociodemographic Characteristics of Leprosy Cases in the State of Pará between 2019 and 2023 – SINAN**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **n** | **n (%)** | |
| **Sex** |  |  |
| Masculine | 7.952 | 65% | |
| Feminine | 4.279 | 34,9% | |
| **Ethnicity** |  |  | |
| Brown | 8.987 | 73,4% | |
| Black | 1.585 | 12,9% | |
| White | 1.340 | 10,9% | |
| Yellow | 84 | 0,6% | |
| Indigenous | 45 | 0,3% | |
| Ignored/Blank | 190 | 1,5% | |
| **Age Range** |  |  | |
| 10 a 14 years | 583 | 4,7% | |
| 15 a 19 years | 694 | 5,6% | |
| 20 a 29 years | 1.594 | 13% | |
| 30 a 39 years | 2.197 | 17,9% | |
| 40 a 49 years | 2.371 | 19,3% | |
| 50 a 59 years | 1.950 | 15,9% | |
| 60 a 69 years | 1.565 | 12,7% | |
| **Education** |  |  | |
| Illiterate | 1.112 | 9% | |
| 1st to 4th incomplete grade of Elementary School | 2.723 | 22,2% | |
| Complete 4th grade of Elementary School | 895 | 7,3% | |
| Incomplete 5th to 8th grade of Elementary School, | 2.122 | 17,3% | |
| Complete elementary education | 729 | 5,9% | |
| Incomplete high school | 927 | 7,5% | |
| Complete high school | 1.609 | 13,1% | |
| Incomplete higher education | 167 | 1,3% | |
| Complete higher education | 350 | 2,8% | |
| Ignored/Blank | 1.534 | 12,5% | |

Regarding the clinical characteristics of the notified cases, there was a predominance of the dimorphic clinical form with 6,768 cases, accounting for 55.3%. Concerning the evaluation of physical disability, grade 0 was the most frequent, with 6,541 cases and a percentage of 53.4%, followed by grade I with 3,589 cases and a percentage of 29.3%. As for the notified operational classification, the multibacillary form predominated with 10,129 classified cases and a percentage of 82.8%, compared to the paucibacillary form with 2,102 classified cases and a percentage of 17.1%.

**Table 2. Clinical Characteristics of Leprosy Cases in the State of Pará between 2019 and 2023 – SINAN**

|  |  |  |
| --- | --- | --- |
| **Variables** | n | n (%) |
| **Operational classification diagnosed** |  |  |
| Multibacillary | 10.129 | 82,8% |
| Paucibacillary | 2.102 | 17,1% |
| **Clinical form** |  |  |
| Dimorphic | 6.768 | 55,3% |
| Virchowian | 2.357 | 19,2% |
| Tuberculoid | 1.049 | 8,5% |
| Indeterminate | 1.321 | 10,8% |
| Not classified | 455 | 3,7% |
| Ignored/Blank | 281 | 2,2% |
| **Disability assessment** |  |  |
| Grade zero | 6.541 | 53,4% |
| Grade I | 3.589 | 29,3% |
| GraudeII | 1.295 | 10,5% |
| Not assessed | 514 | 4,2% |
| Ignored/blank | 281 | 2,2% |

# DISCUSSION

Regarding the gender of the analyzed cases, a predominance of leprosy in male patients was identified, with this group representing about 65% of the cases (7,952), and the female group representing about 35% of the registered cases (4,279). This trend can be observed in the studies by Véras (2023) and Cristofolini (2024), who found a higher prevalence of leprosy cases in men in the states of Paraíba and Mato Grosso, respectively.11 Similarly, in a study conducted in a University Hospital in Pará, it was found that the majority of patients hospitalized for the disease were men.12 Moreover, it is plausible that this gender difference is related to gaps in the integration of leprosy prevention with men's health, leading to late diagnoses and gender differences in health care.13

Regarding the affected age groups, 4.7% are between 10 and 14 years old, and 19.3% are between 40 and 49 years old, being the smallest and largest percentages, respectively. When analyzing this indicator, a lower number of cases is observed in children and adolescents, while, regarding other age groups, there is no significant numerical discrepancy. This epidemiological scenario was previously identified in other studies, one of which recorded decreasing trends in the detection rate of leprosy in children under 15 years old from 2007 to 2017 in Bahia.14,15

Furthermore, a low percentage (4.2%) of those affected by leprosy had access to higher education, which highlights the persistence of social inequalities that are more significantly affected by the disease. 16,17 This metric underscores the strong correlation between social inequality and the onset of the disease.18 As a result, the historical stigma related to the pathological development is reinforced, further exacerbating the social discrimination around health. 15, 19, 20

Marituba was the municipality that registered the highest number of notifications with 1,645 cases. However, this metric may not necessarily relate to the social issues discussed in this context, since the municipality hosts one of the main leprosy treatment units in Pará, the Marcello Cândia Regional Specialized Unit..31 n this sense, population migration from other regions of the state to this center in search of treatment constitutes a significant factor in this logic, considering the possibility of a large portion of the disease cases being notified in Marituba, even though they may not directly belong to this municipality. This dynamic was evidenced in a study on leprosy relapse in the State of Pará, in which most of the patients analyzed lived in the capital Belém, despite the relapse diagnosis being made at the URE Dr. Marcello Cândia in Marituba.32 Thus, it is possible to justify this considerable numerical inflation compared to other cities included in the study, such as the state capital.

Regarding ethnic aspects, the most prevalent ethnicity in the leprosy profile for Pará from 2019 to 2023 was Pardo (mixed race), representing about 73.3% of the recorded cases (8,987). Similarly, the predominance of this epidemiological variant was highlighted in a Brazilian ecological study on leprosy in the northern and northeastern regions, which found a higher frequency of Pardo individuals diagnosed with the disease.21 In the interior of Pará, a study by Queiroz (2024) showed the same predominance of Pardo individuals, with 74% of the cases in Santarém, associated with the diverse ethnic composition of the Brazilian population and the socioeconomic factors typically related to certain communities. 22 herefore, the diagnosis of leprosy may be accompanied by the vulnerability of patients, making them susceptible to different forms of prejudice when the disease is juxtaposed with racial discrimination from specific social groups.23

However, due to the sociodemographic diversity, the association between leprosy and ethnicity varies across the country, as shown in a study conducted in southern Brazil, where the majority of leprosy cases were found in the white population due to the typical social composition of the studied region.24

Additionally, 12,231 cases of leprosy were identified in the state, of which 29% occurred in 2019, representing the majority in the analyzed period. This, however, does not mean that there was some negligence regarding prevention and treatment directed at the population, since there is a record of the significant impact caused by the coronavirus pandemic on notification reporting systems. 25 Therefore, it is not possible to determine if there was underreporting of cases, especially in 2020 and 2021.

Regarding the clinical forms of leprosy, the highest prevalence was of the dimorphic form, with about 55.3% of the cases (6,768), and multibacillary, with approximately 82.8% of the cases (10,129). In a previous epidemiological study conducted in the state of Pará between 2010 and 2015, a majority of dimorphic cases was also identified, representing 45% of a sample of 21,365, with a corresponding predominance of multibacillary cases.26 Moreover, the profiles by Matos (2023) and Barros (2024) conducted in other Brazilian states also showed the same dimorphic and multibacillary predominance, in agreement with the present study. 27,28 ate or inefficient diagnosis is pointed out as the motivation for this significant finding.28

In relation to the assessment of disability, in the leprosy profile of the state of Pará from 2019-2023, it was identified that grade 0 was the most frequent, with 53.3% of the cases (6,541), followed by grade 1 with 29.3% of the cases (3,589). Other studies conducted outside the state showed the same predominance of grade 0 physical disability for the leprosy profile, although the disability characterization made by the Ministry of Health (2020) during the period from 2009 to 2018 showed significant 26.9% of cases of leprosy with GIF 1 and 2. 3,13,29 Furthermore, research conducted in previous years in the northern region and at the national level found considerable levels of grade I and II disabilities associated with leprosy. 21,30 The indication of physical loss of capacity in this pathological context may be associated with the difficulty in early diagnosis, pointing to flaws in the strategies of primary care in the preventive process for the affected population.11

Regarding the limitations of the study, the interpretative issue of the data stands out, which is limited to the informational grouping collected during the research, such as sex and age, excluding other variables that may significantly influence the findings about the disease in a regional parameter, such as, for example, place of residence or lifestyle habits. Moreover, since the study was built from the indirect collection of data, which constitutes a secondary study, the findings of the research are limited to the records found in the information systems. Thus, other subjective factors, which manifest from direct contact with patients, are excluded from the discussion. In this regard, the reliability of these data is entirely dependent on these platforms, and thus any problems related to these databases directly affect the conclusions of the study.

# CONCLUSION

This study found that men and individuals of mixed race (Pardo) ethnicity were the most affected groups by this disease during the researched period. It was also possible to verify that the municipality of Marituba has the highest number of reported cases. Finally, this research helped identify the degree of disability in patients, with grade 0 being the most recurrent, and the clinical forms of the disease, among which both the dimorphic and multibacillary manifestations stand out.

Disclaimer (Artificial intelligence)

Option 1:

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

Option 2:

Author(s) hereby declare that generative AI technologies such as Large Language Models, etc. have been used during the writing or editing of manuscripts. This explanation will include the name, version, model, and source of the generative AI technology and as well as all input prompts provided to the generative AI technology

Details of the AI usage are given below:

1.

2.

3.

REFERENCES

1. BRAZIL. Secretariat of Health Surveillance, Department of Surveillance of Communicable Diseases. Clinical Protocol and Therapeutic Guidelines for Leprosy. Brasília: Ministry of Health. 2022.

2. Alves AP de F, de Oliveira Filho JEL, Gouveia AD de M, Braga AS de M, Tenório DM de C, Cansanção VI de MTC, Carnauba ATL. Epidemiological profile of leprosy in Brazil between 2017 and 2022. Braz. J. Develop. [Internet]. 2023 May 10 [cited 2024 Oct. 27];9(05):15743-5. Available from: https://ojs.brazilianjournals.com.br/ojs/index.php/BRJD/article/view/59638

3. Ministry of Health. Leprosy in Brazil: characterization of physical disabilities. 1st ed. Brasília: Ministry of Health; 2020.

4. WORLD HEALTH ORGANIZATION (WHO). Weekly epidemiological record: global leprosy (hansen disease). 2020.

5. Fujishima Mayumi Aragão, Lemos Lanna Xantipa de Oliveira, Haroldo José de Matos. Spatial distribution of leprosy in children under 15 years of age, in the municipality of Belém, state of Pará, Brazil. Rev Pan-Amaz Saude [Internet]. 2020 [cited 2024 Oct 28] ; 11: e202000229. Available at: http://scielo.iec.gov.br/scielo.php?script=sci\_arttext&pid=S2176-62232020000100017&lng=pt. Epub 25-Aug-2020. http://dx.doi.org/10.5123/s2176-6223202000229.

6. Batista, João & Freitas, Eduarda & Rodrigues, Emanuelle & Borba, Julia & Rosa, Heloísa & Marinheiro, Juliana. (2022). EPIDEMIOLOGICAL CHARACTERISTICS OF LEPROSY IN BRAZIL BETWEEN 2015 AND 2020. The Brazilian Journal of Infectious Diseases. 26. 102089. 10.1016/j.bjid.2021.102089.

7. Lima LV de, Pavinati G, Silva IGP, Moura DR de O, Gil NL de M, Magnabosco GT. Temporal trend, distribution and spatial autocorrelation of leprosy in Brazil: ecological study, 2011 to 2021. Rev bras epidemiol [Internet]. 2022;25:e220040. Available from: https://doi.org/10.1590/1980-549720220040

8. Damasceno, Pollyanna Ribeiro, Victor Alexandre Santos Gomes, Ana Julia Silva De Souza, Mayara Caramês da Silveira, Amanda Lima Laet and Greice Nivea Viana Dos Santos. “Clinical-epidemiological profile of people with leprosy in the state of Pará between 2017-2021.” Contemporary Nursing Journal (2023).

9. Fontelles MJ. Simões, MG, Farias SH, Fontenelles RG. Scientific research methodology: Guidelines for developing a research protocol. Rev. Para. Med. 2009;23(3). Available at: https://pesquisa.bvsalud.org/portal/resource/pt/lil-588477.

10. BRAZIL. Ministry of Health. DATASUS. Health information (TABNET) Ministry of Health; 2024. Accessed on: October 28, 2024.

11. Cristofolini CA, Cruz PN, Arruda VL de, Lima JC, Dominguez OAE, Silva PR de S. Epidemiological profile of leprosy cases and deaths in Mato Grosso: 2011-2020. Cogitare Enferm. [Internet]. 2024.

12. SOARES, Cláudio Galeno de Miranda. Leprosy in the state of Pará: epidemiological profile of the population requiring interaction due to leprosy reactions. 2001. 112 p. Dissertation (Master's in Public Health) - Sergio Arouca National School of Public Health, Oswaldo Cruz Foundation, Rio de Janeiro, 2001.

13. Véras GCB, Soares MJGO, Silva LH, Moraes RM. Epidemiological profile and spatial distribution of leprosy cases in Paraíba. Cad Saúde Colet, 2023; 31 (2):e31020488

14. Miranzi, Sybelle de Souza Castro, Pereira, Lívia Helena de Morais and Nunes, Altacílio Aparecido. Epidemiological profile of leprosy in a Brazilian municipality, from 2000 to 2006. Journal of the Brazilian Society of Tropical Medicine [online]. 2010, v. 43, n. 1 [Accessed 26 October 2024], pp. 62-67. Available at: <https://doi.org/10.1590/S0037-86822010000100014>. Epub 11 Mar 2010. ISSN 1678-9849. https://doi.org/10.1590/S0037-86822010000100014.

15. Santos, Vicente Saul Moreira dos. Documentary research on the history of leprosy in Brazil. History, Sciences, Health-Manguinhos [online]. 2003, v. 10, suppl 1 [Accessed 25 October 2024], pp. 415-426. Available at: <https://doi.org/10.1590/S0104-59702003000400019>. Epub 08 Mar 2004. ISSN 1678-4758. https://doi.org/10.1590/S0104-59702003000400019.

16. Gonçalves A, Mantellini GG, Padovani CR. Leprosy control: perspectives & epidemiological and operational aspects. Rev Inst Med Trop S Paulo. 2010;52(6):311-5. DOI: http://dx.doi.org/10.1590/S0036-46652010000600005»http://dx.doi.org/10.1590/S00306-46652010000600005

17. Lustosa AA, Nogueira LT, Pedrosa JIS, Teles JBM, Campelo V. The impact of leprosy on health-related quality of life. Rev Soc Bras Med Trop. 2011;44(5):621-6. DOI: http://dx.doi.org/10.1590/S0037-868220110005000190» http://dx.doi.org/10.1590/S0037-86822011000500019

18. Cavalcante, Marília Daniella Machado Araújo, Larocca, Liliana Müller and Chaves, Maria Marta Nolasco. Multiple dimensions of leprosy care management and the challenges for elimination. Journal of the USP School of Nursing [online]. 2020, v. 54 [Accessed 25 October 2024], e03649. Available from: <https://doi.org/10.1590/S1980-220X2019010703649>. Epub 07 Dec 2020. ISSN 1980-220X. https://doi.org/10.1590/S1980-220X2019010703649.

19. Monteiro, Lorena Dias et al. Social determinants of leprosy in a hyperendemic State in Northern Brazil. Journal of Public Health [online]. 2017, v. 51 [Accessed October 25, 2024], 70. Available at: <https://doi.org/10.1590/S1518-8787.2017051006655>. Epub July 20, 2017. ISSN 1518-8787. https://doi.org/10.1590/S1518-8787.2017051006655.

20. CC Valley. Leprosy and social representations: the look and the care for those experiencing the disease [dissertation]. Belém: University of the State of Pará; 2021. p. 134.

21. Ferreira, A. F., Amorim de Sousa, E., Soledad Márdero García, G., Silva dos Reis, A., Corona, F., Silveira Lima, M., Silva Nascimento Andrade, E., Ribeiro Filha, C. , Alves de Sena Neto, S., Mendes Donato, I. and Novaes Ramos Jr, A. (2020), Leprosy in the North and Northeast regions of Brazil: an integrated space-time approach. Trop Med Int Health, 25: 193-208. <https://doi.org/10.1111/tmi.13343>

22. Cota Queiroz EJ, Nunes da Rocha I, Valentim LdA, Quaresma TJC, de Souza Filho ZA, et al. (2024) Epidemiological, clinical and geographic characterization of Leprosy in Santarém County-Pará: Insights for effective control and targeted intervention. PLOS Neglected Tropical Diseases 18(3): e0012063. https://doi.org/10.1371/journal.pntd.0012063

23. Jesus ILR de, Montagner MI, Montagner MÂ, Alves SMC, Delduque MC. Leprosy and vulnerability: a scoping review. Public health science [Internet]. 2023Jan;28(1):143–54. Available at: <https://doi.org/10.1590/1413-81232023281.09722022>

24. Moraes PC de, Eidt LM, Koehler A, Ransan LG, Scrofeneker ML. Epidemiological characteristics of leprosy from 2000 to 2019 in a state with low endemicity in southern Brazil. Brazilian Annals of Dermatology. [Internet]. 2023 [cited 2023 Jun. 08]; 98:602-610. Available at: <https://doi.org/10.1016/j.abd.2022.08.009>

25. Sallas, Janaína et al. Decrease in compulsory notifications recorded by the Brazilian National Hospital Epidemiological Surveillance Network during the COVID-19 pandemic: a descriptive study, 2017-2020. Epidemiology and Health Services [online]. v. 31, n. 1 [Accessed 25 October 2024] , e2021303. Available at: <https://doi.org/10.1590/S1679-49742022000100011>. ISSN 2237-9622. https://doi.org/10.1590/S1679-49742022000100011.

26. PiresC. A. A.; KeysE. W.; SalmenC. F.; BalieiroA. B. of R.; SantosM. B. L.; by Araujo FilhoG. G.; MosqueF. M.; FlagS. S.; XavierM. B. Analysis of the clinical-epidemiological profile of leprosy in Pará and evaluation of health indicators. Electronic Journal Health Collection, n. 27, p. e899, 18 Jul. 2019.

27. Matos FM, Pereira MA, Feitosa AHC, Viana LHSC, Silva MDF da, Santos KCB dos. Clinical-epidemiological profile of leprosy in the municipality of Coroatá-MA. Nursing Brazil [Internet]. 2023 Mar 13;22(1):6–19. Available from: <https://convergenceseditorial.com.br/index.php/enfermagembrasil/article/view/5374#:~:text=Resultados%3A%20no%20per%C3%ADodo%20analisado%2C%20notificaram>

28. Barros I da CA, Sousa C da CM, Silva NRF da, Mascarenhas MDM. Characterization of cases and epidemiological and operational indicators of leprosy: analysis of time series and spatial distribution, state of Piauí, Brazil, 2007-2021. Epidemiol Serv Health 2024;33:e2023090. https://doi.org/10.1590/S2237-96222024v33e2023090.en.

29. Lanza FM, Amorim KJ, Guarda KSG, Silva L, Silva J, Vidal SL, et al. Epidemiological profile of leprosy in the municipality of Divinópolis, Minas Gerais, 2011 to 2019. Medicine (Ribeirão Preto) [Internet]. 2022 Nov 9 [cited 2024 Oct 27];55(3):e-193699. Available at: <https://www.revistas.usp.br/rmrp/article/view/193699>

30. Pescarini JM, Teixeira CSS, Silva NB da, Sanchez MN, Natividade MS da, Rodrigues LC, et al.. Epidemiological characteristics and temporal trends of new leprosy cases in Brazil: 2006 to 2017. Cad Saúde Pública [Internet]. 2021;37(7):e00130020. Available from: <https://doi.org/10.1590/0102-311X00130020>

31. Da Silva JB. The former leprosy colony of Marituba: historical, sociological and ethnographic perspectives (Paper 234). NAEA Papers. November 22, 2009;1(1).

32. Melo SL, Mariano G, Andrea C, Heliana M. Leprosy recurrence in a highly endemic area in the State of Pará, Brazil. Pan-Amazonian Health Magazine. August 1, 2014;5(3).