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Trend of pediatric leprosy in an endemic area in Northeast of Brazil, 2008–2018



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ABSTRACT

Background: The incidence of leprosy in children is an important indicator of the disease's tendency in the general population and suggests intense circulation and transmission of *Mycobacterium leprae*.

Objectives: To describe the clinical, epidemiological characteristics and temporal dynamics of leprosy cases in children under 15 years of age from 2008 to 2018 in an endemic municipality.

Methods: A descriptive study with an analytical approach was carried out with data from leprosy cases registered in the Brazilian Information System on Notifiable Diseases for the municipality of Cabo de Santo Agostinho, Pernambuco, Brazil.

Results: Between 2008 and 2018, 112 new cases of leprosy were registered. Most cases were classified as paucibacillary leprosy and occurred in children living in urban areas. There was no significant difference in the incidence of leprosy during the study period. Only 4.5% of the sample presented reactional episodes, but a high number of cases were not evaluated for the occurrence of reactions.

Conclusions: The findings of this study show a high incidence of paucibacillary leprosy in children and adolescents, which reveals active transmission in the community and failures in the detection of new multibacillary cases among adults. Children between 10 and 14 years old are more vulnerable to *M. leprae* infection and mainly develop paucibacillary leprosy.

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Tendencia de la lepra pediátrica en un área endémica del nordeste de Brasil, 2008-2018

R E S U M E N

Palabras clave:

Enfermedad desatendida

Mycobacterium leprae

Niños

Salud pública

Antecedentes: La incidencia de lepra en niños es un indicador importante de la tendencia de la enfermedad en la población general y muestra una intensa circulación y transmisión de *Mycobacterium leprae*.

Objetivos: Describir las características clínico-epidemiológicas y la dinámica temporal de los casos de lepra en menores de 15 años de 2008 a 2018 en un municipio endémico.

Métodos: Se realizó un estudio descriptivo con enfoque analítico con datos de casos de lepra del Sistema Brasileño de Información sobre Enfermedades de Declaración Obligatoria para el municipio de Cabo de Santo Agostinho, Pernambuco, Brasil.

Resultados: Entre 2008 y 2018, se registraron 112 nuevos casos de lepra. La mayoría de los casos fueron clasificados como lepra paucibacilar y ocurrieron en niños que viven en áreas urbanas. No hubo diferencias significativas en cuanto a la incidencia de la lepra durante el período de estudio. Solo el 4,5% de la muestra presentó episodios reaccionales, pero un gran número de casos no fueron evaluados para determinar la aparición de reacciones.

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Conclusiones: Los hallazgos de este estudio muestran una alta incidencia de lepra paucibacilar en niños y adolescentes, lo que revela transmisión activa en la comunidad y fallas en la detección de nuevos casos multibacilares entre adultos. Los niños entre 10 y 14 años son más vulnerables a la infección por *Mycobacterium leprae* y desarrollan principalmente lepra paucibacilar.

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Introduction

Leprosy is a much-neglected tropical disease, mainly caused by *Mycobacterium leprae* (*M. leprae*). It is characterized by dermatological manifestations and damage to the peripheral nerves, and when not treated early, may cause deformities and irreversible physical disabilities.^{1,2} The spectrum of clinical manifestations of leprosy extends from the polar tuberculoid form, a milder form, with a small number of skin lesions and low bacillary load (commonly classified as “paucibacillary”), to the polar form of lepromatous leprosy, with numerous skin lesions, high bacillary load and considered more severe and disfiguring (referred to as “multibacillary”).³ This variability of clinical forms among patients infected with *M. leprae* reflects the individual's immune response and genetic factors associated with environmental factors.⁴

Despite efforts to eradicate leprosy, it is still considered a public health problem, with more than 200,000 new cases identified each year worldwide.³ It is endemic in low- and middle-income countries such as India, Brazil, Indonesia, Bangladesh and Ethiopia, which account for more than 80% of all cases.^{5,6} According to the Epidemiological Bulletin (2022), an average of 17,442 new cases of Leprosy were reported in children under 15 years of age between 2012 and 2021. Preliminary data for 2022 shows a total of 14,962 new cases, of which 645 were in children under 15 years of age (4.3%). Brazil has the second highest global incidence of cases and led to a detection rate of 13.70/100,000 inhabitants.⁷

The detection of leprosy in children aged under 15 years is an important indicator of active transmission of *M. leprae* and the magnitude of disease transmission. The occurrence of cases in this age group is directly related to the proportion of sources of infection (multibacillary cases) untreated by the healthcare services, especially in the intrafamily environment.^{8–12} It should be mentioned that conditions of high transmissibility and early exposure to the infectious agent increase the chances of developing the disease.^{13,14} Early diagnosis of cases and adequate treatment continue to be central issues in developing control strategies to interrupt the transmission of leprosy and reduce the time of exposure of children and adolescents to the transmission foci.^{1,8}

In the last 10 years, the detection rate of leprosy in children aged under 15 years has demonstrated an increasing trend in some Brazilian federal states and capital cities, thereby indicating a recent aggravation of this endemic disease.¹⁵ The state of Pernambuco, located in the Northeastern region of Brazil, is highly endemic for leprosy in detecting both general cases and in children aged under 15 years.¹⁶ In 2018, 2157 cases were registered in the state, of which 8.7% were in children. According to the 2022 Epidemiological Bulletin, the state of Pernambuco ranks third in terms of Leprosy cases both in the general population and in the population aged 0–14 years.

Effective actions aimed at controlling the disease, especially in the active search and early diagnosis of cases, particularly in vulnerable populations such as children and adolescents. Within this context, understanding the risk markers for the incidence of this disease in priority municipalities when monitoring leprosy in Pernambuco will contribute to the formulation of more effective control strategies, since the lack of vigilance and active search

of patients is an important factor in adherence and continuity of treatment.

The present study aimed to describe the clinical and epidemiological characteristics of leprosy in children aged under 15 years, registered from 2008 to 2018 in an endemic municipality in the state of Pernambuco.

Materials and methods

Study type and location

This was a retrospective study of a historical series of leprosy cases (2008–2018) in the municipality of Cabo de Santo Agostinho, Pernambuco, Brazil. Located in the metropolitan region of Recife, covering a total area of 446.57 km², with an estimated population of 208,944, 91% of whom live in urban areas,¹² with a Human Development Index of 0.69.¹³

Study population and data source

The study population consisted of all confirmed cases of leprosy registered in the Notifiable Diseases Information System (SINAN) in individuals aged under 15 years, all residents of the municipality of Cabo de Santo Agostinho. Data were obtained through the Compulsory Notifications of Leprosy forms, registered in the SINAN/Leprosy databases,¹⁴ provided by the Municipal Secretariat of Epidemiology in Cabo de Santo Agostinho.

Cases are considered when a patient presents one or more characteristics that require polychemotherapy. The criteria used to define cases include the presence of skin lesions with altered sensitivity, involvement of nerves with neural thickening. The intradermal bacilloscopy is an important complementary test for the identification and detection of leprosy cases, as well as for the screening of new cases. It is a recommended procedure following the guidelines of the Technical Procedures Guide: bacilloscopy in leprosy by the Ministry of Health.¹⁷ In this study, all patients, in addition to the clinical diagnosis, tested positive on the bacilloscopy.

According to the Brazilian Ministry of Health (2002),¹⁸ the specific treatment for leprosy is polychemotherapy, which involves the combination of medications. The treatment regimen varies based on the patient's classification as Pauci or Multibacillary, and for children under 15 years, it also considers their age. The discharge as cured is granted after the appropriate administration of the prescribed doses. The cure of leprosy plays a crucial role in both individual and public health, as it interrupts the transmission of the disease and contributes to reducing its incidence in affected communities.

The incidence of leprosy in children under 15 years of age was calculated by dividing the number of new cases during the study period by the population of children under 15 years of age in the same period,¹⁹ and the rate was expressed per 100,000 inhabitants.

Data analysis

A descriptive analysis was conducted of the sociodemographic, clinical and epidemiological characteristics of the cases registered

Table 1

Sociodemographic characterization and distribution of leprosy cases according to the mode of entry into the registry of cases in children under 15 years of age in the municipality of Cabo de Santo Agostinho, from 2008 to 2018 (SINAN/Municipal Health Secretariat).

Mode of case entry	Frequency <i>n</i>	Percentage %
<i>New case</i>	112	88.8
<i>Transferred from within the same municipality</i>	7	5.6
<i>Transferred from another municipality in Pernambuco</i>	3	2.4
<i>Transferred from another state</i>	2	1.6
<i>Relapse</i>	1	0.8
<i>Other reasons</i>	1	0.8
Sociodemographic characterization		
<i>Sex</i>		
Female	65	58.0
Male	47	41.9
<i>Age</i>		
0–4	9	8.0
5–9	39	34.8
10–14	64	57.1
<i>Residence</i>		
Urban	107	95.5
Rural	5	4.4

from 2008 to 2018, using the absolute number and frequency (%). Additionally, to detect whether the characteristics varied significantly over time, the data were analyzed from 2008 to 2018. In addition, the leprosy incidence rate (new cases per 100,000 inhabitants) was calculated considering the projection of the population aged under 15 years from 2008 to 2018. To analyze the trend of leprosy incidence over the years, a linear regression model was applied to estimate the incidence from 2008 to 2018.

The linear regression analysis of the leprosy incidence data over the years was performed in R using the ggplot2 package to create the graph. The regression trend line was fitted to assess the trend of leprosy incidence over the years. The linear regression model was fitted using the 'lm' function, where the response variable is the incidence and the predictor variable is the year. The *F*-test was conducted using the 'coeftest()' function from the 'lmtest' package to calculate the joint significance of all model coefficients. The *p*-value associated with the *F*-test was considered significant if it was less than 0.05. The statistical analyses were performed using Statistic 8.0²⁰ and R software.²¹

Results

Data characteristics

In the period from 2008 to 2018, 123 cases of leprosy were identified, 112 corresponding to new cases, were recorded in children aged under 15 years in the municipality of Cabo de Santo Agostinho (Table 1).

Characteristics of leprosy cases

According to the operational classification of the new cases, most of the cases were classified as paucibacillary leprosy. The most common clinical form was tuberculoid, followed by indeterminate and borderline. The Virchowian form had the lowest number of recorded cases. In our study, we observed that in some cases there was no classification regarding the clinical presentation of the disease. Most of the patients did not present any degree of physical disability (Table 2).

Regarding treatment, most patients received treatment without any reactive episodes. Only two cases were reported to have reactions of Type 1 or Type 2. However, there was a lack of information on reactive episodes (Table 2). The number of patients cured

Table 2

Clinical and epidemiological characteristics of new cases in children aged under 15 years diagnosed with leprosy from 2008 to 2018 (SINAN/Municipal Health Secretariat) in Cabo de Santo Agostinho, Northeastern Brazil.

Characteristics	Frequency (<i>n</i> = 112)	Percentage %
<i>Classification</i>		
Paucibacillary	87	77.68
Multibacillary	25	22.32
<i>Clinical form</i>		
Indeterminate	27	24.10
Tuberculoid	34	30.36
Borderline	16	14.29
Virchowian	2	1.79
Not classified	9	8.04
No information	24	21.42
<i>Incapacity</i>		
Grade 0	101	90.18
Grade 1	7	6.26
Grade 2	2	1.78
No information	2	1.78
<i>Leprosy reaction</i>		
Type 1	4	3.57
Type 2	1	0.90
No reaction	67	59.82
No information	40	35.71
<i>Treatment outcome</i>		
Cure	96	85.74
Transference	6	5.36
Abandoned	4	3.57
Diagnostic error	1	0.90
No information	5	4.46

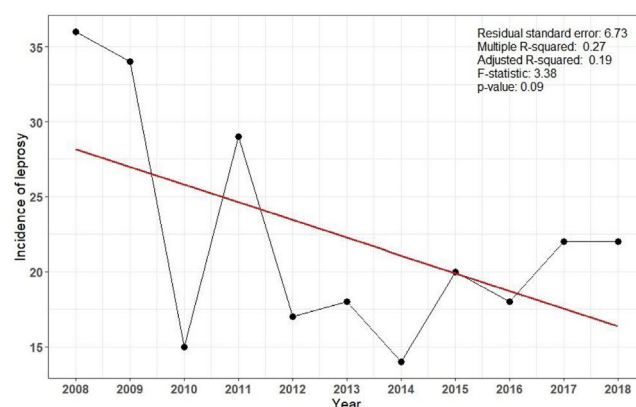


Fig. 1. Temporal trend of leprosy incidence (per 100,000 inhabitants) in children under 15 years of age diagnosed from 2008 to 2018 (SINAN/Municipal Health Secretariat) in Cabo de Santo Agostinho, Northeastern Brazil.

is high, although treatment abandonment still prevails in a small proportion of this population.

Temporal dynamics of leprosy

The analysis of temporal dynamics data reveals that the incidence rate of leprosy in children under 15 years of age in Cabo de Santo Agostinho (22.0 cases/100,000 inhabitants) was higher than the average incidence of leprosy in Brazil, which was approximately 5.86 cases per 100,000 inhabitants, and in Pernambuco it was about 13.0 cases per 100,000 inhabitants for the same period¹⁹ (Fig. 1). There were no significant differences between the evaluated years regarding the incidence or number of cases.

Discussion

The number of new cases of leprosy in children and adolescents in the municipality of Cabo de Santo Agostinho indicates an intense transmission and spread of *M. leprae*, since the detection of cases in this group signals that there are adults in the contagious form without treatment. In relation to the profile of the new cases, studies have shown that individuals between the ages of 10 and 14 are at a higher risk of developing leprosy compared to other age groups,⁴ due to prolonged exposure to the etiologic agent and the long incubation period of the disease.^{6,8,22} Although a predominance of cases in female patients was observed in other studies carried out in the Brazilian Northeastern region,²³ for this study, no differences were observed between the male and female groups in the evaluated period. However, a significant part of the literature reports a greater number of cases of leprosy in males.^{8,9,24}

Although in hyperendemic areas Paucibacillary Leprosy it is not uncommon to prevail over the multibacillary form. Our results have demonstrated that most patients presented with paucibacillary leprosy, and the tuberculoid and indeterminate clinical form, which represents an initial stage of the disease.²⁵ In addition, it is necessary to discuss the possibility of implementing rapid tests for leprosy in public health services, especially in primary health care.²⁶

This study has revealed a low proportion of children with reactive episodes, when compared to other reports, in which the reactive frequency varies between 5 and 20% in children aged under 15 years.^{27,28} A possible explanation for this finding is that a relevant number of cases were not assessed for reactive occurrences, which is of great concern especially since this is a pediatric group.

Several studies have demonstrated that, among children, paucibacillary forms of leprosy are more prevalent.^{6,8,23} However, in areas with a high endemicity rate, it is not unusual for multibacillary forms to prevail over paucibacillary ones. In our study, we observed that most patients had paucibacillary leprosy, with tuberculoid and indeterminate clinical forms being predominant.

Another point to be considered is the fact that paucibacillary disease, the predominant operational classification in the present study, tends to cause few reactive complications and/or deformities.^{18,29} In any case, patients diagnosed with leprosy should be thoroughly examined by a health team which is able to recognize the signs and symptoms of the reactions. However, areas of high endemicity do not have a well-structured surveillance and care system, since they are systematically poorer.^{30,31}

Disability in leprosy is characterized by loss of protective sensitivity, muscle strength and/or visible deformities on the face, upper and lower limbs, with grades that can vary between 0, 1 and 2. Grade 0 – absence of disability (without anesthesia) and no visible damage or deformity to eyes, hands or feet; Grade 1 – loss of protective sensitivity in the eyes, hands and feet; Grade 2 – presence of deformities or visible lesions in the eyes, hands or feet. In leprosy the paralytic deformities are caused by the destruction of the motor nerve fibers that innervate the intrinsic nerve and motor muscles. In general, disabilities in childhood leprosy are often caused by the child's family being unaware, lack of cooperation and delay in diagnosis and therapy, resulting in disease progression that can lead to disability.^{13,14}

Among the patients treated for leprosy, 85.74% had been taken off drug therapy, a proportion considered regular in relation to the quality of care for leprosy by the Ministry of Health. It is important to point out that although officially the completion of leprosy treatment means cure. However, completing the full treatment for leprosy does not always guarantee the elimination of health issues, as some patients may still have a high bacterial load and active lesions even after treatment. It is important to note that the perception of health by the patient may also be affected by other

factors, which should be considered when evaluating treatment outcomes.³² According to a study, the factors associated with the perception of not being cured are physical disabilities and symptoms such as joint pain and muscle weakness.³³

In terms of children aged under 15 years, there is a lack of studies on the self-perception of cure and on complications after being taken off treatment. It should be noted that the post-treatment period is not part of the active surveillance of disease progression, although many reactive episodes may occur after the end of treatment. Thus, a patient care program is needed after the completion of treatment for leprosy.

Conclusions

The findings of this study show a high incidence of paucibacillary leprosy in children and adolescents, which reveals active transmission in the community and failures in the detection of new multibacillary cases among adults. Children between 10 and 14 years old are more vulnerable to *M. leprae* infection and mainly develop paucibacillary leprosy.

Our results reinforce the importance of strengthening public health interventions that prioritize the active search for cases, through examinations of household and social contacts for early diagnosis and reduction of leprosy transmission. In addition, they show that it is essential to invest in the training of health professionals aiming at the diagnosis and adequate treatment of cases and encourage the participation of these professionals in health education actions focused on the child population.

Author's contributions

MEFG and APCP planned the research; MEFG collected the samples and performed the statistical analysis; MEFG and APCP interpreted and discussed the results and reviewed the manuscript. The manuscript is part of the MEFG master's thesis. All authors approved the final version.

Conflict of interest

The authors declare no competing or conflict of interest.

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