

## Epidemiological analysis of leprosy in an endemic state of northeastern Brazil

*Análise epidemiológica da hanseníase em um estado endêmico do nordeste brasileiro*

*Análisis epidemiológica de la lepra en estado endémico del nordeste brasileño*



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### ABSTRACT

**Objective:** To characterise the trend of leprosy according to epidemiological and operational indicators in the state of Paraíba in the period of 2001–2011 with projections for the years 2012–2014.

**Methods:** An epidemiological, retrospective, documentary study of a temporal sequence conducted with 10,476 reported cases of leprosy diagnosed in adults between 2001 and 2011 in 223 municipalities in the state of Paraíba, Brazil. The results were composed and analysed using two epidemiological indicators, an operational indicator and statistical software.

**Results:** The annual detection rate of new cases showed an upward slope between 2001 and 2005 and a declining trend from 2006. Disability showed a cyclic variation with a downward tendency and a medium level of efficiency.

**Conclusion:** The results show that the disease continues to be a problem in the state and reveal the need for shorter assessments that focus on health programmes and strategies that are used to fight leprosy.

**Keywords:** Leprosy. Epidemiology. Public health. Millennium Development Goals.

### RESUMO

**Objetivo:** Caracterizar a tendência, segundo indicadores epidemiológicos e operacionais, de endemia da hanseníase no Estado da Paraíba no período de 2001–2011, com projeções para os anos de 2012–2014.

**Métodos:** Estudo epidemiológico de série temporal, retrospectivo e documental, realizado com 10.476 casos notificados de hanseníase, diagnosticados entre 2001–2011, nos 223 municípios do Estado paraibano. Utilizou-se para composição e análise dos resultados dois indicadores epidemiológicos e um indicador operacional além de software estatístico.

**Resultados:** Para o coeficiente de detecção anual de casos novos, verificou-se inclinação ascendente entre os anos de 2001 a 2005, com tendência de queda a partir de 2006. Quanto à incapacidade física, visualizou-se variação cíclica, com tendência à inclinação descendente, com classificação considerada de média efetividade.

**Conclusão:** Os resultados apontaram continuidade da endemia no Estado, existindo a necessidade de avaliações mais curtas voltadas aos programas e estratégias em saúde utilizadas no combate à hanseníase.

**Palavras-chave:** Hanseníase. Epidemiologia. Saúde Pública. Objetivos de Desenvolvimento do Milênio.

### RESUMEN

**Objetivo:** Caracterizar la tendencia, según los indicadores epidemiológicos y operacionales, la enfermedad de la lepra en el estado de Paraíba, en el período 2001–2011, con proyecciones para los años 2012–2014.

**Métodos:** Estudio epidemiológico de series temporales retrospectivas y documentales, que se realizó con 10.476 casos notificados de lepra diagnosticados entre 2001 a 2011 en 223 municipios del Estado de Paraíba. Se utilizó para la composición y el análisis de los resultados de los indicadores epidemiológicos y un indicador de funcionamiento, así como el software estadístico.

**Resultados:** Para la tasa de detección anual de nuevos casos, hubo pendiente ascendente entre los años 2001–2005, con una tendencia a la baja a partir de 2006. En cuanto a la discapacidad, visualizado si una variación cíclica, con una tendencia a inclinar abajo la clasificación considerada eficacia media.

**Conclusión:** Los resultados muestran la continuidad de la enfermedad en el Estado, hay una necesidad de revisiones más cortas enfocadas en programas y estrategias de salud utilizadas para combatir la lepra.

**Palabras clave:** Lepra. Epidemiología. Salud pública. Objetivos de Desarrollo del Milenio.

<http://dx.doi.org/10.1590/1983-1447.2015.esp.55284>

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## ■ INTRODUCTION

Leprosy is considered a notifiable disease in Brazil and a public health problem due to its epidemiological aspects. The World Health Organization (WHO) submitted official reports from 115 countries. These reports show that the global prevalence of leprosy for the first quarter of 2013 was greater than all the cases reported the previous year. This corresponds to 81.17% of the 232,857 cases detected in 2012<sup>(1)</sup>.

These high rates are heavily influenced by world figures from countries like Angola, Brazil, Central African Republic, India and Madagascar, which include pockets of high endemicity of the disease<sup>(1)</sup>. In Brazil, the ministry of health undertook to eliminate leprosy as a public health problem by 2015, which means achieving less than one case per 10,000 inhabitants. In 2012, the ratio was 1.51/10,000 inhabitants<sup>(2)</sup>.

A study conducted in Brazil identified ten clusters with high detection rates for leprosy. Paraíba represents part of these clusters and it is the largest endemic area of the *sertão* mesoregion of Paraíba, more specifically in the microregions of Cajazeiras, Itaporanga, Catolé do Rocha, Píancó and Serra do Teixeira<sup>(3)</sup>.

The Global Leprosy Programme has had a positive effect on the prevalence of cases recorded in the last twenty years through the implementation of multidrug therapy (MDT). However, further advances in the field of leprosy are hampered by the lack of contemporary tools to continuously detect new cases and the long-term consequences of the disease.

A study<sup>(4)</sup> found that the greatest challenge for the eradication of leprosy is the absence of research that proposes innovations, considering that the global recommendations are still based on strategies initiated 25 years ago. In fact, the Leprosy Research Strategy adopted by the International Federation of Anti-Leprosy Associations (ILEP) in 2011, proposed eight key topics of leprosy control such as disease prevention, early detection, multidrug therapy, reactions, prevention of disabilities, rehabilitation, reducing stigma and social integration<sup>(4)</sup>.

Such topics should be constructed as an integrated research axis that uses convergent methods and bases and is coordinated by a work group. The project in question is based on solid partnerships and brings new evidence of effective interventions that can be implemented in all regions and contexts<sup>(4)</sup>.

A study in Egypt<sup>(5)</sup> found that the detection of new cases of leprosy creates a better picture of disease endemicity, in comparison to prevalence, because it is not affected by

the changing definitions for endemicity standards or duration of treatment. This claim may be justified by a global frequency study<sup>(6)</sup> when it suggests that the detection of new cases increases the prevalence of the disease when evaluated for a short time. In other more immediate terms, prevalence is valuable for the healthcare system but not for the community, which represents an operational variation rather than an epidemiological variation.

Consequently, the use of prevalence of leprosy as an epidemiological indicator should include data on reported cases over the past few years for a medium to long term. The general purpose of leprosy control programmes is to cure, stop the transmission and prevent disability from the disease. Measuring the advancements of this process is an essential part of the method, and this is precisely the purpose of epidemiological indicators<sup>(7)</sup>.

Given the lack of scientific evidence on the epidemiological context of Paraíba, we felt the need to conduct research on this specific subject. This study reviews the number of new cases of leprosy detected annually in the state of Paraíba, Brazil. The aim of this study was to characterise the trend of endemic leprosy according to epidemiological and operational indicators in the state of Paraíba, Brazil, during the 2001-2011 period with projections for the years 2012-2014.

## ■ METHODOLOGY

An epidemiological, retrospective study of a temporal sequence with a documentary basis conducted with 10,476 reported cases of leprosy diagnosed in adults between 2001 and 2011 in 223 municipalities in the state of Paraíba, Brazil. The information was collected in September 2013 and included all confirmed and notified cases of leprosy in the *Sistema de Informação de Agravos de Notificação* (Sinan – NET), a disease notification information system of the state health department (SES), in the municipality of João Pessoa/PB, from January 2001 to December 2011<sup>(8)</sup>.

The chosen time interval covers the start of the disease elimination strategies (2001) and the new guidelines of the integrated plan (2011-2015) for the elimination and control of leprosy<sup>(8)</sup>. During the data collection stage, the data for 2012-2013 were not available at the Sinan due to technical problems.

To characterise the temporal evolution of leprosy, we used two epidemiological indicators (IE) and an operating indicator (IO) recommended by the Brazilian ministry of health<sup>(9)</sup>. The annual detection coefficient for new cases of leprosy per 100,000 inhabitants (EI) measures the

strength of morbidity, magnitude and trend of the disease. The classification follows the standards below: Hyperendemic > 40.0 cases/100,000 inhabitants; Very high 20.00 to 39.99/100,000 inhabitants; High 10.00 to 19.99/100,000 inhabitants; Medium 2.00 to 9.99/100,000 inhabitants; Low < 2.00/100,000 inhabitants<sup>(9)</sup>.

The proportion of cases of leprosy with grade 2 disability at the time of diagnosis among the new cases detected and assessed in the year (IE) indicates the effectiveness of timely detection and/or early cases. The parameters describe the following: High when > 10%; Average when 5% – 9.9%; and Low when < 5%<sup>(9)</sup>.

In relation to the indicators, we found a proportion of new cases of leprosy with the degree of disability (GIF) evaluated in the diagnosis (IO), which assesses the quality of care at the services and results of programme actions, according to the following evaluation parameters: Good > 90%; Regular between 75% – 89.9%; and Precarious < 75%<sup>(9)</sup>. The indicators were constructed using data on population estimates from the publication “*Saúde Brasil 2012*” – Paraíba<sup>(10)</sup>.

Initially, the variables of interest were identified, decoded according to the data dictionary of the Sinan – NET (version 4.0) and typed into a Microsoft Excel® spreadsheet. After entering and checking the consistency of the data, the information was re-encoded for statistical analysis using IBM SPSS (Statistical Package for Social Science) version 20.0.

For data analysis, the statistical techniques of analysis of variance and multiple comparisons were used to detect any significant differences between several samples, estimate the degree of this difference, and compare the evolution of the epidemiological indices proposed over the years of observation. The projection was conducted in the same way, considering the notification cycles and temporal trend assessed in recent years.

In observance of the provisions of the Resolution 466/12<sup>(11)</sup>, this project was approved by the research ethics committee of the Centro de Ciências da Saúde at the Universidade Federal da Paraíba (UFPB) as a subproject of a more comprehensive survey entitled “*Perfil epidemiológico dos doentes de Hanseníase na Paraíba: 2001-2011*”, under protocol 203.485, CAAE 11076312.1.0000.5188. The anonymity and confidentiality of the obtained information was guaranteed, along with all other prerogatives.

The results presented in this paper are based on a master’s dissertation “*Análise epidemiológica e temporal da hanseníase na Paraíba*”, presented to the Programa de Pós-Graduação em Enfermagem of the Universidade Federal da Paraíba<sup>(12)</sup>.

## ■ RESULTS

In the study period, 10,476 cases of leprosy were reported in the Sinan – NET. These cases showed an improvement of the leprosy situation according to the epidemiological and operational indicators (Table 1).

The annual detection coefficient for new cases of leprosy per 100,000 inhabitants showed an upward slope from 2001 to 2005 and a downward trend from 2006 (Figure 1). However, considering the parameters of the ministry of health<sup>(9)</sup>, endemicity remained high (20.00 to 39.99/100,000 inhabitants) for the investigated period. The indicator for the detection of new cases projected a stabilisation period for the years 2012-2014.

The proportion of cases of leprosy with grade 2 disability assessed at the time of diagnosis showed a cyclical variation with a downward slope and a classification of medium effectiveness (of 5% to 9.9%) from 2006. The 2012-2014 projections showed a tendency toward reduction of this indicator (Figure 2).

For the proportion of new cases of leprosy with disability assessed by diagnosis (Indicator 3), the parameters can be described as precarious (Precarious:< 75%). However, for 2006, there was a sharp drop in the number of assessed cases with disability and a tendency toward stabilisation from 2007 (Figure 3).

## ■ DISCUSSION

The trends detected by the epidemiological indicators and analysed over a specific period are far more enlightening than the information obtained by analysing isolated cases. The case detection rate is considered one of the most useful indicators for evaluating the transmission of leprosy in a certain area. This rate mostly depends on the detection of new cases and directly reflects the efficiency of disease control programmes<sup>(7)</sup>.

A study that analysed this endemic disease on a global scale presented data that corroborates the findings of this study. According to the study, the detection coefficient of cases homogeneously dropped worldwide from 1999, with the exception of only eight countries, among which Brazil is not included<sup>(6)</sup>.

The authors<sup>(13)</sup> stated that the slow reduction in the incidence of the disease in endemic countries such as Brazil, India and Indonesia, reflects the epidemiological characteristics of *M. Leprae* due to its long incubation period. This study revealed a drop in the indicator from 2006 with a tendency toward stabilisation for the 2012-2014 projections.

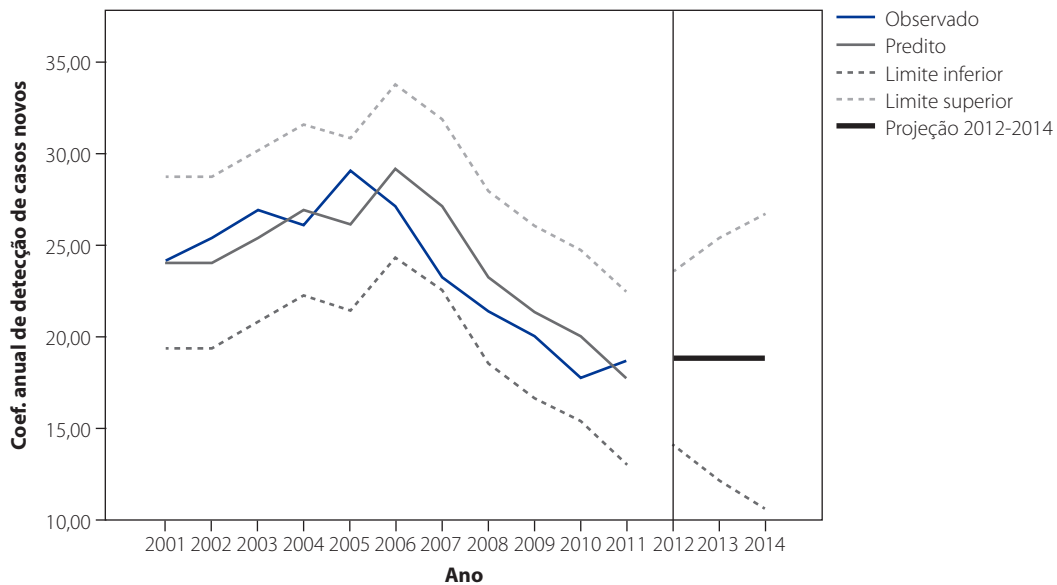
**Table 1** – Evolution of leprosy according to epidemiological and operational indicators in the 2001-2011 period with projections for 2012-2014. Paraíba, Brazil, 2014.

Year	Annual detection coefficient for new cases (100,00 inhab.)		Proportion of cases of leprosy with grade 2 disability assessed in the diagnosis of new cases		Proportion of cases of leprosy with disability assessed in the diagnosis of new cases	
	Value	Classification*	Value	Classification*	Value	Classification*
2001	24.11	Very high	13.39	High	55.32	Precarious
2002	25.43	Very high	9.24	Medium	55.89	Precarious
2003	26.96	Very high	7.12	Medium	54.56	Precarious
2004	26.13	Very high	9.31	Medium	43.78	Precarious
2005	29.09	Very high	10.82	High	44.13	Precarious
2006	27.18	Very high	6.93	Medium	23.40	Precarious
2007	23.31	Very high	5.88	Medium	55.74	Precarious
2008	21.42	Very high	7.87	Medium	59.34	Precarious
2009	27.18	Very high	6.93	Medium	56.27	Precarious
2010	23.31	Very high	5.88	Medium	59.43	Precarious
2011	21.42	Very high	7.87	Medium	55.24	Precarious
2012 <sup>†</sup>	18.83	High	5.57	Medium	51.19	Precarious
2013 <sup>†</sup>	18.83	High	5.08	Medium	51.19	Precarious
2014 <sup>†</sup>	18.83	High	4.60	Low	51.19	Precarious

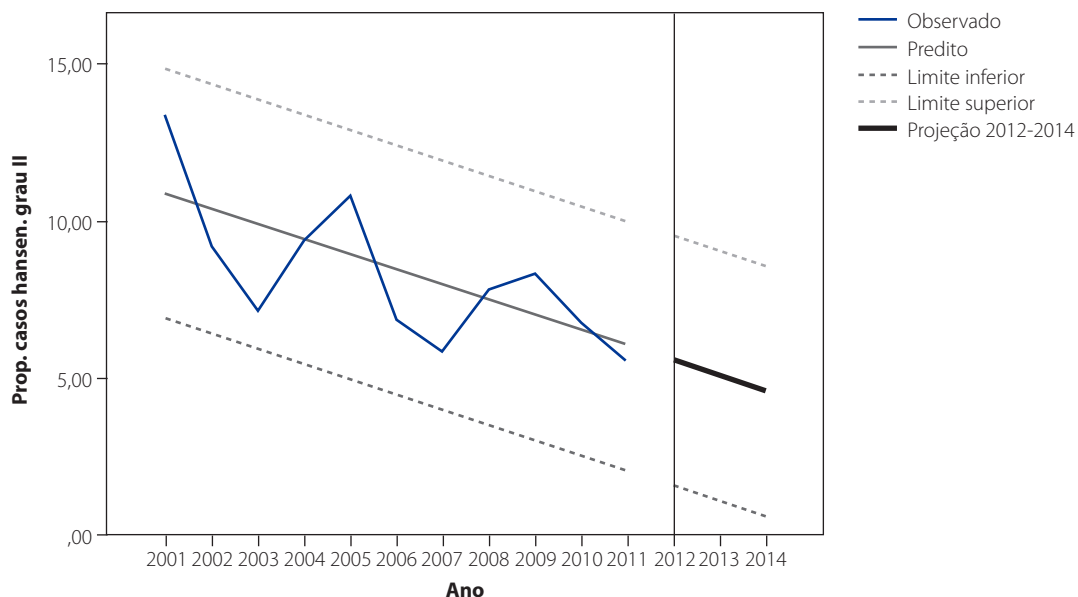
Source: Secondary data – Sinan, 2014.

\*Classification adopted by the Brazilian ministry of health<sup>(9)</sup>.

†Projection

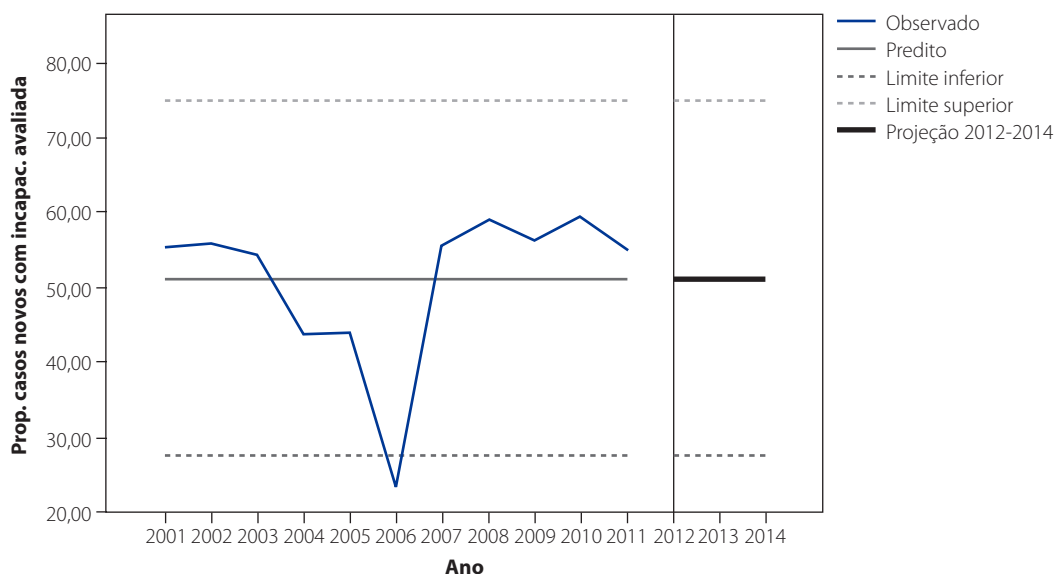
**Figure 1** – Trend of new case detection rates for leprosy during the 2001-2011 period and projections for 2012-2014. Paraíba, Brazil, 2014.

Source: Secondary data – Sinan, 2014.



**Figure 2** – Trend for the proportion of cases with grade 2 physical disability assessed in the leprosy diagnosis for the 2001-2011 period with projections for 2012-2014. Paraíba, Brazil, 2014.

Source: Secondary data – Sinan, 2014.



**Figure 3** – Trend for the proportion of cases with disability assessed during the leprosy diagnosis for the 2001-2011 period with projections for 2012-2014. Paraíba, Brazil 2014.

Source: Secondary data – Sinan, 2014.

Since 2007-2010, major changes have been introduced in Brazil in relation to public policies for leprosy control. The monitoring of patients under 15 and the continued surveillance of contacts are considered the most important strategies to achieve the planned objectives.

An epidemiological study identified risk groups and factors that contribute to disease control and provide the Brazilian ministry of health with a scientific basis for political and administrative actions and investments in government resources<sup>(13)</sup>. It is assumed, therefore, that the de-

tection indicators are dropping as a result of government disease control and eradication actions. To a more gradual degree, the strategies that increase case detection are also associated to this trend and are considered a factor that influences the calculation.

Grade 2 disability is a complication of leprosy and/or of the presence of a reaction at the time of diagnosis, which is a risk factor for the development of physical disability. Consequently, this recognised indicator of quality was included in the WHO Enhanced Global Strategy for Further Reducing the Disease Burden Due to Leprosy and the Operational Guidelines (2011-2015), which exposes the idea of underreporting and the late diagnosis of cases<sup>(14-15)</sup>.

Accordingly, strategies used to ensure timely detection, the commitment of health teams in the active search for cases, health education and examining contacts are actions that have a direct influence on this indicator. A study conducted in 2012 found that the control of contacts is a highly effective strategy in the fight against leprosy and that active surveillance is especially needed in areas of high endemicity, such as Brazil<sup>(15)</sup>.

Researchers<sup>(16)</sup> stated that a successful leprosy control programme requires prevention, early diagnosis, treatment and breaking the chain of transmission. The treatment of healthy carriers and intra-home contacts is an effective strategy to combat the disease because it breaks the chain of transmission by effectively eliminating the bacteria.

According to the study in question, the proportion of cases of leprosy with grade 2 disability among the new cases (Figure 2) converged with the strengthening and decentralisation of political actions to control leprosy in Brazil, mainly from 2006. Recent national studies corroborate with the data presented here and demonstrate the presence of 1 and 2 grade disability in patients during the time of diagnosis<sup>(17-18)</sup>.

The national leprosy control programme has been changing its approach by adopting new technological healthcare measures and incorporating guidelines that are promoted worldwide. One of the priority actions adopted in Brazil since 2007 is the monitoring and evaluation of the national management of the leprosy programme<sup>(19)</sup>.

In order to standardise and accelerate control of the disease, Brazil decentralised control actions to the basic healthcare network by reinforcing the municipal assessment policies that implement priority actions and subsequently configuring the network as a key element of the process<sup>(19)</sup>.

The high number of leprosy cases defines the disease as a public health problem and its potentially disabling effects can hinder the productive phase and the social lives of patients, which leads to economic loss and psycholog-

ical trauma. These disabilities are responsible for the stigma and discrimination of patients<sup>(20)</sup>.

Assessing the grade of disability of patients when diagnosing the disease is of the utmost importance for epidemiological work and one of the most effective ways of evaluating the precocity of a leprosy diagnosis. The higher the degree and intensity of the disability at the time of diagnosis the greater the delay of detection<sup>(20)</sup>.

The proportion of leprosy cases with a disability grade assessed at the time of diagnosis among the new cases in Paraíba revealed a precariousness throughout the study period, especially in 2006, when the slope dropped considerably (Figure 3). Even in 2007, when the trend began to stabilise, the parameters did not exceed 59.4%.

Population-based research<sup>(21)</sup> revealed the importance of access to healthcare and knowledge on the flow and migration trend of patients diagnosed with the disease to control leprosy and reduce the occurrence of its disabilities.

The trends presented in this study for Brazil are worrisome due to the nonachievement of the goals established by the numerous strategies implemented since 2000 to improve the quality of care for leprosy patients.

At a local level, the national leprosy elimination plan for 2006-2010 that promotes the creation of plans that observe the specificities of each country, state and/or municipality may justify the discreet improvement observed since the middle of 2006 in the three indicators evaluated in this study. However, the term 'discreet improvement' of these indicators in the period also triggered the epidemiological state of alert for leprosy in the state of Paraíba.

## ■ CONCLUSION

The results showed a very high coefficient of case detection, precariousness in the evaluation of physical disability at the time of diagnosis and medium effectiveness in the detection of the grade 2 disability also during the diagnosis. Although the data presented in this study do not seem favourable to the elimination of leprosy in the state, the projections for 2012-2014 show trends of stabilisation and improvement of the epidemiological indicators.

Improvements to the endemic condition of the disease have been slow but constant since mid-2006 (for the three evaluated indicators), which stresses the need for shorter assessments of the utilised programmes and strategies in order to correct errors, reorganise healthcare decentralisation actions and consequently expedite the process of fighting leprosy.

The epidemic trend of leprosy in the state becomes an important initiative to guide subsequent interventions in



an effort to control and prevent the spread of the disease. Further research would help better understand the magnitude of leprosy at the national level.

It should be noted that epidemiology is an imperative tool in the control of endemic diseases like leprosy and to appreciate the quality of the data and inputs needed for notifications. In the meantime, nursing is considered the fundamental axis since these professionals accompany diagnosed patients on a monthly basis and act directly on the maintenance and updating of these epidemiological findings.

The limitations of this study is the use of a secondary data source, which prevents some deductions and correlations, and the cross-sectional basis, which does not allow the establishment of causal relationships.

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Received: 26.07.2015

Approved: 04.12.2015