Temporal trend of leprosy in a region of high endemcity in the Brazilian Northeast

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How to cite this article:
Pereira TM, Silva LMS, Dias MSA, Monteiro LD, Silva MRF, Alencar OM. Temporal trend of leprosy in a region of high endemcity in the Brazilian Northeast. Rev Bras Enferm. 2019;72(5):1356-62. doi: http://dx.doi.org/10.1590/0034-7167-2018-0682

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Submission: 08-30-2018 Approval: 02-19-2019

ABSTRACT
Objective: to analyze the temporal trend and epidemiological patterns of leprosy indicators in Sobral, a municipality countryside of the state of Ceará, from 2001 to 2016.
Method: a time series study based on data from the Department of Informatics of the Unified Health System. The time trend analysis was performed using the join point regression model.
Results: There were 2,220 new cases of leprosy in Sobral from 2001 to 2016. Of these, 158 (7.2%) in children younger than 15 years of age, the proportion of new male cases was 52.8% (1,162), cases with grade 2 were 7.0% (156), and proportion of cases diagnosed by contact examination 5.7% (126).
Final considerations: leprosy remains hyperendemic in adults and children, demonstrating the character of neglected disease.

Descriptors: Leprosy; Nursing; Epidemiology; Public Health; Neglected Diseases.

RESUMO
Objetivo: Analisar a tendência temporal e padrões epidemiológicos dos indicadores da hanseníase em Sobral, município do interior do estado do Ceará, no período de 2001 a 2016.
Método: Estudo de séries temporais baseado em dados provenientes do Departamento de Informática do Sistema Único de Saúde. Análise da tendência temporal foi realizada por meio do modelo de regressão joinpoint.
Resultados: Foram registrados 2.220 casos novos de hanseníase e residentes em Sobral de 2001 a 2016. Desses, 158 (7,2 %) em menores de 15 anos; a proporção de novos casos do sexo masculino era del 52,8% (1.162), de casos com grau 2, del 7,0% (156) e proporçãode casos diagnosticados por exame de contatos del 5,7% (126).
Conclusão: A hanseníase se mantém hiperendêmica em adultos e crianças, demonstrando o caráter de doença negligenciada. Análise da tendência permitiu verificar que a instabilidade nos coeficientes de detecção reflete problemas operacionais na organização dos serviços.

Descritores: Hanseníase; Enfermagem; Epidemiologia; Saúde Pública; Doenças Negligenciadas.

RESUMEN
Objetivo: analizar la tendencia temporal y los patrones epidemiológicos de los indicadores de lepra en Sobral, municipio del interior del Estado de Ceará, desde 2001 hasta 2016.
Método: se trata de un estudio de series temporales basado en datos del Departamento de Informática del Sistema Único de Salud. Análisis de la tendencia temporal se realizó a través del modelo de regresión joinpoint.
Resultados: entre 2001 y 2016 se registraron 2.220 nuevos casos de lepra en residentes de Sobral. De éstos, el 7,2% (158), en menores de 15 años; la proporción de nuevos casos del sexo masculino del 52,8% (1.162), de casos con grado 2, del 7,0% (156) y proporción de casos diagnosticados por examen de contatos del 5,7% (126).
Conclusión: la lepra sigue siendo hiperendémica en adultos y niños, lo que demuestra negligencia con respecto a esta enfermedad. El análisis de la tendencia comprobó que la inestabilidad en los coeficientes de detección refleja problemas operacionales en la organización de los servicios.

Descripciones: Lepra; Enfermería; Epidemiología; Salud Pública; Enfermedades Descuidadas.
INTRODUCTION

Leprosy is a neglected disease that remains an object of public health action due to its magnitude and to affect the economically active age group with strong potential to trigger deformities and physical disabilities[1-2]. Early diagnosis and treatment with multidrug therapy (MDT) remain the main strategies for the control of leprosy[3-4].

The impact of neglected tropical diseases is not limited to morbidity and mortality; due to its complexity, has affected a significant portion of society, leading to the permanence of stigma, to social exclusion, and the debate and interventions on health inequities[5-6].

In this context, Brazil adopted as strategies: increased early detection, timely and appropriate treatment, health education actions, contact surveillance, prevention and treatment of disabilities[7].

In 2017, approximately 210,671 new cases of leprosy were registered in the world, with Brazil accounting for 12.76% of the cases. The general detection in the country was 12.94/100 thousand inhabitants (26,875), with 6.4% (1,718 cases) being in children under 15 years of age, which points to the active movement of the disease[8].

Ceará occupies the 6th position in Brazil with the highest detection coefficient and the 4th in the northeast region. In 2017, 1,555 new cases were diagnosed, with a detection coefficient of 17.24/100,000, considered high (10.00 to 19.99/100 thousand) according to WHO parameters[8-9].

Analyzing the spatialization of leprosy cases diagnosed in 2017 in Ceará, it is observed that of the 184 existing municipalities, 05 are classified as hyperendemic (detection coefficient greater than 40 cases per 100 thousand inhabitants). The municipality of Sobral, with general detection coefficient in 2017 of 35,00/100,000 considered very high, according to WHO parameters[8-9].

Despite efforts at early diagnosis in Brazil, there is still an important contingent of people with physical disabilities for leprosy every year. Thus, early diagnosis, correct management of leprosy and neuritis reactions, the practice of self-care and post-discharge follow-up, can avoid negative consequences, such as an increased risk of neural damage[10] and therefore minimize the stigma associated with the disease.

The incorporation of surveillance and leprosy control actions in primary care through the Family Health Strategy (FHS) is considered key to effective and efficient disease control, with the challenge of ensuring that all people regardless of their place of residence, equal opportunity to be diagnosed and treated[6,11].

The worldwide situation of leprosy emphasizes the need for actions sustained by political commitment, aiming at reaching a population in a situation of social vulnerability, promoting reflection on equity and integrality in health and in the process of health care[2,3,5,12].

OBJECTIVE

To analyze the temporal trend and epidemiological patterns of leprosy indicators in Sobral, a municipality in the countryside of the state of Ceará, from 2001 to 2016.

METHOD

Ethical aspects

This study is one paper from the PhD thesis entitled “Mãos que afagam e afastam”: redes sociais do cuidado às pessoas com hanseníase, held in the municipality of Sobral-Ce. The study was approved by the Research Ethics Committee of the State University of Ceará.

Design, setting and study period

This is a time-series study based on data from the Department of Informatics of the Unified Health System (DATASUS), with new leprosy cases from July to August 2017.

The study was conducted in Sobral, which is located in the Northwest region of the State of Ceará and is approximately 235 km from the capital of Ceará. Sobral is a predominantly urban municipality with economy focused on industry. It has a population of 205,529 inhabitants in 2017, with a predominance of the female population[13]. (Figure 1).
Data were obtained from the Department of Informatics of the National Health System (DATASUS) of the Ministry of Health, from the compulsory notification sheets consisting of a standardized form with sociodemographic and clinical information filled out by health professionals. The database is in the public domain available on the website http://datosus.saude.gov.br/.

A case of leprosy has been defined by the World Health Organization (WHO) as the person presenting clinical signs of the disease and requiring specific leprosy treatment. This data may contain possible duplicate records.

Population data were obtained from the Brazilian Institute of Geography and Statistics (IBGE) based on data from the state population censuses (2010) and population estimates for the intercensity years (2001-2009 and 2011-2016)[13].

**Study protocol - Analysis of results**

For descriptive analysis, we selected the variables according to case records per year. The selected indicators were those recommended by the national leprosy evaluation and monitoring program: General detection coefficient (indicates the magnitude of the disease), detection coefficient in children under 15 years of age (indicates the active transmission of the disease); proportion of multibacillary cases (indicates late diagnosis); proportion of paucibacillary cases (indicated early diagnosis) detecting mode (indicating the ability of services for diagnosis) and the proportion of new male cases was 52.8% (1,162), the proportion of cases as -

For the temporal trend analysis the leprosy indicators, the detection coefficients were calculated from the IBGE population estimates for the studied years. The municipality of Sobral was used as geographical unit of analysis in the state of Ceará. The analysis of temporal trends for the period of 16 years of observation was performed through the study period, from 2001 to the period (when available), based on an underlying join point model. The AAPC was estimated as the weighted geometric mean of the APCs, with the weights equal to the length of each segment in the time interval[14]. An increase in the indicators was considered when the trend was growth and the maximum value of the confidence interval was greater than 0 (zero). Conversely, a reduction was considered when there was a decline in trend and the maximum value of the confidence interval was below 0 (zero). A stability was defined when the confidence interval included zero.

The join point regression analyzes were performed using the Join point Regression Program version 4.1.0 (US National Cancer Institute, Bethesda, MD, USA). The calculations of the indicators as well as the preparation of the tables were done in Microsoft Excel worksheets.

**RESULTS**

In the period from 2001 to 2016, 2,220 new cases of leprosy were registered and they were residents of Sobral. Of these, 158 (7.2%) were in children under 15 years of age, the proportion of new male cases was 52.8% (1,162), the proportion of cases assessed for the degree of physical disability was 89 people. The proportion of cases with grade 2 was 7.0% (156), the proportion of cases diagnosed by contact examination was 5.7% (126), (Table 1).

### Table 1 – Epidemiological and operational indicators of leprosy assessed from 2001 to 2016 in the municipality of Sobral, Ceará, Brazil

| Variables | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 |
|-----------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| General Detection Coefficient | 111.0 | 115.4 | 277.1 | 139.9 | 59.6 | 62.0 | 65.6 | 71.1 | 57.6 | 50.5 | 45.6 | 52.8 | 45.0 | 44.6 | 41.1 | 31.9 |
| Coefficient detection <15 years | 23.4 | 24.8 | 41.8 | 24.0 | 13.2 | 8.1 | 28.8 | 14.5 | 18.2 | 18.3 | 18.1 | 9.9 | 13.4 | 9.8 | 13.9 | 8.0 |
| % healed | 91.5 | 89.2 | 87.7 | 84.1 | 95.1 | 89.9 | 91.4 | 93.0 | 87.6 | 94.7 | 90.8 | 92.2 | 89.9 | 93.3 | 94.0 | 86.2 |
| % male | 51.7 | 47.3 | 45.6 | 53.6 | 50.5 | 55.0 | 57.8 | 57.8 | 60.0 | 52.6 | 55.2 | 52.0 | 57.3 | 51.7 | 59.0 | 58.5 |
| % female | 48.3 | 52.7 | 54.4 | 46.4 | 49.5 | 45.0 | 42.2 | 42.2 | 40.0 | 47.4 | 44.8 | 48.0 | 42.7 | 48.3 | 41.0 | 41.5 |
| % PB | 36.4 | 41.9 | 11.9 | 21.5 | 51.5 | 48.6 | 43.1 | 50.8 | 33.3 | 31.4 | 36.8 | 51.0 | 38.2 | 38.2 | 28.9 | 36.9 |
| % MB | 63.6 | 58.1 | 88.1 | 78.5 | 48.5 | 51.4 | 56.9 | 49.2 | 66.7 | 58.9 | 63.2 | 49.0 | 61.8 | 61.8 | 71.1 | 63.1 |
| % assessed at diagnosis | 90.3 | 89.8 | 91.4 | 93.1 | 77.7 | 77.1 | 82.8 | 75.0 | 73.3 | 97.9 | 95.4 | 94.1 | 80.9 | 96.6 | 98.8 | 100.0 |
| % grade 0 | 55.7 | 62.9 | 55.5 | 67.4 | 66.0 | 63.3 | 47.4 | 54.7 | 38.1 | 60.0 | 59.8 | 61.8 | 55.1 | 53.9 | 68.7 | 67.7 |
| % grade 1 | 25.0 | 21.5 | 28.4 | 20.2 | 8.7 | 10.1 | 23.3 | 18.8 | 27.6 | 26.3 | 29.9 | 26.5 | 21.3 | 34.8 | 16.9 | 21.5 |
| % grade 2 | 9.7 | 5.4 | 7.5 | 5.6 | 2.9 | 3.7 | 12.1 | 1.6 | 7.6 | 11.6 | 5.7 | 5.9 | 4.5 | 7.9 | 13.3 | 10.8 |
| % cases diag. by referral | 43.2 | 43.0 | 26.0 | 27.9 | 39.8 | 54.1 | 36.2 | 18.8 | 34.3 | 31.6 | 36.8 | 40.2 | 31.5 | 42.7 | 34.9 | 36.9 |
| % cases diag. by spontaneous demand | 40.3 | 41.4 | 48.9 | 51.1 | 48.5 | 41.3 | 52.6 | 62.5 | 61.9 | 61.1 | 54.0 | 48.0 | 57.3 | 49.4 | 50.6 | 52.3 |
| % population tests diagnosis | 0.6 | 4.8 | 9.0 | 7.3 | 4.9 | 2.8 | 6.9 | 11.7 | 1.0 | 2.1 | 4.6 | 5.9 | 3.4 | 1.1 | 12.0 | 7.7 |
| % cases diag. by collective examination | 1.7 | 5.4 | 11.2 | 12.9 | 3.9 | 0.9 | 1.7 | 6.3 | 1.0 | 2.1 | 2.3 | 2.0 | 4.5 | 3.4 | 2.4 | 1.5 |
In the analysis of temporal trend, the detection coefficient in the general population showed a significant increase of 56.6% (APC: 59.6*, CI: 28.1 to 98.8) between 2001 and 2003, it had a significant reduction of -36.8* (APC: -56.0 to -19.1) in the 2003-2006 period, a significant third decline of -4.3% was observed between 2006 and 2016 (APC: -36.8, CI: -50.6 to -19.1) and in the total period was -5.7% (APC: -6.6 to -2.0). The coefficient of detection in children under 15 years of age dropped significantly for the total period and was -6.9% (APC: -6.9*, CI: -10.9 to -2.7). There was a significant increase in the proportion of male (1.3%) and female (1.5%) cases. The diagnosis by contact examination had an increase of 138.8% between 2001 and 2003, but was not significant and in the period from 2003 to 2016 the fall was -14.0% and statistically significant. There was a significant increase in the diagnosis by spontaneous demand of -36.8* (APC: -50.6 to -19.1) in the period from 2001 to 2015 Sobral showed a pattern of hyperendemicity, being that in 2016 it is considered of very high endemicity. These trends may be related to operational issues of organization of health services, such as changes in management model, turnover of health professionals, reduction of active search, absence of specific protocol for contact surveillance, lack of continuing education practices among others.

Another factor that may be related to the disease trend is the increasing coverage of the family health strategy and the effective decentralization of leprosy control actions to the PHC network as indicative of improved access and the opportunity for early diagnosis. A study carried out in Fortaleza concluded that Basic Health Units present poor performance for diagnosis in children under 15 years of age. A similar study in the Jequitinhonha Valley region, Minas Gerais, showed that the health services were not effective, and that only passive surveillance actions were implemented, favoring the diagnosis of more advanced and severe forms of the disease. The higher prevalence of multibacillary cases indicates a high power of community transmissibility and late diagnosis. Brazilian researchers point out the lack of training of health professionals to diagnose early disease, stigma and prejudice, as favoring for diagnosis in multibacillary forms. In this study, there was a higher prevalence of multibacillary cases throughout the period, reinforcing the need for effective surveillance actions in the territory.

Leprosy affects men and women in a different and diversified way, which makes the need to offer access to these subjects in a
different way\textsuperscript{2, 18}. Access to health services has been configured more centrally in health practices, leading to timely diagnosis and treatment with specific strategies for men and women\textsuperscript{20}. In Sobral, as well as in other studies carried out in the Brazilian northeast, men are more vulnerable to contracting leprosy, contributing to the maintenance of the transmission dynamics of \textit{Mycobacterium leprae}\textsuperscript{19}. The 1.5\% increase in the number of cases in women in the total period (2001 to 2016) is due to the fact that women have more access to health services due to the logic of the organization of services\textsuperscript{20}, in addition to itself playing the care role in the family and in society. In this sense, it emerges as a challenge to look at the male population in a differentiated way, making it the main subject, so as to insert it into the production of care, providing early diagnoses, preventing physical disabilities, as well as avoiding work absenteeism.

Considering its chronicity and the development of physical and psychosocial disabilities, the person affected by leprosy may require primary care, especially nursing, in a longitudinal manner, and access to the other levels of complexity is also required as a means of guaranteeing integrity of attention.

The degree of physical disability is an indicator that evaluates the effectiveness of timely and early detection of new leprosy cases and should be used in conjunction with detection rate\textsuperscript{7}. In Brazil, there has been a decrease in the detection of cases with grade 2 disability, following the downward tendency of the general detection of new cases\textsuperscript{7}. A study conducted in Brazilian municipalities corroborates findings from our study that demonstrate a higher prevalence of deformities in the male population. And yet the analysis of the evolution of the incapacities reveals a tendency to maintain the degree of incapacity at the moments of diagnosis and discharge\textsuperscript{21-22}.

The presence of physical disability at the time of diagnosis denotes late diagnosis\textsuperscript{7}. The degree of physical incapacity at the time of diagnosis in the study period shows instability in its tendency, however, it maintains Sobral classified as an area of high endemicity. Despite the significant fall in grade 2 disability in the period studied, 89.4\% of people are still entering health services with some degree of disability, which demonstrates the inefficiency in capturing cases early.

Two surveys carried out in municipalities of hyperendemic states, responsible for the maintenance of the endemic disease in Brazil, showed that the coefficient of new cases with GIF 2 remained stable\textsuperscript{23-24}, while Amorim’s study\textsuperscript{25} carried out in Bahia showed a trend of significant growth of this coefficient and decreasing evolution in Paraíba\textsuperscript{20}.

It is considered as a household contact, any person who has resided or resides with the patient, regardless of the time of social contact or operational classification, in addition to increasing vigilance for social contact, which also considers any person who lives or has lived together in a prolonged manner, in family or social relationships with the untreated patient. In this sense, contact surveillance contributes decisively to the control of the disease, breaking the chain of transmission, besides reducing the physical incapacities and the reactionary episodes responsible for maintaining the stigma of the disease\textsuperscript{22,23}. Regarding the contact approach, this study pointed to a significant drop, which may be related to the fragility of health education actions and permanent surveillance, understanding that the disease has a long incubation period. A study carried out in Cacoal-RO verified that BCG vaccination is the main action performed in contact surveillance, without the complete dermatoneurological examination and that the contacts are not oriented to return to the health unit for a new evaluation. It was also identified that most of the contacts are evaluated by nurses and a minority by physicians, in addition to other professionals not qualified to testing. Therefore, it is necessary to have health education strategies with emphasis on leprosy-related guidelines and the importance of the contacts to carry out the examination with a view to the early diagnosis and reduction of the social impact of the disease.

**Limitations of the study**

By using SINAN secondary databases, there may be problems related to consistency and non-completeness of the data, besides the possibility of underreporting, which may interfere with the quality and quantity of the information. Even so, this study is of great relevance, since it analyzes the temporal trend of 16 years of a chronic disease with episodes of exacerbation, being able to collaborate with surveillance strategies of control actions and consequent improvement of the attention to people with leprosy.

**Contributions to the area of nursing**

This study contributes to strengthen the health surveillance actions of people affected by leprosy, considering this unusual analysis to emphasize the dialogue with the epidemiological situation of the disease, allowing professionals and managers to draw new strategies to reach the population with greater vulnerability to the disease, disease, strengthening, actions in the territories of care.

**CONCLUSION**

Leprosy remains a pattern of hyperendemicity in both adults and children, demonstrating the disease character neglected by public policies, perpetuating social vulnerabilities. The trend analysis shows that the instability in the detection coefficients does not reflect the epidemiology of the disease, but rather operational problems in the organization of the services to care for the disease in its acute form, also neglecting its chronicity, which requires new health care.

The disease affects men and women with a higher prevalence in the male population, which can be associated with the organizational form of health services. Therefore, the findings of this study invite us to reflect on the organization of health services for the real control of leprosy in the context of PHC, as well as the need to increase access to the male population in order to guarantee early diagnosis and prevent sequelae.

The challenges to disease control are of great complexity, since it pervades the biological issue of the disease process, since they are linked to the conditions of poverty, social inequalities and inequities in health. Therefore, coping requires substantial changes in the mode of health production that takes into account social determination.

The operational indicators evaluation of contacts and evaluation of degree of incapacitation agreed within the scope of
epidemiology services point to the need to improve the quality of control actions developed by the SUS network. The evaluation of contact and evaluation of the degree of incapacities are decisive strategies for improving the care of the people affected by leprosy. The evidence from this study indicates the need for new research that addresses the dynamics of transmission in areas considered to be of greater social vulnerability and consequently of high endemicity and low resolution of health services for timely prevention, diagnosis and treatment. We suggest the use of operational health research since this method is strategic for the strengthening of network care, especially when considering the complexity of the elimination of leprosy as a public health problem.

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