

Magnitude and temporal trend of leprosy indicators in Goiás, Brazil: an ecological study 2001-2017

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Abstract

Objective: To analyze the trend of leprosy indicators in Goiás between 2001 and 2017. **Methods:** An ecological time series study was conducted. Leprosy morbidity and operational indicators were calculated using Notifiable Health Conditions Information System data. Prais-Winsten regression was used for trend analysis. **Results:** There was a falling trend in the detection rate in the general population (Annual Percent Change [APC] = -6.8 – 95%CI -8.2;-5.4) and in children under 15 years old (APC = -7.2 – 95%CI -8.5;-5.9); a rising trend in the proportion of grade 2 disability (APC = 3.7 – 95%CI 2.0;5.3) and in the proportion of examined physical disability (APC = 0.6 – 95%CI 0.3;0.8); healing and examined contacts proportions were stable. **Conclusion:** Detection rates decreased while the proportions of grade 2 physical disability and examined physical disability increased.

Keywords: Leprosy; Time Series Studies; Ecological Studies; Health Status Indicators.

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Introduction

Leprosy is a serious Public Health problem which is of greater magnitude in low and middle-income countries. In 2017, 210,671 new leprosy cases were recorded in 150 countries, resulting in a detection rate of 2.8 cases/100,000 inhabitants. Of the total number of cases, 80.2% were notified in three countries: India, Brazil and Indonesia.¹

The trend analysis of the epidemiological indicators of the disease enables evaluation of the efficiency of prevention measures, as well as monitoring of leprosy behavior patterns and achievement of the target to eliminate leprosy in the country.

Leprosy magnitude is high in Brazil. In 2017, 25,862 new cases were notified, resulting in a detection rate in the general population of 12.9 cases/100,000 inhab. The Federative Units with the highest rates were: Mato Grosso (102.5 cases/100,000 inhabitants), Tocantins (79.9 cases/100,000 inhab.) and Maranhão (44.0 cases/100,000 inhab.).²

Considering the leprosy burden in Brazil, analysis of the epidemiological indicators of the disease enables evaluation of the efficiency of prevention measures, as well as monitoring of leprosy behavior patterns and achievement of the target to eliminate leprosy in the country. Furthermore, indicator behavior provides information for health services to manage the disease, indicating the need to formulate or reformulate prevention strategies and public policies. Specifically, analysis by Federative Unit and identification of those which are most endemic enables implementation of focused interventions, according to regional or local needs and realities.

The objective of this study was to describe the temporal trend of leprosy indicators in Goiás state between 2001 and 2017.

Methods

This is an ecological time series study that analyzed leprosy morbidity indicators and indicators related to the quality of leprosy actions and services (operational

in Goiás state, located in the Midwest region of Brazil, between 2001 and 2017.

According to Brazilian Institute of Geography and Statistics (IBGE) data, Goiás had an estimated population of 6,921,161 inhab. and average per capita income of BRL 1,323 in 2018. In 2010 the state's human development index was 0.735;³ at the end of 2018, its Family Health Strategy coverage was estimated as being 66.6%; while Primary Care coverage was estimated as being 73.4%.⁴

The study used Notifiable Health Conditions Information System data. The size of the resident population, used as a denominator, was taken from the 2010 Demographic Census and from intercensal projections (2001 to 2017), both of which were carried out by the IBGE.

Two blocks of indicators were calculated, in accordance with Health Ministry recommendations:⁵ (i) morbidity indicators; and (ii) action and service quality indicators. The way these indicators were calculated and their meaning are shown in Figure 1.

The data were analyzed with the aid of the Stata version 15.0 computer program. Prais-Winsten generalized linear regression⁶ was used to analyze leprosy trends in the state. The dependent variables used in the models were the logarithmized morbidity and operational indicators; the independent variable corresponded to the year. The regression model equation can be described as follows:

$$\log(Y_t) = \beta_0 + \beta_1 X$$

where:

β_0 = constant or intercept

$\log(Y_t)$ = logarithmized values of the dependent variable

β_1 = trend linear trend coefficient

x = independent variable

The coefficient of determination (R^2) was used as the regression model fitting measurement. Following this, annual percent change (APC) and respective 95% confidence interval (95%CI) were calculated.⁶ A 5% significance level was adopted. The trends found were classified as rising, stable or falling.⁶

Results

Between 2001 and 2017, 42,471 leprosy cases were notified in the general population and 2,068 cases in the population under 15 years old in Goiás state. Mean detection rates in the general population and

in under 15 year olds in 2007 and 2017 were 43.3 cases/100,000 inhab. and 7.9 cases/100,000 inhab. respectively. A falling leprosy detection rate was found in the general population, from 60.6 to 20.0 cases/100,000 inhab. between 2001 and 2017 ($\Delta\%$: -82.6), as well as in the population under 15 years old, from 10.1 to 3.7 per 100,000 inhab. in the same period ($\Delta\%$: -68.7) (Figure 2A). A falling trend was found in the detection rate in the general population (APC = -6.8 – 95%CI -8.2;-5.4) and in the population under 15 years old (APC = -7.2 – 95%CI -8.5;-5.9) (Table 1).

The mean proportion of grade 2 physical disability, specifically in the ten-year period from 2007 to 2017, was 4.5%. This indicator did, however, rise from 3.3 to 6.5%/10,000 inhab. in the period 2001-2017 ($\Delta\%$: 97.0) (Figure 2B), a rising trend of physical disability caused by leprosy was therefore

found in the entire period studied (APC = 3.7 – 95%CI 2.0;5.3) (Table 1).

The mean proportion of cure was 77.6% in the period. The proportion of examined contacts was 67.6%; while the proportion of examined physical disability was 91.9%. The proportion of cure of new cases varied between 83.6 and 84.4% ($\Delta\%$: 0.3) between 2001 and 2017 (Figure 2B). The proportion of examined contacts increased from 72.3% in 2001 to 85.6% in 2017 ($\Delta\%$: 18.4). Between 2001 and 2017, the proportion of examined physical disability varied between 88.9 and 95.0% ($\Delta\%$: 6.9).

A stable trend was found for proportion of cure (APC = 1.1 – 95%CI -0.6;2.7) and for proportion of examined contacts (APC = 4.9 – 95%CI -2.2;12.5); while a rising trend was found for proportion of examined physical disability (APC = 0.6 – 95%CI 0.3;0.8) (Table 1).

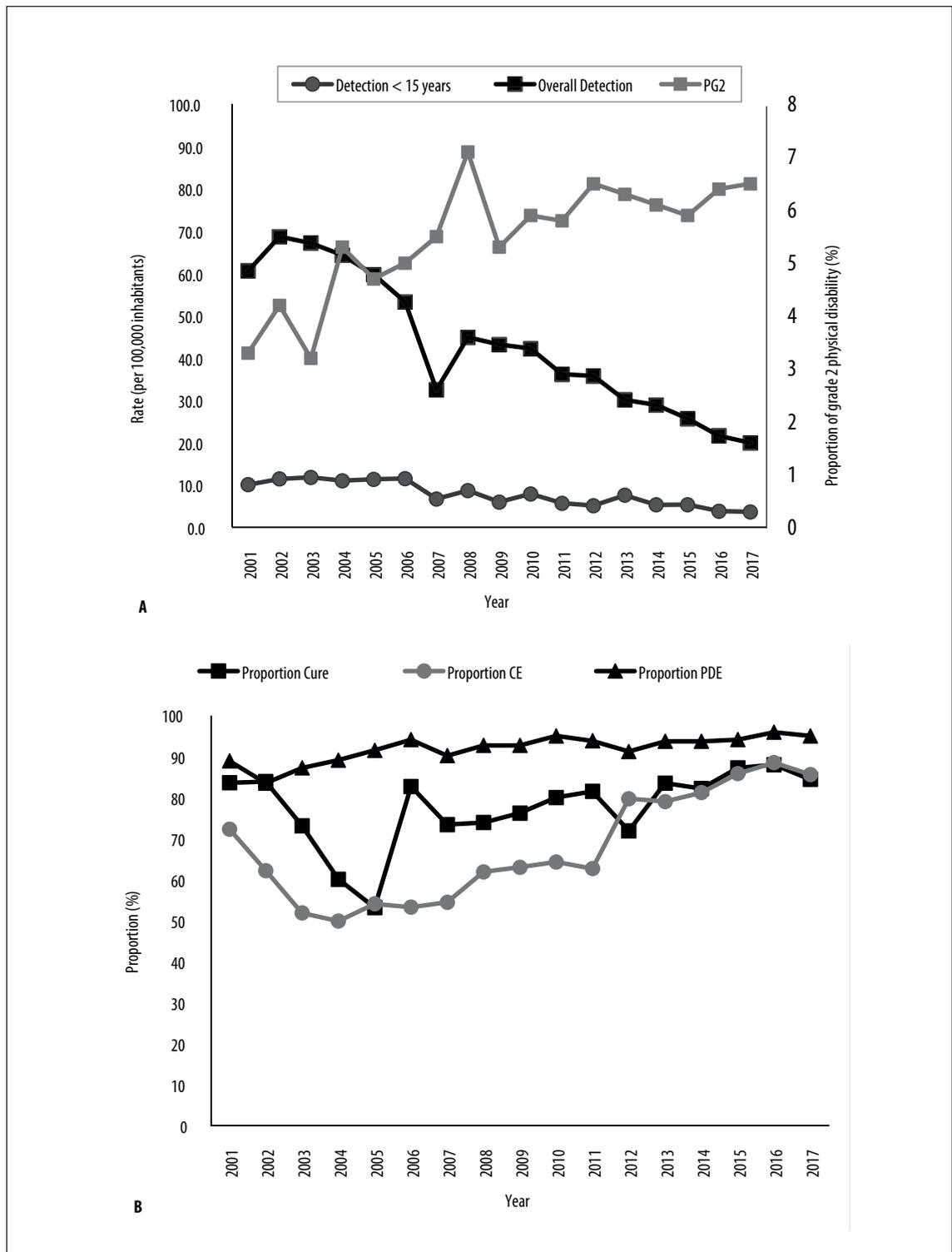
Table 1 – Prais-Winsten regression analysis of epidemiological indicators of leprosy, Goiás state, 2001-2017

| Indicators | R ² ^a | APC ^b | 95%IC ^c | p-value | Trend |
|--|-----------------------------|------------------|--------------------|---------|---------|
| Morbidity | | | | | |
| Detection rate in the general population | 0.836 | -6.8 | -8.2;-5.4 | <0.001 | Falling |
| Detection rate in the population <15 years old | 0.904 | -7.2 | -8.5;-5.9 | <0.001 | Falling |
| Proportion of grade 2 physical disability | 0.617 | 3.7 | 2.0;5.3 | <0.001 | Rising |
| Operational | | | | | |
| Proportion of cure | 0.808 | 1.1 | -0.6;2.7 | 0.178 | Stable |
| Proportion of contacts examined | 0.131 | 4.9 | -2.2;12.5 | 0.156 | Stable |
| Proportion of physical disability examined | 0.981 | 0.6 | 0.3;0.8 | 0.001 | Rising |

a) R²: coefficient of determination.
 b) APC: annual percent change.
 c) 95%CI: 95% confidence interval.

| Indicator | Construction | Unit | Classification (parameters) |
|--|---|---|---|
| Annual detection rate of new leprosy cases per 100,000 inhabitants | Numerator New cases resident in a given place and diagnosed in the year of assessment Denominator Total population resident in the same place and period Multiplication factor: 100,000 | Measurement of force of morbidity, magnitude and trend of the endemic | Hyperendemic: ≥40.00/100,000 inhab. Very high: 20.00 - 39.99/100,000 inhab. High: 10.00 - 19.99/100,000 inhab. Medium: 2.00 - 9.99/100,000 inhab. Low: <2.00/100,000 inhab. |
| Annual detection rate of new leprosy cases in the population aged under 15 years old per 100,000 inhabitants | Numerator New cases in under 15 year olds resident in a given place and diagnosed in the year of assessment Denominator Population aged under 15 years old in the same place and period Multiplication factor: 100,000 | Measurement of the recent force of the endemic and its trend | Hyperendemic: ≥10.00/100,000 inhab. Very high: 5.00 - 9.99/100,000 inhab. High: 2.50 - 4.99/100,000 inhab. Medium: 0.50 - 2.49/100,000 inhab. Low: <0.50/100,000 inhab. |
| Proportion of leprosy cases with grade 2 physical disability at the time of diagnosis, among new cases detected and assessed in the year | Numerator New cases resident in a given place local, diagnosed in the cohort years and cured by December 31 st of the year of assessment Denominator Total of new cases resident in the same place and diagnosed in the cohort years Multiplication factor: 100 | Evaluation of the effectiveness of timely and/or early case detection activities | High: ≥10% Medium: 5.00 - 9.99% Low: <5.00% |
| Proportion of leprosy cure among new cases diagnosed in the cohort years | Numerator New cases resident in a given place local, diagnosed in the cohort years and cured by December 31 st of the year of assessment Denominator Total of new cases resident in the same place and diagnosed in the cohort years Multiplication factor: 100 | Evaluation of the quality of care and follow-up of new diagnosed cases up to completion of treatment Monitoring of the Pact for Life (Pacto pela Vida) (MoH Ordinance GM/MS No. 325, dated February 21 st 2008) | Good: ≥90.00% Regular: 75.00% - 89.99% Precarious: <75.00% |
| Proportion of people examined among recorded intrahousehold contacts of new leprosy cases in the year | Numerator Examined intrahousehold contacts examined of new cases resident in a given place and diagnosed in the year of assessment Denominator Total recorded intrahousehold contacts of new cases resident in the same place and diagnosed in the year of assessment Multiplication factor: 100 | Evaluation of service capacity to perform surveillance of intrahousehold contacts of new leprosy cases in order to detect new cases Monitoring of the results of Health Surveillance Action Programming (PAVS) | Good: ≥75.00% Regular: 50.00% - 74.99% Precarious: <50.00% |
| Proportion of leprosy cases with grade 2 physical disability assessed at diagnosis | Numerator New leprosy cases with grade of physical disability assessed at diagnosis, resident in a given place and detected in the year of assessment Denominator New leprosy cases resident in the same place and diagnosed in the year of assessment Multiplication factor: 100 | Measurement of quality of health service care and monitoring of results of actions Health Surveillance Action Programming (PAVS) | Good: ≥90.00% Regular: 75.00% - 89.99% Precarious: <75.00% |

Figure 1 – Calculation, meaning and interpretation parameters of epidemiological indicators of leprosy



Legend:
 PG2 = proportion of grade 2 physical disability.
 CE = contacts examined.
 IFE = physical disability examined.

Figure 2 – Evolution of leprosy morbidity indicators (per 100,000 inhabitants) (A) and leprosy operational indicators (B), Goiás state, 2001-2017

Discussion

Between 2007 and 2017, a falling trend was found in leprosy case detection rates, among both the general population and under 15 year olds, resident in Goiás state. A rising trend was found in the proportion of grade 2 physical disability, a stable trend in the proportion of cure and examined contacts, and a rising trend in the proportion examined physical disabilities.

The detection rate in the general population corresponds to the primary indicator of leprosy. It enables overall analysis of the health status of a population, as well as guiding control strategies and indicating risk of leprosy detection.^{7,8} A falling trend was found for this indicator in both the general population and the population under 15 years old. However, the leprosy classification for Goiás continued to be very high (20.0 cases per 100,000 inhab.) in 2017, this rate being higher than the rate for Brazil as a whole (12.9 cases per 100,000 inhab.).² The same falling trend found for leprosy in this study has also occurred in other Federative Units where the leprosy burden is high, i.e. Tocantins, Maranhão, Paraíba and Bahia, as well as for Brazil as a whole.⁹⁻¹³

Certain factors may have contributed to the reduction in leprosy magnitude and incidence in Goiás. Standing out among these factors are (i) increased early diagnosis through prevention actions, (ii) specific polychemotherapy, (iii) increased Family Health Strategy coverage in recent years, contributing to identification and prioritization of families at risk and reduction in health inequities,¹⁴⁻¹⁶ (iv) active tracing of social and/or family contacts and active tracing among school-age children (e.g., campaigns in schools) and (v) vaccination/revaccination against the Calmette-Guérin bacillus (BCG), which, although not specific for leprosy, offers protection and contributes to preventing new cases of the disease.^{14,17,18} These leprosy prevention and control measures are established in the 'Guidelines for surveillance, care and elimination of leprosy as a public health problem', recommended by the Health Ministry for implementation at all levels of health care.¹⁸

A rising trend was found in the proportion of cases with grade 2 physical disability, possibly indicating late detection – despite increased Family Health Strategy coverage –, besides difficulties in preventing disabilities.¹⁹ Previous studies have shown a stationary trend^{20,21} or a rising trend^{8,11,20} in this indicator in Brazil.

Assessment of the degree of disability is an important tool for identifying patients at greater risk of developing new disabilities, during treatment, at the end of polychemotherapy and after discharge from medical care, and can contribute to reducing morbidity caused by the disease.¹⁸

In this study, proportion of cure had a stable trend in Goiás, as also found by earlier studies.^{8,11,21} This result suggests intensification of actions to promote timely and adequate patient polychemotherapy.²² A stable trend was also found in the proportion of examined contacts. Other studies conducted in Brazil have revealed a rising trend in this indicator.^{8,11} Assessment of examined contacts is one of the indicators capable of evaluating public leprosy surveillance actions,¹⁸ and its increase can contribute to interrupting transmission of infection.²²

This study has certain limitations. It used secondary data and these are susceptible to problems with the quality and quantity (coverage) of leprosy case information and variables. The possibility of underreporting can result in the indicators being underestimated. On the other hand, this study assessed the magnitude and the main indicators of leprosy in Goiás, which can assist evaluation of leprosy control interventions and actions already undertaken or yet to be undertaken in the state.

In conclusion, this study found a falling trend in leprosy morbidity indicators – detection rate in the general population and under 15 year olds; prevalence rate – in Goiás, between 2001 and 2017. The proportion of cure and examined contacts was stable, while the proportion of examined physical disability increased. However, leprosy has high magnitude, characterizing a serious Public Health problem in the state. As such, there is a need to intensify actions to control this disease, which affects a considerable number of people in Goiás.

Authors' contributions

Lima MHGM, Nascimento JP, Souza ML, Paraizo VA, Nunes PS and Guimarães RA took part in the concept and design of the study, analysis and interpretation of the data and drafting the manuscript. Guimarães RA took part in a relevant critical review of the intellectual contents of the manuscript. All the authors have approved the final version and declare themselves to be responsible for all aspects thereof, including the guarantee of its accuracy and integrity.

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