

## LEPROSY: EPIDEMIOLOGY OF THE MORBIDITY, MORTALITY AND PUBLIC SPENDING IN THE NORTHEAST OF BRAZIL

Hanseníase: epidemiologia da morbimortalidade e gastos públicos no nordeste brasileiro

Lepra: epidemiología de la morbimortalidad y gastos públicos en el nordeste brasileño

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### ABSTRACT

**Objective:** To describe the morbidity, mortality and public spending due leprosy in the northeast of Brazil between 2012 and 2017. **Methods:** Ecological and descriptive study based on data from Hospital Information Systems. It were selected the variables: federative units, age group, sex, race/color and public spending. **Results:** It were registered 7.067 hospitalizations, 147 deaths and mortality of 2,08%. The hospitalization highlighted themselves in *Pernambuco* (33,82%), aged between 30 and 34 years old (9,31%), male sex (64,94%) and brown (49,80%). The deaths highlighted themselves in *Maranhão* (22,45%), aged between 75 a 79 years old (12,93%), male sex (68,71%) and race/color without information (48,30%). The greater mortality happened in Sergipe (6,06%), aged between 75 a 79 years old (9,69%), male sex (2,2%) and race/color without information (2,47%). There was a financial impact superior to 3,7 millions of reais and *Pernambuco* spent 42% of this value. **Conclusion:** The mortality presented a growing behavior, highlighting the importance of early diagnosis and treatment to avoid complications.

**Descriptors:** Epidemiology; Public health; Public health surveillance; Primary health care; Health care costs.

### RESUMO

**Objetivo:** Descrever a morbimortalidade e gastos públicos por hanseníase no nordeste brasileiro entre 2012 e 2017. **Métodos:** Estudo ecológico e descritivo realizado com dados do Sistema de Informações Hospitalares. Selecionou-se as variáveis: unidades federativas, faixa etária, sexo, raça/cor e gastos públicos. **Resultados:** Registrou-se 7.067 internações, 147 óbitos e mortalidade de 2,08%. As internações se

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destacaram em Pernambuco (33,82%), idade entre 30 a 34 anos (9,31%), sexo masculino (64,94%) e pardos (49,80%). Já os óbitos se destacaram no Maranhão (22,45%), idade entre 75 a 79 anos (12,93%), sexo masculino (68,71%) e raça/cor sem informação (48,30%). A maior mortalidade ocorreu em Sergipe (6,06%), idade entre 75 a 79 anos (9,69%), sexo masculino (2,2%) e raça/cor sem informação (2,47%). Houve impacto financeiro superior a 3,7 milhões de reais e Pernambuco onerou 42% desse valor. **Conclusão:** A mortalidade apresentou comportamento crescente, evidenciando a importância da precocidade diagnóstica e terapêutica para prevenir complicações.

**Descritores:** Epidemiologia; Saúde pública; Vigilância em saúde pública; Atenção primária à saúde; Custos de cuidados de saúde.

## RESUMÉN

**Objetivo:** Describir la morbimortalidad y gastos públicos por lepra en el nordeste brasileño entre 2012 y 2017. **Métodos:** Estudio ecológico y descriptivo realizado con datos del Sistema de Información Hospitalaria. Fueron seleccionadas las variables: unidades federativas, franja etaria, sexo, raza/color y gastos públicos. **Resultados:** Se registraron 7.067 internamientos, 174 muertes and mortalidad de 2,08%. Los internamientos se destacaron en Pernambuco (33,82%), edad entre 30 y 34 años (9,31%), sexo masculino (64,94%) y pardos (49,80%). Las muertes se destacaron en Maranhão (22,45%), edad entre 75 y 79 años (12,93%), sexo masculino (68,71%) y raza/color sin información (48,30%). La mayor mortalidad ocurrió en Sergipe (6,06%), edad entre 75 y 79 años (9,69%), sexo masculino (2,2%) y raza/color sin información (2,47%). Hubo un impacto financiero superior a 3,7 millones de reales y Pernambuco gastó 42% de ese valor. **Conclusión:** La mortalidad presentó comportamiento creciente, evidenciando la importancia de la precocidad diagnóstica y terapéutica para prevenir complicaciones.

**Descriptor:** Epidemiología; Salud pública; Vigilancia en salud pública; Atención primaria de salud; Costos de la atención en salud.

## INTRODUCTION

Leprosy, also known as Hansen's disease, is defined as a dermatological, infectious pathology, of slow and chronic evolution, transmitted through the upper airways of people with the *Mycobacterium leprae* bacillus in the transmission phase.<sup>1-4</sup> The disease is characterized by dermato-neurological manifestations that mainly affect skin and nerves peripheral.<sup>5</sup> In general, nerve cell involvement is related to inflammation or the direct establishment of the bacillus in the nerve,<sup>6</sup> which generates sensory changes, deformities and disabilities.<sup>6,7</sup>

The physical disability resulting from leprosy occurs due to failure in early diagnosis, therapeutic and care insufficiency, among other factors, to negatively interfere in the individual's quality of life and increasing the chances of social isolation.<sup>5,8</sup> In this perspective, leprosy is a serious public health problem in Brazil and in developing countries, whose control becomes a dependent variable in all instances of municipal management. Given this viewpoint, the basic

health units are considered one of the doors for users to enter the *Sistema Único de Saúde (SUS)* [Brazilian Unified Health System] and play an important role in the diagnosis, treatment, and monitoring of confirmed cases.<sup>1</sup>

Nevertheless, one of the most relevant questions poorly discussed in Brazil and other countries is the significant inequality in the epidemiological indicator of leprosy cases, the determinants and conditions for its emergence. This reality promotes reflection on the contextualization and effectiveness of public health policies concerning cultural, socioeconomic and behavioral factors of the pathology itself in a given geographical area.<sup>1</sup>

Brazil occupies the first place in the statistics of countries with the highest incidence and the second-highest worldwide prevalence of leprosy, losing only to India. Moreover, the country is responsible for concentrating 90% of the cases notified in the American continent, with an average annual incidence of 47 thousand cases.<sup>7</sup> Among these, 23.3% have a degree of disability I and II, which shows the need for organization of the health network to ensure efficient monitoring of users during and after treatment in order to prevent and/or mitigate sequelae.<sup>8</sup>

Due to the high global rate of leprosy cases, the World Health Organization (WHO) has set as a target only 1 case for every 10 thousand citizens in each country by the year 2015. To ensure compliance with the target, the early diagnosis and treatment under polychemotherapy with rifampicin, clofazimine, and dapsone. Given the aforesaid, the dissemination of epidemiological and spatial information on the disease is essential, in such a way as to enable the understanding of the existing relationships between the bacillus and the individual inserted in their social context. Thus, there is the possibility of expanding actions effectively, strategically, and rationally, considering the inherent characteristics of each region.<sup>2,7</sup> Therefore, the objective of this study is to further describe the morbidity, mortality and public spending due to leprosy in the Northeast of Brazil over the period from 2012 to 2017.

## METHODS

It is an ecological and descriptive study performed with secondary data on leprosy available in the Hospital Information System from the *SUS*. The Hospital Information System consists of an administrative database of data on hospital admissions within the scope of the *SUS* throughout the national territory.<sup>9</sup> Data collection took place through electronic access in July 2018 and the region was selected northeast of Brazil as a study scenario. The region consists of 9 Federative Units (States): *Maranhão, Piauí, Ceará, Rio Grande do Norte, Paraíba, Pernambuco, Alagoas, Sergipe,* and *Bahia*, as shown in **Table 1**.

**Table 1** - Description of the Federative Units that belong to the Brazilian Northeastern region. Jequié city, Bahia State, Brazil, 2018.

Federative Unit	Human Development Index*	Territorial extension	Estimated population**	Population density*
Maranhão	0.639	331,936.949 km <sup>2</sup>	7,000,229	19.81 inhab/km <sup>2</sup>
Piauí	0.646	251,611.929 km <sup>2</sup>	3,219,257	12.40 inhab/km <sup>2</sup>
Ceará	0.682	148,887.633 km <sup>2</sup>	9,020,460	56.76 inhab/km <sup>2</sup>
Rio Grande do Norte	0.684	52,811.107 km <sup>2</sup>	3,507,003	59.99 inhab/km <sup>2</sup>
Paraíba	0.658	56,468.435 km <sup>2</sup>	4,025,558	66.70 inhab/km <sup>2</sup>
Pernambuco	0.673	98,076.021 km <sup>2</sup>	9,473,266	89.62 inhab/km <sup>2</sup>
Alagoas	0.631	27,848.140 km <sup>2</sup>	3,375,823	112.33 inhab/km <sup>2</sup>
Sergipe	0.665	21,918.443 km <sup>2</sup>	2,288,116	94.36 inhab/km <sup>2</sup>
Bahia	0.660	564,732.450 km <sup>2</sup>	15,344,447	24.82 inhab/km <sup>2</sup>

\*Information updated in 2010

\*\*Information updated in 2017

Source: Instituto Brasileiro de Geografia e Estatística (IBGE) [Brazilian Institute of Geography and Statistics]<sup>10</sup>

The morbidity and mortality data were correlated with the following variables: all federative units in the region, time cut from January 1st, 2012, to December 31st, 2017, age (<1 year old to ≥80 years old), gender (male and female) and race/skin color (white, black, brown, yellow and indian), following the standard procedure of the Instituto Brasileiro de Geografia e Estatística (IBGE) [Brazilian Institute of Geography and Statistics] to categorize the Brazilian population.<sup>11</sup> Among the list of morbidity available on the platform, there were selected two cases related to the study theme: leprosy and sequelae of leprosy. It should be noted that the option referring to the sequelae does not distinguish the degree of impairment, and therefore exposes the data in general.

For data analysis, simple descriptive statistics (absolute and relative frequencies) were adopted. The mortality rate was calculated considering the ratio between the total number of deaths and the number of admissions approved

through the Hospitalization Authorizations, and multiplied by 100.<sup>12</sup> Due to the secondary source of data collection without identifying the participants and in the public domain, there was no need for approval by the Research Ethics Committee, according to the Resolution No. 466/2012 from the National Health Council.

## RESULTS

Among the results, it can be seen in Table 2 that there were notifications of 7,067 hospitalizations and 147 deaths, which corresponds to a 2.08% mortality rate due to leprosy in the Brazilian Northeastern region. Furthermore, distributing by Federative Unit, it was noted that Pernambuco, Maranhão, and Sergipe had the highest prevalence of hospital admissions with 2,390 (33.82), deaths with 33 (22.45%) and mortality rate with 6.06%, respectively.

**Table 2** - Morbidity and mortality due to leprosy in the Northeast region according to year of care service and Federative Unit from 2012 to 2017. Jequié city, Bahia State, Brazil, 2018.

Variables	Hospitalizations	%	Deaths	%	Mortality rate
<b>Year of care service</b>					
2012	178	2.52	3	2.04	1.69
2013	1,943	27.49	37	25.17	1.90
2014	1,403	19.85	32	21.77	2.28
2015	1,131	16.00	20	13.61	1.77
2016	1,163	16.46	24	16.33	2.06
2017	1,249	17.67	31	21.09	2.48
Total	7,067	100	147	100	2.08
<b>Federative Unit</b>					
Maranhão	1,805	25.54	33	22.45	1.83
Piauí	167	2.36	3	2.04	1.8
Ceará	510	7.22	9	6.12	1.76
Rio Grande do Norte	109	1.54	3	2.04	2.75
Paraíba	565	7.99	26	17.69	4.6
Pernambuco	2,390	33.82	29	19.73	1.21
Alagoas	546	7.73	10	6.80	1.83
Sergipe	33	0.47	2	1.36	6.06
Bahia	942	13.33	32	21.77	3.4
Total	7,067	100	147	100	2.08

Source: Brazilian Ministry of Health - Hospital Information System from the SUS.

Concerning the age group, **Table 3** shows that the age group with the highest prevalence of hospitalizations was between 30 and 34 years old (9.31%). Deaths stood out with 196 (2.77%) cases in the age group between 75 and 79 years old and people aged 80 years or older showed higher mortality rate due to leprosy.

**Table 3** - Morbidity and mortality due to leprosy in the Northeast region according to age group from 2012 to 2017. Jequié city, Bahia State, Brazil, 2018.

Age group (years old)	Hospitalizations	%	Deaths	%	Mortality rate
< 1 year old	29	0.41	-	0.00	-
1 to 4	80	1.13	-	0.00	-
5 to 9	118	1.67	-	0.00	-
10 to 14	213	3.01	1	0.68	0.47
15 to 19	377	5.33	2	1.36	0.53
20 to 24	504	7.13	8	5.44	1.59
25 to 29	625	8.84	7	4.76	1.12
30 to 34	658	9.31	6	4.08	0.91
35 to 39	634	8.97	5	3.40	0.79
40 to 44	604	8.55	12	8.16	1.99
45 to 49	601	8.50	9	6.12	1.5
50 to 54	586	8.29	10	6.80	1.71
55 to 59	539	7.63	12	8.16	2.23
60 to 64	431	6.10	11	7.48	2.55
65 to 69	369	5.22	18	12.24	4.88
70 to 74	285	4.03	10	6.80	3.51
75 to 79	196	2.77	19	12.93	9.69
≥80	218	3.08	17	11.56	7.8
Total	7,067	100	147	100	2.08

Source: Brazilian Ministry of Health - Hospital Information System from the SUS.  
 Note: Numeric data equal to 0 not resulting from rounding (-).

**Table 4** addresses morbidity and mortality by gender and race/skin color. It is noted that there was a predominance of males in hospitalizations 4,589 (64.94%), deaths 101 (68.71%), and mortality rate (2.2%). Considering the race/skin color, self-declared brown people predominated in hospitalizations 3,522 (49.8%), while in most deaths and mortality there was no information vis-à-vis ethnicity, showing values of 71 (48.30%) and 2.47%, respectively.

**Table 4** - Morbidity and mortality due to leprosy in the Northeast region according to gender and race/skin color from 2012 to 2017. Jequié city, Bahia State, Brazil, 2018.

Variables	Hospitalizations	%	Deaths	%	Mortality rate
<b>Gender</b>					
Male	4,589	64.94	101	68.71	2.2
Female	2,478	35.06	46	31.29	1.86
Total	7,067	100	147	100	2.08
<b>Race/skin color</b>					
White	373	5.3	4	2.72	1.07
Black	88	1.2	-	0.00	-
Brown	3,522	49.8	67	45.58	1.9
Yellow	209	3.0	5	3.40	2.39
Indian	2	0.0	-	0.00	-
No information	2,873	40.7	71	48.30	2.47
Total	7,067	100	147	100	2.08

Source: Brazilian Ministry of Health - Hospital Information System from the SUS.  
 Note: Numeric data equal to 0 not resulting from rounding (-).

Concerning the financial impacts, it is observed in **Table 5** that leprosy cost more than R\$ 3.7 million to the SUS resulting from the hospital services offered to users. Among this amount, the Pernambuco State stood out in the first place with a value of R\$ 1,570,012.36 (42.00%). Soon after, the Maranhão State appears in second place with R\$ 818,579.74 (21.90%).

**Table 5** - Financial impacts generated due to leprosy in the Northeast region according to Federative Unit from 2012 to 2017. Jequié city, Bahia State, Brazil, 2018.

Federative Unit	Price of hospital services (R\$)	%
Maranhão	818,579.74	21.90
Piauí	61,011.16	1.63
Ceará	206,716.56	5.53
Rio Grande do Norte	70,676.81	1.89
Paraíba	291,930.56	7.81
Pernambuco	1,570,012.36	42.00
Alagoas	254,335.69	6.80
Sergipe	43,286.05	1.16
Bahia	421,226.17	11.27
Total	3,737,775.10	100

Source: Brazilian Ministry of Health - Hospital Information System from the SUS.

## DISCUSSION

Concerning disease morbidity and mortality in certain geographic spaces, it is emphasized that there is no restriction on the relief and metric limits that delimit a region. It also takes into account the interpersonal ties developed between the population and the local nature over the generations.<sup>7</sup> Furthermore, the municipalities that make up the Brazilian Northeastern region, for the most part, have a low rate of leprosy detection,<sup>13</sup> which can favor the increase in physical disabilities in the population.

The low detection rate can be related to several factors, among them, the low effectiveness of health services in the diagnosis and active search of communicants, unsatisfactory economic conditions, lack of user participation in health services and low education level stand out. population that reflects the clinical insensitivity to the signs and symptoms associated with pathology. Nevertheless, there is still a lack of professional training, especially in primary care to offer assistance to cases of the disease.<sup>14,15</sup>

The association between leprosy and the low values of the Human Development Index is already disclosed in the literature, which creates yet another challenge for the control of the disease, as is the case in the Northeast region, characterized by significant social inequalities and consequently, the increase in endemic diseases among the population.<sup>16</sup> This fact may justify the increasing behavior of the mortality rate from between 2013 and 2017, as shown in **Table 2**. An economically viable and effective alternative to the problem is the development of educational actions among users of the service in order to make them trained in the identification of essential aspects for early diagnosis, which will make them active agents in the health process.<sup>17</sup>

Regarding the age group, the present study showed differences between the variables of morbidity and mortality, as shown in **Table 3**. It is emphasized that leprosy is identified as a disease of adults, due to the long period of incubation of the bacillus that occurs between 2 to 7 years. However, the occurrence of cases in families living in endemic areas

significantly increases the risk of children being affected by the bacillus and developing the disease.<sup>18</sup>

The largest number of hospitalizations, 658 (9.31%) occurred in people between 30 and 34 years old, as shown in **Table 3**. It is noted that this profile corresponds to young and economically active individuals, corroborating with other studies that showed a higher prevalence of leprosy in As a result of this, especially if the diagnosis is late, people with the disease may develop physical disabilities, harm the State's economy, suffer exclusion from the labor market and, consequently, burden public money with admission in social rehabilitation and/or pension programs.<sup>18</sup>

The age group from 75 to 79 years old stood out in deaths with 19 (12.93%) and in mortality rate with 9.69%. These values might be associated with the natural aging process in which there is a decrease in the immune system and, therefore, predisposes the elderly to greater sensitivity to infectious and contagious diseases.<sup>20-2</sup>

Observing the gender, the present study reveals that there was a predominance of males in hospitalizations 4,589 (64.94%), deaths 101 (68.71%) and mortality (2.2%), according to **Table 4**. These data corroborate with other studies that point to greater involvement of leprosy in this population.<sup>2,8,18,23</sup> According to the WHO, leprosy has a pathogenic capacity in both sexes and in most cases, the male stands out with greater involvement, showing a ratio of 2:1.<sup>8</sup> This statement can be *SUSTAINED* due to the greater female participation in health services, which guarantees an early detection and prevention of the consequences of the disease.<sup>24,25</sup>

In this perspective, the data cited can be associated with the results of studies<sup>19</sup> that revealed a higher prevalence of physical impairment in men. It is a population resistant to health services and permeated by a strong cultural factor of masculinity that hinders self-care and concern for health. Moreover, in the case of leprosy, there is also the fear of losing the financial source due to the stigma present in Brazilian society.<sup>14,26</sup>

Nonetheless, it is noteworthy that there is still no pattern of leprosy occurrence in the literature according to gender, however, other studies show a higher prevalence in females.<sup>27</sup> Nevertheless, especially in Africa, there is a similar record between men and women and in some regions, the female gender is more affected.<sup>8</sup>

Concerning the race/skin color, self-declared brown people prevailed in hospitalizations 3,522 (49.8%), corroborating with another study<sup>28</sup> that demonstrates the browns with the highest confirmed diagnosis rate. Meanwhile, most deaths and mortality did not include information regarding ethnicity, showing values of 71 (48.30%) and 2.47%, respectively, as shown in **Table 4**.

In the literature, there is dualism in relation to the race/skin color variable, evidencing a higher prevalence in the self-declared browns<sup>8</sup> and whites.<sup>2</sup> Consequently, this variable is little considered in the studies and, in cases where it is mentioned, generally the authors refer to the geographical location where the study was conducted and

not the direct association with the disease.<sup>8</sup> Given this viewpoint, a larger involvement of blacks and browns was expected in this study, due to the large number of those belonging to these ethnicities in the Brazilian Northeastern region. Furthermore, there was no notification of deaths for the self-declared blacks in this study, which may show underreporting of the records.

With regard to public spending, there was a financial impact of more than R\$ 3.7 million to the SUS and the Pernambuco State was responsible for R\$ 1,570,012.36, which corresponds to 42% of the total, as shown in Table 5. These values correspond to hospital services offered to users who have already shown some type of organic impairment. Such values are less costly in outpatient care characterized by early diagnosis and treatment, in addition to the use of low-cost resources.

Hence, it is evident that the importance and responsibility of the primary health care network in the development of actions for the promotion, protection, and recovery of health, in addition to the prevention of diseases and injuries. It is noteworthy that primary care is a strategy with significant potential from the technical operational point of view for the early diagnosis and treatment of leprosy and other infectious diseases. Nevertheless, there is still resistance from professionals in the clinical management of the disease, as it also happens in cases of tuberculosis at the primary level of health care.<sup>19</sup>

Among the main actions that help with the leprosy control, the decentralization of actions for primary care was underlined, in order to ensure early diagnosis, therapies, and cure. It was also emphasized screening and diagnostic procedures in household contacts to break the chain of transmission and ensure individual and community health.<sup>29</sup> Furthermore, the detailed evaluation to detect disabilities at the beginning of treatment stood out, once that any sign of neural impairment is indicative of specific referrals, as there is an increased probability of developing disabilities.<sup>19</sup> Nevertheless, it is ineffective to think about leprosy control without taking into account the social determinants involved in this health-disease process in the entire national territory.<sup>28</sup>

## CONCLUSION

Through this study, it was possible to further describe the morbidity, mortality and financial impacts generated due to leprosy in the Brazilian Northeastern region. Herein, the Northeast region registered 7,067 hospitalizations and 147 deaths, which corresponds to a 2.08% mortality rate.

The highest prevalence of hospitalizations occurred in the Pernambuco State, people within the age group from 30 to 34 years old, males and self-declared brown race/skin color. The number of deaths were higher in the Maranhão State, people within the age group from 75 to 79 years old, males and race/skin color without information. Conclusively, the larger mortality rate occurred in the Sergipe State, people within the age group from 75 to 79 years old, males and race/skin color without information. It should be noted that

the mortality rate due to leprosy has shown an increasing trend, then emphasizing the importance of early diagnosis and treatment to avoid further problems.

Concerning the public spending, leprosy generated a financial impact superior to R\$ 3.7 million, where the Pernambuco State alone spent 42% of that value. Considering that this study was based on secondary data available at the Hospital Information System from the SUS, there might be underreporting of the records, therefore, inconsistency of the discussed data. Nonetheless, it is an important tool for the SUS, because it allows the epidemiological monitoring of health problems and, consequently, the direction of actions that guarantee their prevention, control, and elimination.

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