

# EPIDEMIOLOGY OF PULMONARY TUBERCULOSIS IN THE NORTHEAST REGION OF BRAZIL: AN ANALYSIS FROM 2018 TO 2023

## EPIDEMIOLOGIA DA TUBERCULOSE PULMONAR NA REGIÃO NORDESTE DO BRASIL: UMA ANÁLISE DE 2018 A 2023

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### ABSTRACT

Tuberculosis is an infectious and transmissible disease caused by the bacterium *Mycobacterium tuberculosis*, also known as Koch's bacillus. The disease primarily affects the lungs (pulmonary form), but it can affect other organs and/or systems. The objective is to describe the epidemiological aspects of pulmonary tuberculosis in the Northeast region of Brazil between 2018 and 2023. This is a descriptive, retrospective, cross-sectional study with a quantitative approach. The data were extracted from the Department of Informatics of the National Health System (Departamento de Informática do Sistema Único de Saúde, DATASUS-Brazil)/Ministry of Health (Ministério da Saúde, MS) available on the website of the DATASUS. The number of hospitalizations for pulmonary tuberculosis decreased from 2018 to 2023, while the number of deaths generated a slight increase (3,243 vs. 2,567 and 236 vs. 255, respectively). Analyzing the last year of the study, males had higher percentages of hospitalization and deaths (73.7% and 78.4%, respectively). Our results showed that the number of hospitalizations decreased in northeastern Brazil, but there was a small increase in mortality during the study period.

**KEYWORDS:** Tuberculosis; epidemiology; DATASUS; hospitalization; mortality; national health programs.

### RESUMO

A tuberculose é uma doença infecciosa e transmissível causada pela bactéria *Mycobacterium tuberculosis*, também conhecida como bacilo de Koch. A doença afeta principalmente os pulmões (forma pulmonar), mas pode acometer outros órgãos e/ou sistemas. O objetivo é descrever os aspectos epidemiológicos da tuberculose pulmonar na região Nordeste do Brasil entre 2018 e 2023. Trata-se de um estudo descritivo, retrospectivo, transversal, com abordagem quantitativa. Os dados foram extraídos do Departamento de Informática do Sistema Único de Saúde (DATASUS-Brazil)/Ministério da Saúde (MS) disponíveis no site do DATASUS. O número de internações por tuberculose pulmonar diminuiu de 2018 a 2023, enquanto o número de óbitos gerou um ligeiro aumento (3.243 vs. 2.567 e 236 vs. 255, respectivamente). Analisando o último ano do estudo, os homens apresentaram maiores percentuais de hospitalização e óbitos (73,7% e 78,4%, respectivamente). Nossos resultados mostraram que o número de hospitalizações diminuiu no nordeste do Brasil,

mas houve um pequeno aumento na mortalidade durante o período do estudo.

**PALAVRAS-CHAVE:** Tuberculose; epidemiologia; DATASUS; hospitalização; mortalidade; programas nacionais de saúde.

### 1. INTRODUCTION

Tuberculosis (TB) is a communicable disease, and the bacillus *Mycobacterium tuberculosis* is the infectious agent<sup>1</sup>. It is also the current leading cause of death among infectious diseases in the world<sup>2</sup>. TB mainly affects lung tissue (pulmonary TB) but can also spread to other sites in the body, known as extrapulmonary TB<sup>1</sup>.

TB is a worrying disease for public health worldwide, given its high morbidity and mortality rates<sup>1,3</sup>. Data from the World Health Organization (WHO)<sup>4</sup>, how that in 2023, 1.25 million people died from TB and that it affected 10.6 million individuals, including adults and children<sup>4,5</sup>, including adults and children, with adult males being the most affected population.

In addition to the worrying outcome of mortality, TB has considerable socio-economic impacts since it mainly affects adults in the economically active phase and generates treatment costs of more than 20% of family income. Therefore, to reduce the current scenario, the WHO estimates that an investment of 22 billion is needed in TB prevention, diagnosis, and treatment to reach the global targets by 2027<sup>4</sup>.

The countries most affected by TB are those that are underdeveloped or underdeveloped, including regions in Southeast Asia, the African region, and the Western Pacific<sup>4</sup>.

Brazil is among the 30 countries with the highest TB burden in the world and is one of the WHO's priority nations for TB control<sup>6</sup>. National efforts, as well as the international model, include diagnosis, notification of the disease, treatment coverage, and control of incidence and mortality. Therefore, plans and

investments are needed to strengthen access to prevention, diagnosis and treatment of the disease, including research and innovation<sup>4,6</sup>.

Given the need to deepen the study of the epidemiology of TB in the country, the objective of this study was to analyze the epidemiology of pulmonary TB and its particularities in the Northeast region, which is subdivided into 9 states, with distinct social realities.

2. METHODS

This is a descriptive, retrospective, cross-sectional study with a quantitative approach. The data were extracted from the Department of Informatics of the National Health System (Departamento de Informática do Sistema Único de Saúde, DATASUS)/Ministry of Health (Ministério da Saúde, MS) available on the website of the DATASUS (Ministry of Health)<sup>7</sup>. Data collection was conducted in November 2024, assessing hospitalization and mortality rates for TB only in hospitalized patients as defined by the International Classification of Diseases, 10th revision (ICD-10) according to sex, age, and region in northeastern Brazil.

The study population consisted of data related to notifications of cases of TB. Statistical information related to the period from January 2018 to December 2023 and patients between the age range of <1 year and 80 years and over were included, thus contemplating the choices of study variables. Epidemiological studies are well designed using the DATASUS-Brazil database in different diseases<sup>8-11</sup>. As this is a public domain database made available by the SUS, there was no need to submit the work to the Research Ethics Committee<sup>8</sup>.

Data analyses were conducted using Prism, version 8.0 (GraphPad Software, San Diego, CA, USA).

3. RESULTS

From 2018 to 2023, the Northeast region of Brazil had more than 1300 deaths and more than 15000 hospitalizations due to TB. Bahia had the highest percentage of hospitalizations (25.4%), followed by Pernambuco (24%) and Ceará (15.7%). In terms of mortality, Pernambuco (24.1%), Bahia (21.7%) and Rio Grande do Norte (13.5%) were in sequence. Table 1 and Table 2 show the total number of hospitalizations and deaths from TB between the years 2018 to 2023 and these numbers by sex and region.

**Table 1.** Distribution of the total number of hospitalizations and deaths from pulmonary tuberculosis by year and sex.

Years	Hospitalization				Mortality			
	n	Men		Women	n	Men		Women
		n	%			n	%	
2018	3243	2384	73.5	859	26.5	236	174	73.7
2019	3057	2201	72.0	856	28.0	228	162	71.0
2020	2302	1756	76.3	546	23.7	183	142	77.6
2021	2159	1620	75.0	539	25.0	187	147	78.6
2022	2401	1742	72.5	659	27.5	221	163	73.7
2023	2567	1891	73.7	676	26.3	255	200	78.4
Total	15729	11594		4135		1310	988	

n: number; %: percentage. **Source:** the Authors.

**Table 2.** Distribution of the total number of hospitalizations and deaths from pulmonary tuberculosis in the Northeastern states and year.

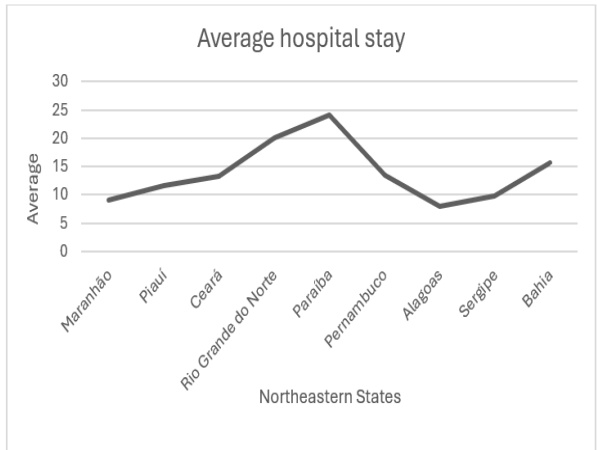
Northeastern States	Hospitalization						
	2018	2019	2020	2021	2022	2023	%
Maranhão	107	112	91	133	159	169	4.9
Piauí	76	76	54	94	85	102	3.1
Ceará	471	527	317	316	403	429	15.7
Rio Grande do Norte	367	358	333	287	362	293	12.7
Paraíba	310	347	182	289	321	366	11.5
Pernambuco	851	740	448	449	567	723	24.0
Alagoas	44	33	16	9	14	20	0.9
Sergipe	60	67	49	27	46	38	1.8
Bahia	957	797	812	555	444	427	25.4
Total	3243	3057	2302	2159	2401	2567	100

Northeastern States	Mortality						
	2018	2019	2020	2021	2022	2023	%
Maranhão	5	11	9	14	20	13	5.5
Piauí	6	8	5	16	16	16	5.1
Ceará	30	30	23	21	29	27	12.2
Rio Grande do Norte	41	29	23	22	23	39	13.5
Paraíba	23	28	17	27	31	47	13.2
Pernambuco	57	47	52	48	40	72	24.1
Alagoas	2	10	3	0	4	3	1.7
Sergipe	12	13	5	1	3	5	3.0
Bahia	60	52	46	38	55	33	21.7
Total	236	228	183	187	221	255	100

%: percentage. **Source:** the Authors.

The state of Paraíba had the highest average number of days of hospitalization during the study (24 days). Figure 1 shows the average length of stay by states in the northeast region of Brazil due to TB between 2018 and 2023.



**Figure 1.** Average hospital stays for pulmonary tuberculosis between 2018 and 2023 by state. **Source:** the Authors.

4. DISCUSSION

The number of hospitalizations for TB decreased from 2018 to 2023, while the number of deaths generated a slight increase (3243 vs. 2567 and 236 vs. 255, respectively). Analyzing the last year of the study, males had higher percentages of hospitalization and deaths (73.7% and 78.4%, respectively). Even so,

approximately one death/day and more than 2500 hospitalizations were observed annually. In addition, the state of Bahia had higher hospitalization rates (25.4%), while Pernambuco had higher mortality rates (24.1%).

We can associate this decline in hospitalizations with the efforts of the Brazilian government to combat the disease, with emphasis on the strengthening of tuberculosis control programs in municipalities and states<sup>12</sup>. Added to this is a greater scope of Family Health Strategy actions in recent years<sup>13</sup>. In the state of Piauí, the actions carried out by the Family Health Strategy, whose coverage reached 98.7% in 2016<sup>14</sup>, and the decentralization of TB control actions in Primary Care can result in greater access to diagnosis and treatment and, consequently, in the reduction of disease transmission<sup>13</sup>. Another important aspect is the progress observed in Paraíba, in 2007, the priority municipalities already had 95% of the health units with the TB control program implemented, and of these, 55% were already using the supervised treatment strategy<sup>15</sup>.

The results found by Brito *et al.* (2020)<sup>16</sup>, agree with our study, with a reduction in hospitalizations in addition to a greater proportion of cases among males (63.53%). Another important result was found by Cortez *et al.* (2021)<sup>17</sup>, where it was observed that throughout the study (2006 to 2015), there was a slight reduction in the prevalence of tuberculosis in Brazil as a whole (from 46.1% in 2006 to 39.9% in 2015), with the greatest reduction (from 48.1% to 37.4%) in the Northeast region and the smallest (from 37.5% to 36.4%) in the South region.

The higher rate of cases among males may be associated with resistance to seeking health care, as well as lower access to these services by this population, conditions that complicate early diagnosis of the disease<sup>17-19</sup>.

In Brazil, the TB mortality rate was 2.2 deaths per 100,000 inhabitants, with an average annual percentage change of -0.4% (95% CI [-1.0, 0.2])<sup>20</sup>. The mortality results agree with those found in the literature, in which the state of Pernambuco had the highest mortality rate in the period studied (2010 to 2019), reaching almost 4.5 deaths per 100,000 inhabitants in 2017, always above the regional average<sup>21</sup>. The Brazilian government has goals for better disease management, including reducing the incidence of the disease to less than 10 cases per 100,000 inhabitants, in addition to reducing the number of deaths to one per 100,000 inhabitants by 2025<sup>22</sup>.

Our study has several limitations. The data analyzed were collected from electronic medical records. Although reporting is mandatory, there is potential for missing data and inclusion of incorrect records, which may lead to underreporting of the disease. Another important aspect is the reduction in the number of hospitalizations from 2020 to 2021, which may be associated with the restriction measures recommended by the WHO due to COVID-19. In

addition, this study does not include corrections per 100,000 inhabitants: we only present absolute data from DATASUS<sup>7</sup>.

## 5. CONCLUSION

Our results showed that the number of hospitalizations decreased in northeastern Brazil, but there was a small increase in mortality during the study period. The state of Bahia had the highest percentage of hospitalizations, while Pernambuco had the highest mortality rate. We strongly suggest that further studies be conducted to further analyze pulmonary tuberculosis in northeastern Brazil. 2024/00263-6

## 6. FINANCIAL SUPPORT

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