

EPIDEMIOLOGICAL PROFILE OF NEW TUBERCULOSIS CASES IN MARANHÃO 2014-2023

PERFIL EPIDEMIOLÓGICO DOS CASOS NOVOS DE TUBERCULOSE NO MARANHÃO 2014-2023

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ABSTRACT

Background: Tuberculosis (TB) is a public health problem, with 10.7 million new cases in 2024. In Brazil, there were 84,308 cases, with Maranhão standing out, where socioeconomic factors contribute to the high incidence of the disease. **Aim:** To describe the epidemiological profile of new TB cases reported in Maranhão in a 10-year historical series. **Methods:** Descriptive study on TB cases between 2014 and 2023, using data from the Notifiable Diseases Information System (SINAN). The study analyzed variables such as sex, age group, race, education level, clinical form, HIV testing, directly observed treatment (DOT), and treatment closure status. **Results:** During the study period, 21,916 cases of TB were registered in Maranhão. The new cases were predominantly male (65.91%), of mixed race (71.64%), of working age (20 to 59 years), and with low levels of education (50.43%). Furthermore, 89.62% had the pulmonary form of the disease, 7.98% tested positive for HIV, and only 21.65% underwent directly observed treatment (DOT). Regarding case outcomes, 70.25% were cured and 11.17% abandoned treatment. **Conclusions:** The profile of TB in Maranhão (men, mixed race, low education level, and pulmonary form) reflects social inequities. The low coverage of DOT (Directly Observed Therapy) and the high abandonment rate highlight the urgency of strengthening control actions and adherence to treatment in the state.

Keywords: Tuberculosis; Epidemiology; Epidemiological Profile.

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RESUMO

Contexto: A tuberculose (TB) é um problema de saúde pública, com 10,7 milhões de novos casos em 2024. No Brasil, foram registrados 84.308 casos, com destaque para o Maranhão, onde fatores socioeconômicos contribuem para a alta incidência da doença. **Objetivo:** Descrever o perfil epidemiológico dos novos casos de TB notificados no Maranhão em uma série histórica de 10 anos. **Métodos:** Estudo descritivo de casos de TB entre 2014 e 2023, utilizando dados do Sistema de Informações sobre Agravos de Notificação (SINAN). O estudo analisou variáveis como sexo, faixa etária, raça, escolaridade, forma clínica, teste de HIV, tratamento diretamente observado (TDO) e situação de encerramento do tratamento. **Resultados:** Durante o período do estudo, foram registrados 21.916 casos de TB no Maranhão. Os novos casos foram predominantemente do sexo masculino (65,91%), pardos (71,64%), em idade economicamente ativa (20 a 59 anos) e com baixo nível de escolaridade (50,43%). Além disso, 89,62% apresentavam a forma pulmonar da doença, 7,98% testaram positivo para HIV e apenas 21,65% estavam em tratamento diretamente observado (TDO). Em relação aos desfechos dos casos, 70,25% foram curados e 11,17% abandonaram o tratamento. **Conclusões:** O perfil da TB no Maranhão (homens, pardos, baixa escolaridade e forma pulmonar) reflete iniquidades sociais. A baixa cobertura do TDO e o alto abandono destacam a urgência em fortalecer as ações de controle e adesão ao tratamento no estado.

Palavras-chave: Tuberculose; Epidemiologia; Perfil Epidemiológico.

INTRODUCTION

Tuberculosis (TB), caused by *Mycobacterium tuberculosis*, is transmitted through inhalation and is the infectious disease that causes the greatest number of deaths worldwide. It is a disease with high morbidity and mortality in several countries, which gives it the status of a global public health problem (WHO, 2025).

Globally, more than 10 million people were diagnosed with TB in 2024, the highest number recorded since the start of global monitoring in 1995. This significant increase, compared to the 7.5 million reported in 2022, again places TB as the leading cause of death from infectious diseases in 2024, surpassing COVID-19 (WHO, 2025).

In the Americas, estimates show that 350,000 people were diagnosed with TB in 2024 (WHO, 2025). Brazil is among the 30 countries with the highest number of TB cases and TB-HIV coinfection cases. In 2024, 84,308 new cases of the disease were registered, with the country accounting for 1/3 of all cases in the Americas. The profile of cases is male (68.2%), with the disease occurring mainly in black and brown people (65.8%) (Brazil, 2025).

In Maranhão, in 2024, 2,741 new cases of TB were reported, which is equivalent to an incidence rate of 39.1 cases per 100,000 inhabitants (Brazil, 2025). Maranhão has significant challenges related to diagnosis, treatment and prevention, associated with factors such as poverty, difficulty accessing health services and high population density in precarious urban areas. It is known that poverty is a strong risk factor for TB, and therefore the disease is more prevalent in low-income population groups (WHO, 2025).

In 2014, the World Health Organization took measures to combat tuberculosis and called it the End TB Strategy, to ensure the eradication of the epidemic by 2035 (WHO, 2014; Barreira, 2018). In this way, tuberculosis has become a marker of social inequities in health, where unequal social classes interfere in the health-disease process (Magalhães *et al.* 2018).

Therefore, understanding the characteristics of cases becomes necessary for the implementation or expansion of public policies aimed at controlling and preventing tuberculosis, as well as helping to achieve the global goals of eradicating the disease by 2035. Thus, the present study aims to describe the epidemiological profile of new TB cases reported in the state of Maranhão in a historical series of 10 years (2014 to 2023).

METODOLOGY

This is a descriptive study of tuberculosis cases in the state of Maranhão, registered in the Notifiable Diseases Information System (SINAN), from 2014 to 2023. Maranhão belongs to the Brazilian Northeast Region, has an area of 329,651 km² and an estimated population of 7,153,262 inhabitants. It is politically and administratively organized into 217 municipalities and 19 health regions (IBGE, 2022).

The population of this study consisted of all new TB cases residing in Maranhão. Duplicate records and those whose entry method was not as a 'new case' were excluded, in order to guarantee the reliability of the epidemiological profile. The data source was SINAN, available online and free of charge through the Department of Informatics of the Unified Health System (DATASUS). The data were collected in August 2025 and exported to a Microsoft Excel spreadsheet. It should be noted that 'ignored' or blank data were retained in the relative frequency analyses to highlight the quality of surveillance and completion of notification forms in the state.

The absolute and relative frequencies of the following variables were calculated: sex, age group, race, education level, clinical form, HIV testing, directly observed treatment (DOT), and closure status.

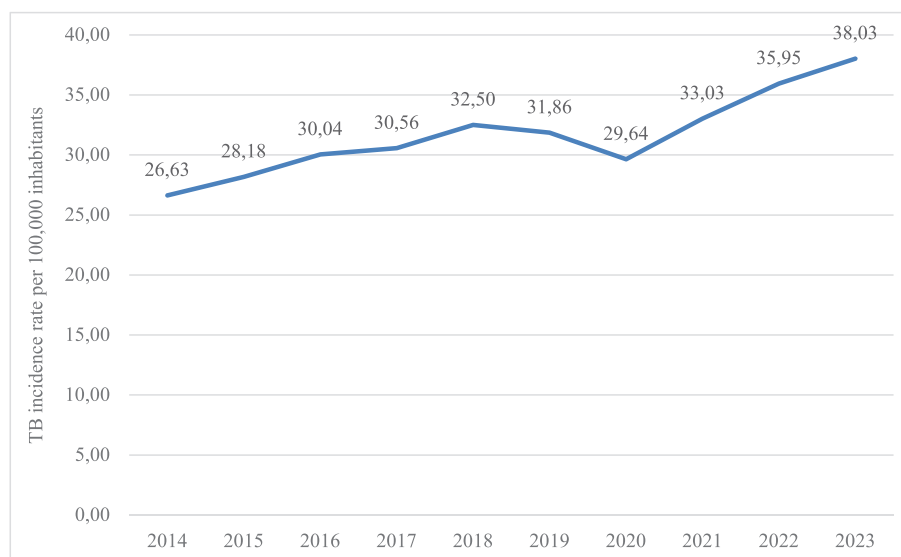
Since the data used in this study were secondary and in the public domain, review by a research ethics committee was not required, in accordance with Resolution 466/2012 of the Brazilian National Health Council (CNS) and its complementary regulations

RESULTS

Between 2014 and 2023, 21,916 cases of TB were reported in Maranhão. A progressive increase in the incidence of TB in the state of Maranhão is observed. At the beginning of the period, in 2014, the rate was 26.63 cases per 100,000 inhabitants, reaching its peak in 2023 with 38.03 cases per 100,000 inhabitants, representing an increase of approximately 42.8% in the incidence of the disease

over the decade. A temporary decline in the indicator is noted during 2020 (29.64/100,000 inhabitants), coinciding with the first year of the COVID-19 pandemic. However, from 2021 onwards, the rate resumed an upward trajectory, exceeding pre-pandemic levels.

Figure 1 - Historical series of the incidence rate of new tuberculosis cases in Maranhão, 2014-2023.



Source: Sinan (2024).

Regarding the sociodemographic characteristics of the newly reported TB cases, it was observed that the majority were male (65.91%), mixed-race (71.64%), of working age (20 to 59 years, N= 15,856, 72.35%) and with low education (illiterate or incomplete primary education - 50.43%) (Table 1).

Table 1 - Sociodemographic characteristics of new tuberculosis cases in Maranhão, 2014-2023.

Characteristics	N	%
Sex		
Male	14,445	65.91
Female	7,471	34.09
Race/color		
White	2,564	11.70
Black	2,814	12.84
Brown	15,700	71.64
Yellow	164	0.75
Indigenous	395	1.80
Ignored/In blank	279	1.27
Age group (years)		
0-4	240	1.10
5-14	388	1.77
15-19	1,349	6.16
20-39	9,251	42.21
40-59	6,605	30.14
60-69	2,084	9.51
Over 70	1,991	9.08
Ignored/In blank	8	0.04

Characteristics	N	%
Education		
Illiterate	2,611	11.91
Incomplete primary school	8,441	38.52
Complete primary school	1,469	6.70
Incomplete high school	1,882	8.59
Complete high school	3,981	18.16
Incomplete college	437	1.99
Complete college	688	3.14
Not applicable	289	1.32
Ignored/In blank	2,118	9.66

Source: Sinan (2024)

Concerning clinical characteristics, it was observed that 89.62% of cases had the pulmonary clinical form, 7.98% tested positive for HIV, and only 21.65% underwent directly observed treatment (DOT). Furthermore, regarding the outcome, 70.25% progressed to cure and 11.17% abandoned treatment (Table 2).

Table 2 - Clinical and laboratory characteristics of new tuberculosis cases in Maranhão, 2014-2023.

Characteristics	N	%
Clinical Type		
Pulmonary	19,642	89.62
Extrapulmonary	2,054	9.37
Pulmonary + Extrapulmonary	212	0.97
Ignored/In blank	8	0.04
HIV Test		
Positive	1,748	7.98
Negative	17,148	78.24
In progress	157	0.72
Not performed	2,855	13.03
Ignored/In blank	8	0.04
Directly observed treatment performed		
Yes	4,745	21.65
No	14,598	66.61
Ignored/In blank	2,573	11.74
Closure Status		
Cure	15,397	70.25
Abandonment	2,449	11.17
Death from tuberculosis	731	3.34
Death from other causes	903	4.12
Transfer	1,236	5.64
TB-DR	205	0.94
Scheme Change	96	0.44
Collapse	21	0.10
Ignored/In blank	878	4.01

Source: Sinan (2024)

A high proportion of data was recorded as ‘unknown/blank’ in variables fundamental to epidemiological monitoring. Of particular note are the level of education, with 9.66% (n=2,118) of incomplete records, and the performance of Directly Observed Treatment (DOT), which presented 11.74% (n=2,573) of unknown data.

DISCUSSION

The results of this study show that TB still represents a significant public health problem for the state. The analysis of the historical series reveals a scenario characterized by a sustained growth in the incidence rate throughout the decade. This shows that the current control strategies have not been sufficient to curb the transmission of the disease (Cunha *et al.* 2015).

The decrease in the incidence rate observed in 2020 should be analyzed from the perspective of the collapse of health systems during the COVID-19 pandemic. This epidemiological ‘false decline’ does not indicate a reduction in the disease burden, but rather a gap in the detection of new cases. The redirection of laboratory supplies and human resources to combat the pandemic, coupled with the population’s fear of seeking medical assistance, generated a diagnostic backlog. Consequently, the significant jump recorded in subsequent years (2021-2023) reflects both the recovery of these late records and the impact of transmission maintained by cases that were not opportunely isolated and treated during the critical period of the health crisis (Uchoa *et al.*, 2023; Maia *et al.*, 2022; Silva, 2024).

Moreover, the growth of the indicator after 2021 suggests that the health crisis exacerbated socioeconomic vulnerabilities in Maranhão, such as increased poverty and food insecurity, factors historically associated with a higher incidence of TB. Therefore, the peak recorded in 2023 not only reflects the recovery of backlogged records, but also signals a real worsening of the epidemic, reinforcing the urgent need for public policies that integrate clinical management with social support and the active search for symptomatic respiratory patients (Souza *et al.*, 2024).

Regarding the profile, a higher frequency of cases was observed in males, similar to the results of the study carried out by Oliveira and colleagues (2018) in Piauí, which showed a predominance of male individuals, adults aged between 20 and 49 years, which is justified by the fact that men do not take adequate care of their health and are also more exposed to risk factors for the disease when compared to women (Zagmignan *et al.*, 2018).

In Maranhão, the brown race/color was predominant in new TB cases, a finding similar to other studies available in the literature (Soeiro *et al.*, 2022; Zagmignan *et al.*, 2018; Oliveira *et al.* 2018). This is certainly related to the fact that the population of Maranhão is mostly composed of black individuals (black and brown) (IBGE, 2022).

Concerning age range, there was a prevalence in economically active age groups, with a decrease in the number of reported cases as age increased, a result similar to the study by Pimentel *et al.* (2024).

This pattern may be associated with this group's greater exposure to risk factors for contagion, such as prolonged stays in closed environments or without external ventilation, in addition to adverse working conditions (Martins *et al.*, 2022; Ferreira *et al.*, 2024).

Regarding education, it was observed that most cases had few or no years of schooling. Low education or the absence of it is a risk factor for TB (Moraes *et al.*, 2017; Rodrigues; Mello, 2018; Moreira; Kritski; Carvalho, 2020). This unfavorable condition reflects a whole set of precarious socioeconomic conditions, which increase vulnerability to the disease and are responsible for the higher incidence of the disease and lower adherence to the respective treatment (Zagmignan *et al.*, 2018; Moreira; Kritski; Carvalho, 2020).

In this context, the predominance of brown individuals with low education should not be seen merely as a demographic characteristic, but rather as a critical analysis of the social determinants of health. The articulation between these variables reveals that brown race and low education level act as markers of social inequity that sustain the maintenance of the disease in Maranhão. Such conditions impose structural barriers to access, diagnosis and understanding of treatment, perpetuating the cycle of vulnerability that favors the transmission of the bacillus (Valente *et al.*, 2024).

The pulmonary form of TB was predominant in this study, corroborating the findings of Tavares *et al.* (2020). This clinical form is the most frequent and most concerning due to the ease of transmission and the fact that the bacillus finds favorable conditions to develop in the pulmonary alveoli. In addition, this form is of great importance for epidemiological analyses, early diagnosis and control of TB (Martins *et al.*, 2020).

The data on HIV testing reveal important epidemiological aspects and challenges in addressing TB-HIV coinfection. A positive HIV result reinforces the strong association between these two diseases, since the immunosuppression caused by the virus increases susceptibility to tuberculosis and can worsen its progression (Bastos *et al.* 2019). The proportion of tests not performed represents a gap in the screening of co-infection, which may compromise the adoption of appropriate clinical management strategies, allowing greater susceptibility to worsening. According to the guidelines of the Ministry of Health, it is recommended that all individuals diagnosed with tuberculosis undergo rapid HIV testing (Brazil, 2019).

The analysis revealed that most individuals diagnosed with TB did not undergo Directly Observed Treatment (DOT), which negatively impacts therapeutic adherence and constitutes one of the main bottlenecks for achieving control goals in the state. Without expanding and strengthening this strategy in primary care, the effectiveness of the TB control program remains compromised, culminating in high dropout rates in this historical series, deviating significantly from the 5% limit recommended by the World Health Organization (WHO, 2023).

Although more than two-thirds of patients progressed to a favorable outcome, the results resemble other national scenarios (Tavares *et al.*, 2020; Oliveira *et al.*, 2021) and remain below the 85%

cure rate parameter defined by national and international guidelines. Adding to this challenge is the existence of records with unknown closure status, which suggests flaws in the completeness of notification forms and may mask an even more severe epidemiological reality (Canto *et al.*, 2020). Thus, it becomes imperative to reassess surveillance and care actions, focusing on the effectiveness of care for the most vulnerable groups to reverse the scenario of treatment interruption and ensure the consolidation of cure (Soeiro *et al.*, 2022; Costa *et al.*, 2019; Pimentel *et al.*, 2024).

Despite the relevance of the results presented, this study has limitations, such as those related to the data source, which may present gaps and inconsistencies, especially due to the underreporting of TB cases. However, it is important to highlight that the data used in this research comes from the Notifiable Diseases Information System (SINAN), which consolidates information from across the country. This provides a comprehensive and detailed view of the tuberculosis situation, allowing for the analysis of trends and epidemiological profiles of the disease in different regions. Even with the aforementioned limitations, the data allow for an understanding of the disease scenario in the state and have the potential to support the fight against TB as a public health problem.

CONCLUSION

The epidemiological profile of TB in Maranhão from 2014 to 2023 reveals the persistence of the disease as a reflection of the state's social disparities. The predominance of cases in men, brown-skinned individuals, and those with low levels of education confirms that the pathology remains intrinsically linked to markers of socioeconomic vulnerability, which act as barriers to the effective control of transmission. The trajectory of incidence during this period shows that, despite surveillance efforts, the state faces a worsening scenario, intensified by the impacts of the COVID-19 pandemic, which caused a backlog of diagnoses and a subsequent increase in registrations. The limitations observed in the coverage of Directly Observed Treatment (DOT) and the failure to meet cure and abandonment targets indicate that the current care model needs strengthening, especially in primary care.

In this context, more incisive and adapted active search strategies are proposed for the daily lives of the male population of working age, aiming at early diagnosis outside the traditional clinical environment. Furthermore, it is urgent to consolidate universal HIV testing for all patients diagnosed with TB in order to mitigate the harms of co-infection. Only through the articulation between rigorous clinical management and public policies that address the social determinants will it be possible to reverse the upward trend of the disease and ensure the sustainability of control actions in the state.

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