





ORIGINAL

## Epidemiological Characterization of Pulmonary Tuberculosis in Cuba

### Caracterización epidemiológica de la tuberculosis pulmonar en Cuba

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#### ABSTRACT

**Introduction:** Tuberculosis (TB) remains the leading infectious cause of mortality worldwide, with approximately 10,8 million new cases and 1,25 million deaths in 2023. The highest incidence rates occur in the Southeast Asia Region (45 %), Africa (24 %), and Western Pacific Region (17 %).

**Objective:** to epidemiologically characterize pulmonary tuberculosis in Cuba.

**Method:** this study employed historical data analysis. Data were obtained through a systematic literature review of 21 sources from SciELO, UpToDate, PubMed, and Cuban national press publications.

**Results and Discussion:** recent years have shown declining TB incidence rates across Latin America and the Caribbean. Cuba maintains one of the lowest incidence rates in the Americas, reporting 706 cases in 2023. Havana province demonstrated the highest disease burden. Current socioeconomic challenges necessitate programmatic adjustments to the National Tuberculosis Control Program.

**Conclusions:** recent months have seen concerning incidence increases attributable to deteriorating socioeconomic conditions. We recommend programmatic updates aligned with Cuba's current (2025) epidemiological and socioeconomic reality.

**Keywords:** Tuberculosis; Pulmonary Tuberculosis; Epidemiology; Cuba; National Tuberculosis Control Program.

#### RESUMEN

**Introducción:** la tuberculosis (TB) sigue siendo la principal causa infecciosa de mortalidad en todo el mundo, con aproximadamente 10,8 millones de nuevos casos y 1,25 millones de muertes en 2023. Las tasas de incidencia más altas se registran en la región del sudeste asiático (45 %), África (24 %) y la región del Pacífico occidental (17 %).

**Objetivo:** caracterizar epidemiológicamente la tuberculosis pulmonar en Cuba.

**Método:** este estudio empleó el análisis de datos históricos. Los datos se obtuvieron mediante una revisión sistemática de la literatura de 21 fuentes de SciELO, UpToDate, PubMed y publicaciones de la prensa nacional cubana.

**Resultados y discusión:** en los últimos años se ha observado una disminución de las tasas de incidencia de la TB en América Latina y el Caribe. Cuba mantiene una de las tasas de incidencia más bajas de América, con 706 casos notificados en 2023. La provincia de La Habana presentó la mayor carga de morbilidad. Los retos socioeconómicos actuales requieren ajustes programáticos en el Programa Nacional de Control de la Tuberculosis.

**Conclusiones:** en los últimos meses se ha observado un preocupante aumento de la incidencia atribuible al deterioro de las condiciones socioeconómicas. Recomendamos actualizaciones programáticas acordes con la realidad epidemiológica y socioeconómica actual (2025) de Cuba.

**Palabras clave:** Tuberculosis; Tuberculosis pulmonar; Epidemiología; Cuba; Programa Nacional de Control de la Tuberculosis.

## INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis* that primarily affects the lungs (pulmonary TB), though it may involve other organs (extrapulmonary TB). Transmission occurs through airborne respiratory droplets expelled when infected individuals cough, sneeze, or speak.<sup>(1)</sup>

The World Health Organization (WHO) reports TB as the leading infectious cause of mortality worldwide, with approximately 10,8 million new cases and 1,25 million deaths in 2023. The highest incidence rates occur in the Southeast Asia Region (45 %), Africa (24 %), and Western Pacific Region (17 %).<sup>(2,3)</sup> (figure 1)

Cuba ranks among the four countries with the lowest TB incidence in the Americas, reporting a mortality rate of 0,5 per 100 000 population in 2023.<sup>(4,5)</sup> The National Tuberculosis Control Program has served as the cornerstone for disease diagnosis, treatment, and surveillance since its implementation, demonstrating significant success.<sup>(5)</sup>

## Objective

To conduct an epidemiological characterization of pulmonary tuberculosis in Cuba.

## METHOD

This study utilized historical data analysis. Data were obtained through a comprehensive literature review of 21 Spanish and English-language references, including articles from scientific databases (SciELO, UpToDate, PubMed) and Cuban national press publications addressing various aspects of the epidemiological profile of pulmonary tuberculosis in Cuba.

## RESULTS AND DISCUSSION

The epidemiological chain of tuberculosis consists of the following links:<sup>(6,7,8,9,10,11,12,13,14,15)</sup>

1. *Causative agent*: Human tuberculosis bacillus of the *Mycobacterium tuberculosis* complex.
2. *Reservoir*: Humans and, in some countries or regions, primates, cattle, swine, and other mammals.
3. *Portal of exit*: Mouth and nasal cavities of the reservoir.
4. *Mode of transmission*: Respiratory.
5. *Portal of entry*: Mouth and nasal cavities of the susceptible host.
6. *Susceptible host*: Healthy individuals and at-risk or vulnerable patients.
7. *Immunity level*: Host response against the pathogen.
8. *Incubation period*: 2 to 10 weeks.
9. *Clinical manifestations*: Disease symptoms or asymptomatic presentation.
10. *Pathogen survival*: Some bacteria survive and remain latent but viable for years.

The World Health Organization (WHO) estimated that in 2023 there were 10,8 million new cases of tuberculosis (TB). Of these, 400 000 had multidrug-resistant tuberculosis (resistant to isoniazid and rifampicin).<sup>(3)</sup> Among all new tuberculosis cases in 2023, an estimated 6,1 percent were co-infected with HIV. Seventy-four percent of these cases occur in Africa.<sup>(16)</sup>

With COVID-19, an increase was observed. By 2023, tuberculosis reached a new peak of 8,2 million cases, meaning that 2,6 million people with tuberculosis remain undiagnosed (the “missing millions”). It caused approximately 1,25 million deaths. It is estimated that more than 1,7 million people (approximately 22 % of the world’s population) are infected with *M. tuberculosis*.<sup>(3,17)</sup>

The WHO strategy to end tuberculosis between 2016 and 2035 focuses on reducing deaths, disease incidence, and costs. This reduction could decrease tuberculosis incidence to <1 case per million by 2050.<sup>(18)</sup> In recent years, a decline in incidence has been observed in Latin America and the Caribbean, although it remains a health problem. Notably, Cuba is one of the four countries with the lowest incidence rate in the Americas.<sup>(5,19)</sup>

In 2023, 706 cases were reported, of which 635 were pulmonary tuberculosis cases and 71 were extrapulmonary cases.<sup>(8)</sup> Despite this low number, recent statements by Dr. Francisco Durán García, National Director of Epidemiology at Cuba’s Ministry of Public Health, during the International Tuberculosis Day commemoration at the Havana Pneumological Hospital, reveal an increase in this disease over the past two years.<sup>(20)</sup>

The province with the highest reporting was Havana, with 205 new cases and 11 relapses, while the lowest was Isla de la Juventud with 3 new cases and no relapses.<sup>(8)</sup>

Age is a significant risk factor for this disease. It is related to physiological immunosuppression occurring at the extremes of life, as well as the incidence of chronic diseases. The group with the highest incidence was 15

to 64 years old with a rate of 8,5 per 100 000 inhabitants. On the other hand, the age group with the lowest incidence was children under 5 years with a rate of 0,8 per 100 000 inhabitants.<sup>(8)</sup>

Charro et al.<sup>(10)</sup> presented a study which found that tuberculosis remains most frequent in the 45 to 54-year range, the pulmonary form (80,1 % of diagnosed cases), and in males (72,4 %). Regarding mortality, in 2023 a total of 50 deaths were reported for a rate of 0,5 per 100 000 inhabitants; of these, 5 were female and 45 were male, confirming a male predominance.<sup>(8)</sup>

Cuba, along with other countries, has joined the task of eliminating tuberculosis as a public health problem. To this end, it created the National Tuberculosis Control Program: a strategic framework, a coherent plan based on strengthening the comprehensive intersectoral intervention strategy that consists of renewed intensification of coordinated actions by different actors in the health sector.<sup>(5)</sup>

The general objective of the Program is to reduce morbidity and disease transmission, until achieving its pre-elimination as a public health problem (5 cases per 100 000 inhabitants)<sup>(5)</sup>. Despite this, to date the need has been noted to readjust this program according to the current deterioration of socioeconomic conditions on the island and to update it considering the availability of resources for disease detection and control.<sup>(11)</sup>

The above coincides with León et al.<sup>(11)</sup>, who conducted an analysis from the perspective of managers and provided important elements in the analysis of inequalities in access, availability, acceptability and quality of health services in the care of pulmonary tuberculosis patients in Havana. As well as aspects related to the availability of diagnostic technologies, program process management, quality of human resources, social indiscipline, social stigmas regarding the disease, difficulties in food and required transportation for these patients. All these observations contribute positively to the Program's redesign toward continuous improvement until tuberculosis elimination.<sup>(5)</sup>

The comprehensive management of a tuberculosis patient is based on the actions of various sectors of society and governing institutions. On the other hand, the family plays a fundamental role in treatment adherence. It is necessary to act on each link of the chain. Below are proposed measures for each link.<sup>(5,12)</sup>

#### **Measures for the sick (agent and reservoir)**

- Definitive diagnosis
- Case reporting (on the charge sheet and mandatory reporting card)
- Isolation (home admission during both treatment phases)
- Specific treatment (outpatient and controlled)
- Preparation of epidemiological history (In Cuba, model 84-05 is used)
- Individual and group health education (educational talks, family dynamics, debates, health hearings and other health promotion actions, healthy habits, personal hygiene. Emphasize the importance of avoiding overcrowding, having a balanced diet, a ventilated home with optimal hygienic conditions)
- Epidemiological discharge (Will be issued by the epidemiologist based on clinical-epidemiological criteria, with remission of symptoms, negative bacteriological sputum results at the 2nd month of treatment and at the end plus negative culture. Clinical discharge will be given by a clinician after symptom improvement)

#### **Measures for the Susceptible Host (healthy individual)**

The best way to prevent TB is to provide adequate treatment and achieve cure of all contagious cases.<sup>(20)</sup>

##### *General measures:*

- Health education (Act on risk factors)
- Adequate nutrition
- Healthy lifestyle, avoid smoking, alcoholism, drug addiction
- Adequate housing conditions (ventilated, illuminated)

##### *Specific measures: (Prevention Levels)*

###### *Primary prevention:*

- BCG vaccination: Part of the Program's prevention measures. It is recommended due to its impact on severe childhood forms and TB mortality. It has protective value against severe forms of primary tuberculous infection dissemination, mainly in children under 5 years. BCG vaccination coverage in the population under 1 year in Cuba in 2023 was 98,5 %.<sup>(5)</sup>
- Chemoprophylaxis: Primary when indicated for uninfected persons, i.e., tuberculin-negative, to prevent infection. Secondary or preventive treatment, indicated for infected persons.

Isoniazid chemoprophylaxis is contraindicated in the following cases: active tuberculosis cases, history of liver damage confirmed by corresponding tests (laboratory, biopsy), individuals who have received anti-TB

treatment, drug toxicity, alcoholics.<sup>(18)</sup>

Secondary prevention: Secondary chemoprophylaxis.

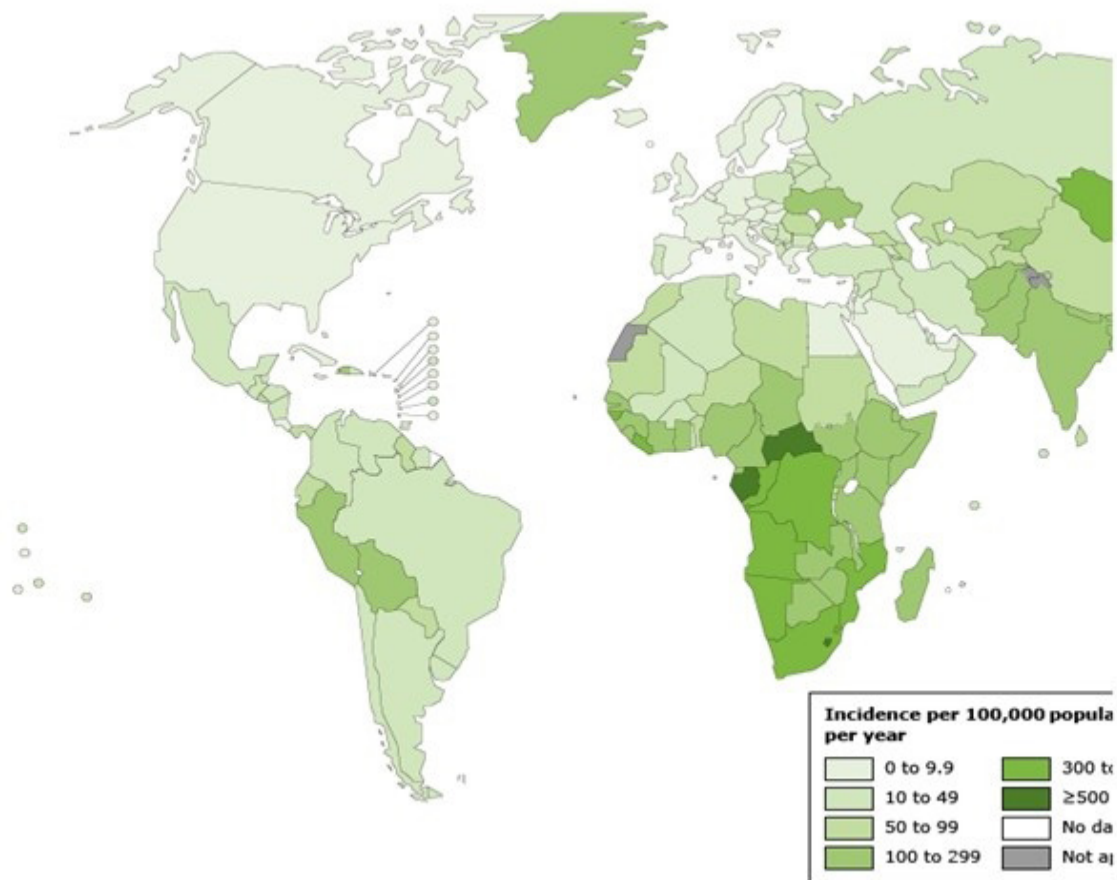
Tertiary prevention: Activities for comprehensive rehabilitation (including psychological).

Quaternary prevention: Performed to avoid damage from overdoses and adverse reactions to antituberculosis drugs (ARAD). In case of severe ARAD, suspension of all medications is indicated until the affected organ or system normalizes, which usually occurs within 2 to 3 weeks. For example, Ethambutol should not be used in persons whose limitations prevent timely detection of optic nerve toxicity and in those with pre-existing optic neuropathy, for which a fundoscopic eye exam is performed at treatment initiation.

### Environmental measures

In homes: adequate ventilation, lighting and hygiene. Concurrent and terminal disinfection. Hygienic control of the environment.

Given the recent upward trend, projections suggest challenges for 2025 unless interventions are strengthened.



**Figure 1.** Estimated incidence rates of tuberculosis, 2023.

**Source:** Reproduced from the Global Tuberculosis Report 2024, World Health Organization (Ed), page 10. Copyright (© 2024). Data from 2023, published in 2024. World Health Organization. Available from: <https://www.who.int/publications/i/item/9789240101531>

### CONCLUSIONS

Despite maintaining one of the lowest tuberculosis (TB) incidence rates in the Americas, Cuba has experienced a concerning rise in pulmonary TB cases in recent months, attributable to worsening socioeconomic conditions. This trend underscores the urgent need to adapt public health strategies to the current epidemiological landscape.

The National Tuberculosis Control Program has historically been effective in TB management; however, programmatic updates are now essential to address emerging challenges. We recommend: strengthening surveillance systems to detect cases early, particularly in high-burden areas like Havana; allocating additional resources to mitigate the impact of socioeconomic barriers on TB transmission and treatment adherence; community-based interventions to reduce stigma and improve education on prevention.

These measures, aligned with Cuba's 2025 public health priorities, could curb the upward trend and

accelerate progress toward TB elimination.

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## ETHICS STATEMENT

The authors declare they have obtained permission to use all images included in this article.

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## CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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