DOI: 10.17058/reci.v15i3.19956

ORIGINAL ARTICLE

Epidemiological profile of tuberculosis in Uberaba, a priority municipality in Minas Gerais, 2013 to 2023

Perfil epidemiológico da tuberculose em Uberaba, município prioritário de Minas Gerais, 2013 a 2023

Perfil epidemiológico de la tuberculosis en Uberaba, municipio prioritario de Minas Gerais, 2013 a 2023

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Submetido: 09/10/2024
Aceite: 14/05/2025

ABSTRACT

Background and Objectives: Tuberculosis is an infectious disease and presents risk factors linked to social and behavioral issues, as well as comorbidities. This study aimed to evaluate tuberculosis cases reported in Uberaba/MG between 2013 and 2023. **Methods:** A cross-sectional study was conducted using data from the Notifiable Diseases Information System regarding the notified cases of tuberculosis in the city of Uberaba, over a 10-year period (2013-2023). **Results:** During the evaluation period, 931 cases of tuberculosis were notified in Uberaba, with an average incidence of 25.6 cases/100,00 inhabitants. The majority of the cases were recorded in men (74.2%), aged between 25 and 44 years (48.3%), with elementary or high school education (complete or incomplete) (61.6%). In terms of social factors, 9.8% of tuberculosis cases were associated with individuals deprived of liberty and 5.4% of the patients were homeless. Regarding comorbidities, 20.1% of the patients with tuberculosis were co-infected with HIV, 32.1% were alcoholics, 7.5% were diabetic and 27.5% used illicit drugs. Laboratory confirmation of the disease occurred in 60.9% of the cases. The most common form of tuberculosis diagnosed was pulmonary (77.1%); pleural tuberculosis was the most common extrapulmonary form of the disease (36.6%). The majority of cases were classified as new cases (81.8%) with the most common outcomes being cure (55.4%), loss to follow-up (14.9%), and death from tuberculosis (10.6%). **Conclusion:** The results highlight well-defined sociodemographic characteristics among tuberculosis patients, such as adult males with low education level, comorbidities, and engaging in risky behaviors.

Keywords: *Tuberculosis. Epidemiology. Health Vulnerability.*

RESUMO

Justificativa e Objetivos: A tuberculose é uma doença infecciosa e apresenta fatores de risco associados a questões sociais e comportamentais, bem como comorbidades. Este estudo teve como objetivo avaliar os casos de tuberculose notificados em Uberaba/MG, entre 2013 e 2023. **Métodos:** Foi realizado um estudo transversal utilizando dados do Sistema de Informação de Agravos de Notificação, sobre os casos de tuberculose notificados em Uberaba, ao longo de 10 anos (2013-2023). **Resultados:** Durante o período de avaliação, foram notificados 931 casos de tuberculose em Uberaba, com uma incidência média de 25,6 casos/100 mil habitantes. A maioria dos casos foi registrada em homens (74,2%), com idade entre 25 e 44 anos (48,3%), e com escolaridade de nível fundamental ou médio (completo ou incompleto) (61,6%). No aspecto social, 9,8% dos casos de tuberculose estavam associados a indivíduos privados de liberdade e 5,4% dos pacientes eram moradores de rua. Em relação às comorbidades, 20,1% dos pacientes com tuberculose eram co-infectados com HIV, 32,1% eram alcoólatras, 7,5% eram diabéticos e 27,5% faziam uso de drogas ilícitas. A confirmação laboratorial da doença ocorreu em 60,9% dos casos. A forma de tuberculose mais comum diagnosticada foi a pulmonar (77,1%), sendo a forma extrapulmonar mais frequente a pleural (36,6%). A maioria dos casos foi classificada como novos casos (81,8%), com os desfechos mais comuns sendo cura (55,4%), perda de seguimento (14,9%) e morte por tuberculose (10,6%). **Conclusão:** Os resultados ressaltam características sociodemográficas bem definidas entre os pacientes com tuberculose, como homens adultos com baixa escolaridade, comorbidades e comportamentos de risco.

Descritores: *Tuberculose. Epidemiologia. Vulnerabilidade em saúde.*

RESUMEN

Justificación y Objetivos: La tuberculosis es una enfermedad infecciosa que presenta factores de riesgo vinculados a cuestiones sociales y comportamentales, así como comorbilidades. Este estudio tuvo como objetivo evaluar los casos de tuberculosis notificados en Uberaba/MG, entre 2013 y 2023. **Métodos:** Se realizó un estudio transversal utilizando datos del Sistema Nacional de Información de Enfermedades de Notificación Obligatoria, sobre los casos de tuberculosis notificados en Uberaba, a lo largo de 10 años (2013-2023). **Resultados:** Durante el período de evaluación, se notificaron 931 casos de tuberculosis en Uberaba, con una incidencia promedio de 25,6 casos/100 mil habitantes. La mayoría de los casos fueron registrados en hombres (74,2%), con edad entre 25 y 44 años (48,3%), y con educación de nivel básico o medio (completa o incompleta) (61,6%). En el aspecto social, el 9,8% de los casos de tuberculosis estaban asociados a individuos privados de libertad y el 5,4% de los pacientes eran personas sin hogar. En cuanto a las comorbilidades, el 20,1% de los pacientes con tuberculosis estaban co-infectados con VIH, el 32,1% eran alcohólicos, el 7,5% eran diabéticos y el 27,5% usaban drogas ilícitas. La confirmación laboratorial de la enfermedad ocurrió en el 60,9% de los casos. La forma más común de tuberculosis diagnosticada fue la pulmonar (77,1%), siendo la forma extrapulmonar más frecuente la pleural (36,6%). La mayoría de los casos se clasificaron como nuevos casos (81,8%), siendo los resultados más comunes la cura (55,4%), pérdida de seguimiento (14,9%) y la muerte por tuberculosis (10,6%). **Conclusión:** Los resultados subrayan características sociodemográficas bien definidas entre los pacientes con tuberculosis, como hombres adultos con baja educación, comorbilidades y comportamientos de riesgo.

Palabras Clave: *Tuberculosis. Epidemiología. Vulnerabilidad en Salud*.

INTRODUCTION

Tuberculosis is an infectious disease caused by *Mycobacterium tuberculosis*. This infection presents risk factors linked to social and behavioral issues, as well as comorbidities, such as incarceration, smoking, alcoholism, illicit drug use, diabetes mellitus, hepatitis C, and Human Immunodeficiency Virus/Acquired Immunodeficiency Syndrome (HIV/AIDS).[1] Pulmonary tuberculosis is the most common form of the disease, although the microorganism can spread hematogenously, affecting the bones and/or meninges, spreading through the lymphatic pathways, or extending by contiguity, leading to the pleuropulmonary form.[2]

Although preventable and curable, tuberculosis is considered a global public health threat according to the World Health Organization. In 2023, tuberculosis returned to being the world's leading cause of death from a single infectious agent, accounting for almost twice as many deaths as HIV/AIDS.[3] According to the Epidemiological Bulletin of Tuberculosis in Brazil, 84,994 new cases of tuberculosis were reported in 2023, corresponding to an incidence of 40.1 cases per 100,000 inhabitants. In 2023, 6,025 deaths due to tuberculosis were notified in Brazil (2.8 deaths per 100,000 inhabitants).[4]

The city of Uberaba, located in the Triângulo Mineiro, state of Minas Gerais, has 337,836 people, ranking as the 7th largest population in the state and the 81st in the country.[5] In 2023, the city notified 114 cases of tuberculosis, representing an incidence of 33.7 cases per 100,000 inhabitants.[4] In 2024, Uberaba was designated a priority municipality in the Healthy Brazil Program, a government initiative aimed at combating 14 diseases and infections that disproportionately affect socially vulnerable populations, such as tuberculosis. The municipality is one of the 175 out of 5,571 Brazilian cities facing the highest burdens of diseases/infections, requiring special attention in the planning and implementation of public health policies aimed at addressing the needs of the groups most affected by social inequalities.[6]

This study aimed to evaluate the epidemiological profile of tuberculosis cases reported between 2013 and 2023, in Uberaba (MG).

METHODS

This is a cross-sectional, quantitative, descriptive, and retrospective study. Data on notified cases of tuberculosis in the city of Uberaba-MG, over 10 years (2013-2023), was collected from the Notifiable Diseases Information System (*Sistema de Informação de Agravos de Notificação*-SINAN), from the online platform DATASUS (Brazilian Health System Database) of the Ministry of Health.[7] Data was collected from January to June 2024. The search was made using "Tuberculosis Cases - Since 2001 (SINAN)"; the years 2013 to 2023 were selected in the "Available Periods" field, and the code "317010 Uberaba" was entered in the

"Notification Municipality" field. Based on the recorded number of cases of the disease, the annual incidence was calculated using the population of each respective year.

The variables analyzed were number of cases, sex, race, age, education level, if homeless/deprived of liberty or beneficiary of government cash transfer program, presence of comorbidities, alcoholism, use of illicit drugs, smoking, laboratory diagnoses and form of tuberculosis, type of entry, outcome of the disease, susceptibility test and directly observed treatment.

Population estimates for the city of Uberaba from 2013 to 2023 were obtained from data available on the Brazilian Institute of Geography and Statistics (IBGE) website. Incidence rates were calculated using the formula: number of new tuberculosis cases in Uberaba in a given year/total population residing in the city in the same year x 100,000.

Regarding the inclusion criteria, all reported cases with confirmed diagnosis of tuberculosis in Uberaba, from 2013 to 2023, and notified in DATASUS were included, regardless of the degree of data completeness. Exclusion criteria were not applied.

This research was conducted in accordance with the principles outlined in Resolutions 466/2012 and 510/2016, which govern ethics in scientific studies involving humans directly or indirectly. As the present research has used secondary data obtained from publicly available platforms, approval by the Ethics and Research Committee was not required. The data was tabulated and subjected to statistical analysis using GraphPad Prism 5.0 software. When the variable consisted of two groups, pairwise inferences were made using the nonparametric Mann-Whitney test. Nonparametric Kruskal-Wallis test, followed by Dunn's post-test, was used for three or more independent group comparisons. A statistical significance level of $p<0.05$ was established.

RESULTS

A total of 931 cases of tuberculosis were reported in the city of Uberaba, between 2013 and 2023, with the lowest number of notifications occurring in 2016 (n = 67) and the highest in 2023 (n = 114). The annual mean number of cases for the period was 85 cases (standard deviation of 14.9), resulting in an average tuberculosis incidence of 25.6 cases per 100,000 inhabitants, with rates ranging from 20 to 33.7 cases per 100,000 inhabitants (Figure 1).

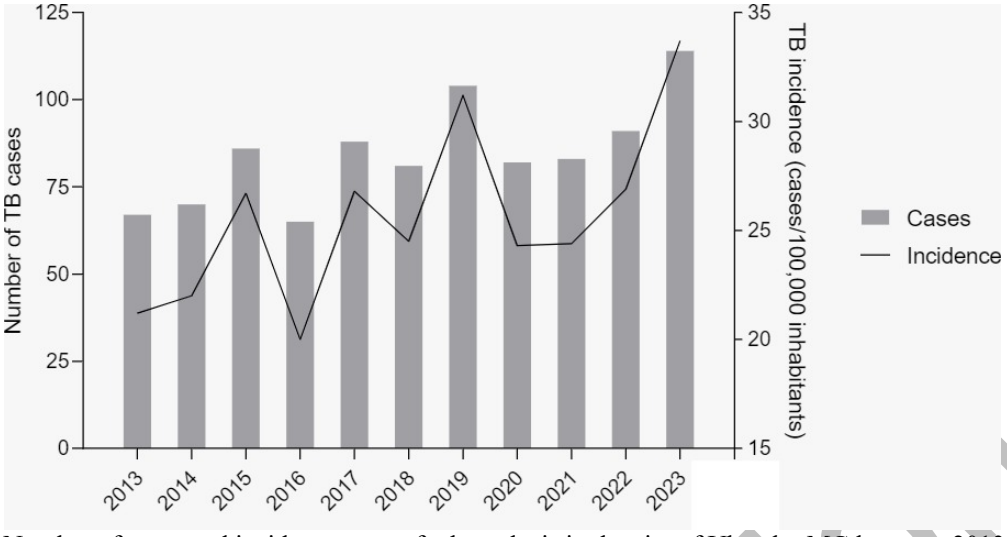

Figure 1. Number of cases and incidence rates of tuberculosis in the city of Uberaba-MG between 2013 and 2023.

There was a higher occurrence of tuberculosis cases among men ($p < 0.01$), with a male-to-female ratio of approximately 3:1. The majority of patients fell within the 25 - 44 age range (48.3%) and had complete or incomplete elementary or high school education (61.6%). Individuals of white (39.3%), black (16.9%), or mixed race (30.7%) were the most affected by the disease, although the proportion of tuberculosis cases showed a significant increase (approximately 10 times) among individuals who self-identified as black and mixed race in the city of Uberaba during the evaluated period. This proportion rose from 5.97% (n = 4) in 2013 to 55.3% (n = 63) in 2023. Only 9.8% of tuberculosis cases occurred in incarcerated individuals, 5.4% of patients were homeless, and 3.5% were beneficiaries of government cash transfer programs (Table 1).

Table 1. Profile of patients diagnosed with tuberculosis in the city of Uberaba-MG between 2013 and 2023.

Variable	**N (%)**	**p**
Sex		<0.01
Male	691 (74.2)	
Female	240 (25.8)	
Race		<0.01
White	366[a] (39.3)	
Black	157[a] (16.9)	
Mixed	286[a] (30.7)	
Yellow (Asian)	9[b] (1.0)	
Indigenous	2[b] (0.2)	
Ignored/blank	111[a] (11.9)	
Age range (years old)		<0.01
0 to 14	29[a] (3.1)	
15 to 24	110[a,c] (11.8)	

25 to 34	239[b] (25.7)	
35 to 44	210[b] (22.6)	
45 to 54	148[b,c] (15.9)	
55 to 64	100[a,c] (10.7)	
65 or more	95[a,c] (10.2)	
Education		<0.01
Illiterate	11[a] (1.2)	
Incomplete elementary education	289[b] (31.0)	
Complete elementary education	101[b] (10.8)	
Incomplete high school	64[a,b] (6.9)	
Complete high school	120[b] (12.9)	
Incomplete higher education	19[a] (2.0)	
Complete higher education	28[a] (3.0)	
Not applicable	25[a] (2.7)	
Ignored/blank	274[b] (29.4)	
Homeless population*		<0.01
Yes	50[a] (5.4)	
No	809[b] (86.9)	
Ignored/blank	72[a] (7.7)	
Population deprived of liberty*		<0.01
Yes	91[a] (9.8)	
No	766[b] (82.3)	
Ignored/blank	74[a] (7.9)	
Beneficiary of a government cash transfer program*		<0.01
Yes	33[b] (3.5)	
No	610[a] (65.5)	
Ignored/blank	288[a] (30.9)	

Different letters indicate different data, considering a statistical significance level of $p < 0.05$.
*These variables were included in the notification forms in 2014.

Regarding the presence of comorbidities, 20.1% of patients diagnosed with tuberculosis during the evaluated period were HIV positive, 32.1% suffered from alcoholism, 7.5% were diabetic, and 27.5% were using some illicit drug. The frequency of tuberculosis was similar between tobacco smokers and non-smokers (Table 2).

Table 2. Comorbidities in tuberculosis cases reported in the city of Uberaba-MG between 2013 and 2023.

Comorbidity	N (%)	p
HIV		<0.01
Positive	187[a] (20.1)	
Negative	568[b] (61.0)	
Test in progress	1[c] (0.1)	
Not performed	175[a] (18.8)	
Alcoholism		<0.01
Yes	299[a] (32.1)	
No	580[b] (62.3)	

Ignored/Blank	52[c] (5.6)	
Diabetes		<0.01
Yes	70[a] (7.5)	
No	825[b] (88.6)	
Ignored/Blank	36[a] (3.9)	
Illicit drugs		<0.01
Yes	256[a] (27.5)	
No	541[b] (58.1)	
Ignored/Blank	134[a] (14.4)	
Tobacco smoking		<0.01
Yes	368[a,b] (39.5)	
No	434[a] (46.6)	
Ignored/Blank	129[b] (13.9)	

Different letters indicate different data, considering a statistical significance level of $p < 0.05$.

The diagnosis of tuberculosis was confirmed by laboratory tests in 60.9% of the cases, with positive results provided by the sputum smear microscopy of the 1st sample (31.7%) and by sputum culture (40.4%). In most cases (87.1%; $p < 0.01$), the sputum smear microscopy of the 2nd sample was left blank/ignored, and it is no longer being recorded in Uberaba since 2015 (table 3). In the rapid molecular test, susceptibility to rifampicin was detected in 44.4% of the tests performed, while resistance to that antimicrobial agent has been detected in 12.9% of the tests performed. The form of tuberculosis predominantly diagnosed was pulmonary (77.1%, $p < 0.01$), while the extrapulmonary form included mainly pleural tuberculosis (36.6%), followed by peripheral lymph node (14.6%) and miliary (15.0%) tuberculosis ($p < 0.01$) (Table 3).

Table 3. Laboratory diagnosis and form of tuberculosis in cases reported in the city of Uberaba-MG between 2013 and 2023.

Variable	N (%)	p
Laboratory confirmation		0.03
Yes	567 (60.9)	
No	364 (39.1)	
1st sputum smear microscopy		<0.01
Positive	295[a] (31.7)	
Negative	196[b] (21.1)	
Not performed	387[a] (41.6)	
Not applicable	53[b] (5.7)	
2nd sputum smear microscopy		<0.01
Positive	40[a] (4.3)	
Negative	20[a] (2.1)	
Not performed	60[a] (6.4)	
Ignored/Blank	811[b] (87.1)	
Sputum culture		<0.01
Positive	376[a] (40.4)	

Negative	162[b] (17.4)	
Not performed	385[a] (41.4)	
In progress	8[b] (0.9)	
Form of tuberculosis		<0.01
Pulmonary	718[a] (77.1)	
Extrapulmonary	181[b] (19.4)	
Pulmonary + Extrapulmonary	32[c] (3.4)	
Type of Extrapulmonary		<0.01
Pleural	78[a] (36.6)	
Peripheral ganglionic	31[a,d] (14.6)	
Miliary	32[a] (15.0)	
Meningoencephalitis	15[b,d] (7.0)	
Genitourinary	7[c] (3.3)	
Bone	7[c] (3.3)	
Ocular	2[c] (0.9)	
Cutaneous	5[c] (2.3)	
Others	36[a] (16.9)	
Rapid molecular test		0.04
Susceptible to Rifampicin	413[a] (44.4)	
Resistant to Rifampicin	12[b] (12.9)	
Undetectable	97[a] (22.5)	
Inconclusive	17[b] (18.3)	
Not performed	315[a] (33.8)	
Ignored/Blank	77[b] (8.3)	

Legend: different letters indicate different data, considering a statistical significance level of $p < 0.05$.

The majority of notified cases were new cases (81.8%, $p < 0.01$), followed by re-entry after loss to follow-up (9.7%) and recurrence (5.3%). Most notified cases progressed to cure (55.4%, $p < 0.01$), although 14.9% of patients were lost to follow-up. The number of tuberculosis deaths recorded during the evaluated period was 99 (10.6% of the patients) (Table 4).

Approximately 29% of the *M. tuberculosis* strains were susceptible to the drugs used in tuberculosis treatment. However antimicrobial susceptibility analysis was not performed in a high number of cases (28.8%) or it was ignored (37.5%). Directly observed treatment (DOT)[8] was conducted in 52.6% of patients (Table 4). DOT refers to the ingestion of medications by the patient in the presence of a healthcare professional.[8]

Table 4. Type of entry, outcome, susceptibility test and directly observed treatment in tuberculosis cases reported in the city of Uberaba-MG between 2013 and 2023.

Variable	N (%)	p
Entry type		<0.01
New case	762[a] (81.8)	

Recurrence	49[b] (5.3)	
Reentry after abandonment	90[b] (9.7)	
Transfer	21[b,c] (2.3)	
Post-death	9[c] (1.0)	
Outcome		<0.01
Cure	516[a] (55.4)	
Abandonment	139[a,b] (14.9)	
Death from tuberculosis	99[a,b] (10.6)	
Death from other causes	40[b] (4.3)	
Transfer	55[b] (5.9)	
Drug resistant tuberculosis	14[c] (1.5)	
Regimen change	7[c] (0.8)	
Primary abandonment	11[c] (1.2)	
Ignored/Blank	50[c] (5.4)	
Directly observed treatment		<0.01
Yes	490[a] (52.6)	
No	345[a] (37.1)	
Ignored/Blank	96[b] (10.3)	
Susceptibility Test		<0.01
Susceptible	268[a] (28.8)	
1st line drug resistant	5[b] (0.5)	
Isoniazid resistant	5[b] (0.5)	
Rifampicin resistant	1[b] (0.1)	
Resistant to Isoniazid and Rifampicin	4[b] (0.4)	
Test in progress	31[b] (3.3)	
Not performed	268[a] (28.8)	
Ignored/Blank	349[a] (37.5)	

Different letters indicate different data, considering a statistical significance level of $p < 0.05$.

DISCUSSION

During the decade 2013 - 2023, Uberaba had an average annual tuberculosis incidence of 25.6 cases per 100,000 inhabitants, a value that was below the national average (36.4) and above the state average (20.6) for the same period.[7] This discrepancy can be explained by the different sociodemographic and health characteristics of the Brazilian regions.[9]

A discontinuous growth in the incidence of tuberculosis was observed during the period evaluated in this study. From 2013 to 2019 the incidence increased from 21.2 to 31.2 cases per 100,000 inhabitants. A decline was observed in 2020 (24.3), followed by a resurgence of cases in the years 2021 to 2023. The reduction in 2020 can be attributed to the Covid-19 pandemic, a phenomenon also highlighted in another study[10], while the larger number of new diagnoses in 2021-2023 likely included a backlog of people who developed TB in previous years, but whose diagnosis and treatment was delayed by Covid-related disruptions.

Geographical differences in tuberculosis also extend to individual variables. The higher incidence of the disease among male patients (74.2%) was also reported in the studies which evaluated the profile of tuberculosis patients in Brazilian municipalities and identified the predominance of men in 69.0%.[11] The reasons explaining why men are more affected by the disease include lack of self-care, low priority of health campaigns targeting this audience, and greater involvement of men in the job market, exposing them more to the disease.

During the evaluated period, there was no predominance of tuberculosis in any specific race in the city of Uberaba, which was also noted when analyzing tuberculosis notification data in the state of Mato Grosso do Sul from 2001 to 2009.[12] However, it is noteworthy that the number of disease records with race left blank or ignored in Uberaba decreased from 74.6% in 2013 to 0.9% of records in 2023, indicating improved completion of notification forms. In this sense, an increasing proportion of tuberculosis cases among individuals who self-identified as black or mixed race was observed (5.97% of tuberculosis cases in 2013 and 55.3% in 2023). A higher incidence of tuberculosis among black and mixed-race individuals was reported in the city of Belém-PA.[13] The racial discrepancies observed in these studies may be linked to regional differences in the population composition of the country.

The low level of education identified among tuberculosis patients in Uberaba (elementary or high school education in 61.6% of cases) resembles the education profile of tuberculosis patients in Belo Horizonte, the capital of Minas Gerais, from 2001 to 2017, which was 12 years of schooling.[14] In general, black or mixed-race populations and those with lower levels of education are more susceptible to poorer housing conditions, lack of basic sanitation, and limited access to health services. These factors can facilitate disease transmission and hinder diagnosis and treatment.[15]

The vulnerability of patients to acquiring tuberculosis is also correlated with socioeconomic status. In this study, 5.4% of the patients diagnosed with tuberculosis were homeless and 9.8% were incarcerated. Research using SINAN data on tuberculosis in the city of Belo Horizonte described the profile of homelessness in 0.8% of cases and incarceration in 1.6% of notifications.[14] Furthermore, each group has peculiar factors that favor *M. tuberculosis* infection: in the incarcerated population, the existence of a plurality of incarcerated individuals, as well as their respective health problems, the situation of confinement, and overcrowded cells; in the homeless population, the lack of access to food, rest, and health services.[16]

Government cash transfer programs can benefit tuberculosis patients by providing financial resources that could enable treatment continuity. However, nearly two-thirds of the cases analyzed in our study lacked the information regarding receiving the benefit. The

incompleteness of this data in health systems compromises the analysis of the impact of cash transfer programs on the number of confirmed cases, and on tuberculosis treatment success. However, other studies have identified that most tuberculosis notifications involve patients who are not beneficiaries of government programs.[17,18]

The coinfection *M. tuberculosis* and HIV was present in one-fifth of the patients, however, it should be noted that this number may be underreported, as 18.8% of patients were not tested for HIV. Similarly, 21.5% of the patients diagnosed with tuberculosis in Ribeirão Preto-SP were co-infected with HIV.[19] These findings reinforce that immunosuppression caused by the virus may facilitate the multiplication of *M. tuberculosis* and the onset of the disease.[20] A HIV-positive patient is 18 times more susceptible to tuberculosis than non-infected individuals, also demonstrating that these diseases have similar epidemiological profiles, such as male patients, young age, alcohol use, smoking, and illicit drug use.[21]

Alcohol use and tobacco smoking were reported by 32.1% and 39.5%, respectively, of tuberculosis patients in Uberaba, while the prevalence for the general population is 18.4% for alcoholism, and 17.3% for smoking.[22] These percentages demonstrate that the occurrence of alcoholism and smoking is 1.7 and 2.3 times higher, respectively, among tuberculosis patients in the city of Uberaba when compared to the Brazilian population.

The diagnosis is identified as one of the bottlenecks in the fight against tuberculosis in Uberaba, where laboratory tests were not performed in 39.1% of the cases. The most neglected test in the city of Uberaba was sputum microscopy of the second sample, accounting for 93.5% of patients, when considering both non-performed (6.4%) and blank/ignored completion (87.1%). The municipality of Uberaba ceased to register this examination since 2015, a conduct incompatible with the recommendations of the Brazilian Ministry of Health, which determines that sputum microscopy should be performed in two samples: the first sample at the initial consultation and the second sample on the morning of the following day.[23] Failure to perform this laboratory test may have important implications for the treatment and outcome of the disease.

Another test with low performance was the antimicrobial susceptibility test of the bacterium, which was not performed (28.8%) or had blank/ignored completion (37.5%) in most reported cases. The low testing aligns with other results indicating that only 15 to 20% of the tuberculosis cases undergo evaluation of *M. tuberculosis* susceptibility profile to treatment drugs.[24] The deficiency in performing this test hampers the detection of strains resistant to rifampicin and isoniazid, which complicates the treatment of patients. This highlights the need for training the healthcare team on the importance of requesting and offering the test.[25]

Implemented nationally in 2014, the rapid molecular test for tuberculosis was introduced in the same year in the city of Uberaba. During the study period, the detection of rifampicin susceptibility profile among *M. tuberculosis* strains was useful for guiding treatment. However, the high rate of undetectable or inconclusive results (40.8%) can be considered a limitation for tuberculosis diagnosis in Uberaba. The main challenge in the widespread use of the rapid molecular test is the requirement for training healthcare professionals to ensure the quality of samples collected and the proper processing of sputum, aiming to assure an accurate and reliable diagnosis from the test.[26]

The pulmonary form of tuberculosis was the most prevalent (77.1%) in this study, while the extrapulmonary form (19.4%) predominantly affected sites such as the pleura, peripheral lymph nodes, and others, causing the disseminated form (miliary). These findings could be explained by the preference of *M. tuberculosis* for these areas of the body due to increased oxygen concentrations.[27]

The entry of patients into the health system predominated as a new case (81.8%). However, it is noteworthy the number of patients who re-entered the system after treatment abandonment (9.7%) and recurrence (5.3%), demonstrating that patients returned to the health system after dropping out of treatment or experiencing a recurrence of the disease, which also reinforces the importance of requesting a drug susceptibility test in order to offer a more appropriate treatment for the patient.

Regarding the outcome, although most cases resulted in cure (55.4%), the proportions of abandonment (14.9%) and death from tuberculosis (10.6%) reveal that there is still much work to be done to maintain treatment adherence and effectiveness. The numbers presented here are in line with the study which analyzed tuberculosis notifications in the state of São Paulo and identified 53% of cure, 11% of death, and 8% of abandonment.[11] However, these numbers are below the targets indicated by the WHO, which recommends a minimum cure rate of 85% for tuberculosis patients, and a maximum of 5% of patients with loss to treatment follow-up.[3]

As an approach to ensure that medication is taken correctly, increasing the cure rate and reducing abandonment in tuberculosis treatment, the ingestion of medications by the patient in the presence of a healthcare professional, referred to as DOT, is a good strategy. It is done daily in the intensive phase and at least three times weekly in the maintenance phase of treatment.[8] In Uberaba, DOT reached 52.6%, significantly lower than the 63.5% reported in municipalities with 301 to 400 thousand inhabitants in the state of São Paulo.[28]

Some limitations must be considered when interpreting the results of this study, which utilized tuberculosis data from DATASUS. First, the data is subject to potential inaccuracies

due to underreporting, misclassification, or delayed reporting, as well as the use of preliminary data for the year 2023 and the alterations in the notification forms in 2014, which may lead to biases in the estimation of tuberculosis incidence and outcomes. Another limitation is the observational nature of the study design precludes causal inferences, as the use of secondary data from DATASUS does not allow control over confounding factors or biases related to the data collection process. Thus, while the study provides valuable insights into tuberculosis trends, the findings should be interpreted with caution.

This study outlines the epidemiological, clinical, diagnostic, and evolutionary profile of tuberculosis in the city of Uberaba over a period of 10 years. Although nationwide data is available in SINAN, regional differences require a closer examination of the unique reality of a municipality to identify the variables that contribute to the success or insufficiency of health policies in managing the disease. The identification of the tuberculosis epidemiological profile, which affects more males, adults with a low education profile, and the presence of comorbidities such as AIDS, as well as risk behaviors including alcohol use, tobacco smoking, and illicit drug use serve to direct and prioritize health actions for these groups in the city of Uberaba. The low quantity of tuberculosis laboratory confirmations and directly observed treatment are points that need to be discussed and reorganized by the healthcare system in order to improve treatment adherence and increase the chances of tuberculosis cure. The multifactorial nature of tuberculosis requires a multidisciplinary health approach, aiming to integrate the patient into the healthcare system and establish bonds to ensure that the therapeutic journey, from entry to outcome, is as short and successful as possible.

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AUTHOR'S CONTRIBUTIONS

Apollo Nobre Reis contributed to the database search, writing of the abstract, introduction, methodology, discussion, interpretation and description of results, preparation of tables, conclusions and review. **Mírian Akiko Kawamura** contributed to writing the abstract, introduction, methodology, discussion, interpretation and description of results, conclusions and review. **Yasmin Neves Vieira Sabino** contributed to writing the abstract, interpretation of results, conclusions and review. **Aline Dias Paiva** contributed to writing the abstract, interpretation and description of results, preparation of tables, conclusions, review and statistics.

All authors approved the final version to be published and are responsible for all aspects of the work, including ensuring its accuracy and integrity.