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EPIDEMIOLOGICAL PROFILE OF TUBERCULOSIS NOTIFICATIONS IN THE STATE OF PARANÁ

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ABSTRACT

Objective: To characterize the epidemiological profile of tuberculosis notifications in the state of Paraná. Method: This was a cross-sectional descriptive study that analyzed public domain data collected from the Notifiable Diseases Information System (SINAN) of DataSUS, considering the period between 2013 and 2023. The variables analyzed include gender, age group, homeless population, health macro-region, institutionalized (prison), pre-existing conditions such as smoking and HIV. The data were organized and analyzed in the Microsoft Excel software, with simple descriptive analysis, using absolute and relative frequency. Results: The age group between 20 and 29 (23%) and 30 and 39 (22%) was predominant in the number of confirmed cases. The number of positive sputum culture cases for males (6,136) was three times higher than for females (2,074). The eastern region of the state stood out with the highest percentage of cases in the state. Conclusion: In the present study, there was a predominance of confirmed cases of tuberculosis in males aged between 20 and 29 years with positive sputum cultures for the disease, living in the eastern region of the state, and smokers who had abandoned tuberculosis treatment.

Keywords: Epidemiology. Notification. Tuberculosis. HIV. Smoking.

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INTRODUCTION

On March 24, 1882, German scientist Robert Koch discovered the existence of the bacillus Mycobacterium tuberculosis, which causes the disease Tuberculosis (TB), becoming a significant milestone in the history of medicine, as it paved the way for more effective diagnosis, treatment, and prevention of this disease that plagued humanity (Paho, 2022).

According to the latest epidemiological bulletin of the Ministry of Health (MoH), published in March 2024, it is estimated that in 2022, about approximately 10.6 million people developed active tuberculosis worldwide, resulting in 1.3 million deaths, according to the World Health Organization (WHO). Given this scenario, urgent measures are needed for Brazil to achieve the goal of eliminating tuberculosis as a public health problem by 2030, in line with the recommendations of the United Nations (UN) and anticipating the WHO goal, scheduled for 2035 (Brasil, 2019).

In Brazil, 80,012 new cases of tuberculosis were registered in 2023, corresponding to an incidence of 37.0 cases per 100 thousand inhabitants. After two consecutive years of increase, with 34.3 cases per 100 thousand inhabitants in 2021 and 38 cases per 100 thousand inhabitants in 2022, the risk of developing the active disease decreased in 2023, with 2022 with an index of 81,604, and 2023 with 80,012 new cases. It is important to note that the data for 2023 are still preliminary. However, unlike the increase observed in the previous year's bulletin, the 2023 figures indicate a reduction, suggesting a possible reversal of the trend or, at least, a mitigation, with a slowdown in the increase or stabilization, reflecting a post-covid-19 pandemic recovery movement in the country (Brasil, 2019).

TB is an infectious disease triggered by the bacterium also known as Koch's bacillus. Although it often reaches the lungs, it can spread to other organs and tissues in the body, such as the kidneys, bones, central nervous system, and lymph nodes, and is a serious challenge for public health (Fiocruz, 2022).

Transmission of tuberculosis occurs mainly when infected individuals cough, sneeze, or speak, releasing aerosols containing the disease's bacilli into the air. These aerosols are small droplets that can remain suspended in the air for a long period, being inhaled by other people and resulting in infection. However, TB bacilli deposited on objects such as clothing, sheets, and glasses do not play a significant role in transmission, as they are not easily dispersed into the air as aerosols (Brazil, 2024).

The most frequent signs of TB include a persistent cough that lasts more than four weeks, with or without expectoration, especially if it is accompanied by other signs such as

fatigue, mild fever at the end of the day, night sweats, inappetence, pallor, weight loss, and asthenia (Fiocruz, 2022).

Laboratory tests, such as sputum smear microscopy, are a crucial diagnostic tool, allowing direct detection of the bacillus responsible for the disease. In addition, chest X-ray is commonly used to identify typical patterns of lung infection, such as infiltrates and cavitations, which indicate the possibility of TB (Fiocruz, 2022).

Early treatment of TB plays a key role in reducing transmission of the disease. Starting treatment gradually decreases the bacterial load in the patient, reducing the amount of active bacilli in respiratory secretions and, consequently, the risk of transmission to other people. Measures such as covering the mouth when coughing or sneezing and maintaining well-ventilated and illuminated environments are important even during treatment, contributing to further reduce the risk of transmission while the patient recovers (Brasil, 2024).

According to the Ministry of Health, the systematic notification of tuberculosis cases by the Notifiable Diseases Information System (SINAN) enables continuous monitoring of the disease. The up-to-date and detailed information provided by the system is critical to identifying outbreaks and implementing control measures. This process is essential to map the distribution of the disease and assess its magnitude in different regions (Sinan, 2022.)

The analysis of epidemiological data from TB notifications is essential to develop more efficient prevention and control strategies, identify groups of greater vulnerability, and evaluate the effectiveness of the interventions adopted. In view of this scenario, it is essential to know which patients are affected by this pathology, aiming at centralized treatment.

The Family Health Strategy (FHS) focuses on humanized and continuous care, based on the needs expressed by the individual, taking into account their sociocultural and psychosocial conditions, aiming at health promotion and disease prevention. In the context of tuberculosis (TB), the relationship of trust between the health professional and the user favors autonomy, making the patient a protagonist in coping with their fears, misgivings and stigmas in relation to the disease and treatment. In addition, nursing care practices include the organization of services, the identification of suspected cases, home visits, and the management of the referral and counter-referral flow, always in articulation with the specialized care network. Talking about care practices, therefore, involves both individual attention and family and community care, from a technical and relational perspective (Acosta, 2023).

In this sense, the following research question arose: "What is the epidemiological profile of tuberculosis notifications in the state of Paraná?". Based on this question, the present study aims to characterize the epidemiological profile of tuberculosis notifications in the state of Paraná.

METHODOLOGY

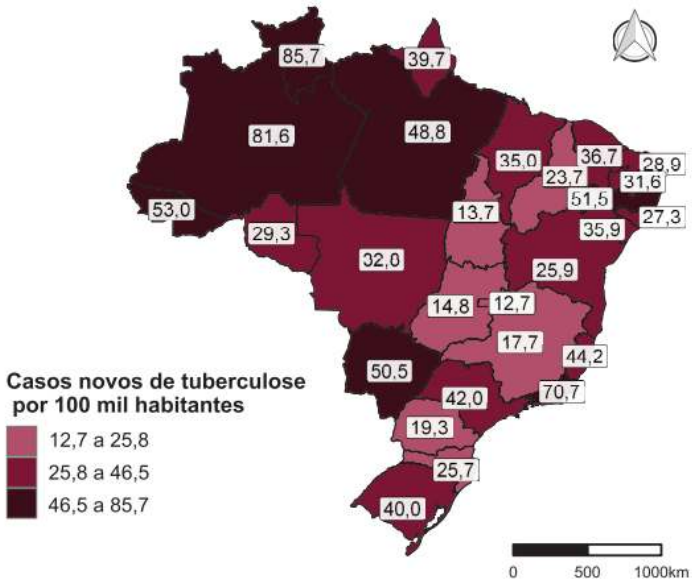
TYPE OF STUDY

This is a cross-sectional descriptive observational epidemiological study that analyzed public domain data collected from compulsory TB notifications through the Diseases and Notifications Information System (SINAN), the Department of Information and Informatics of the Unified Health System (DATASUS) and the Ministry of Health (MS).

Cross-sectional studies are developed to understand and describe aspects of public health, providing essential information to guide health actions and policies for the prevention and control of diseases, such as tuberculosis. The study involves important steps and concepts, such as using numerical data to identify patterns, test theories, and make predictions. Quantitative analysis allows an objective evaluation of the data collected. Being cross-sectional, the study collected data from a sample in a time interval, proposing the description of characteristics of a given population (Previva, 2023).

SAMPLE AND STUDY LOCATION

The study sample consisted of people aged 10 years or older with TB notification in SINAN, living in macro-regional regions throughout Brazil.



Source: Notifiable Diseases Information System/State Health Secretariats/Ministry of Health; Brazilian Institute of Geography and Statistics. Data extracted and qualified in February/2024. Preliminary data, subject to change.

As an exclusion criterion, reports with inconclusive results for TB were not included in the study.

DATA COLLECTION

The collection took place through TabNet, a tabulation tool that allows you to generate spreadsheets and organize data quickly through the database of the Unified Health System (SUS), DATASUS. The collection period took place between July 1 and 31 of 2024, with a time frame of 10 years, in the period between 2013 and 2023.

STUDY VARIABLES

The variables selected for the study are: total confirmed cases, sex (male and female), age group (10 to 14 years, 15 to 19 years, 20 to 29 years, 30 to 39 years, 40 to 49 years, 50 to 59 years, 60 to 69 years, 70 to 79 years and 80 years, equal to or above), year of notification (2013 to 2023), macro-regional health (north, northwest, east, and west), homeless population, type of entry (readmission after dropout), sputum culture (positive and negative), smoking (yes and no), illicit drugs (yes and no), HIV (positive and negative), and closed situation (cure, treatment abandonment, and death from tuberculosis), and institutionalized (prison population).

DATA ANALYSIS

The collected data were transferred and stored in a spreadsheet developed by the researchers in Microsoft Excel software and were analyzed using simple descriptive statistics with absolute and relative frequency.

ETHICAL ASPECTS

As this was a study with a secondary database in the public domain without individual identification, it was exempted from analysis by the Human Research Ethics Committee, in accordance with Resolution No. 510/2016.

RESULTS

The first table deals with the distribution of confirmed cases of tuberculosis by age group over eleven years, between 2013 and 2023. The importance of this division lies in the fact that the incidence of the disease varies significantly according to the age of the patients. It was noted, for example, that the younger age groups, such as 10 to 14 years and 15 to 19 years, had relatively low numbers of cases, with 214 and 1,236, respectively,

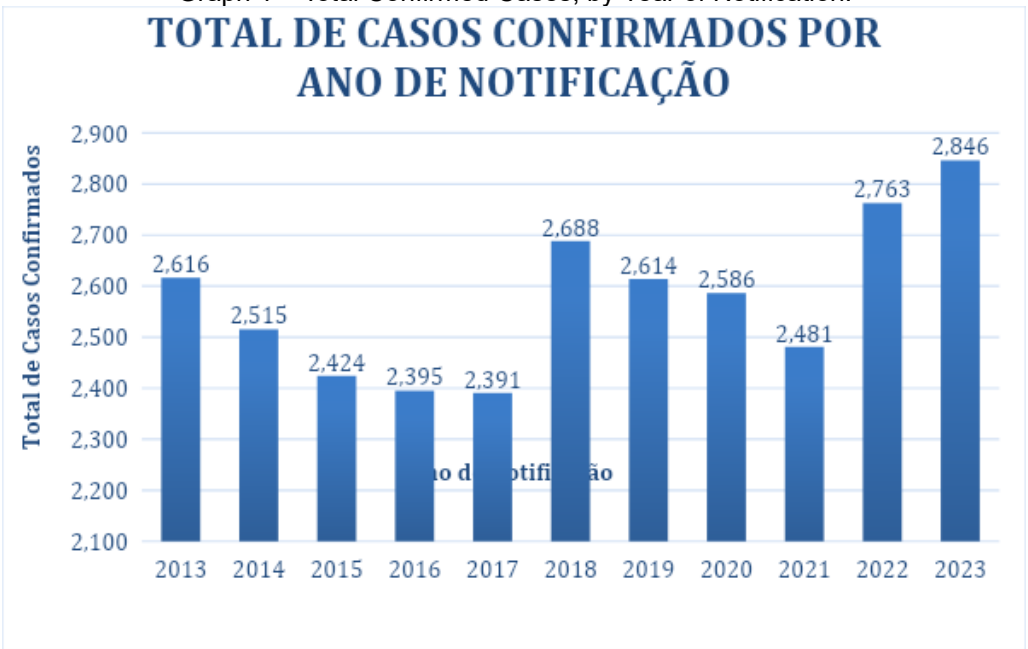
in the total of years analyzed. On the other hand, the most affected age group was 20 to 29 years old, with a cumulative total of 6,378 cases. In the more advanced age groups, from 60 years of age onwards, a moderate increase in the number of cases was observed, but not comparable to the intermediate age groups (30 to 49 years), which maintain a high incidence of tuberculosis cases. Over the years, it can be seen that the number of confirmed cases has remained stable, with a peak in 2018 (2,688 cases) and a slight increase in 2023 (2,846 cases). (Table 1).

Table 1 – Confirmed cases by year of notification according to age group.

CONFIRMED CASES BY YEAR OF NOTIFICATION												
Age group	Year											Total (%)
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
10 to 14 years old	24	23	17	16	15	20	21	21	19	16	22	214 (1%)
15 to 19 years old	133	127	114	122	120	114	131	90	85	95	105	1.236 (4%)
20 to 29 years old	563	526	545	537	546	629	623	654	572	588	595	6.378 (23%)
30 to 39 years old	561	560	547	536	549	574	509	519	533	600	619	6.107 (22%)
40 to 49 years old	541	543	459	444	472	508	521	493	470	560	565	5.576 (20%)
50 to 59 years old	426	388	378	396	349	426	398	411	388	448	439	4.447 (16%)
60 to 69 years old	221	208	235	205	208	245	260	226	255	295	323	2.681 (9%)
70 to 79 years old	100	100	98	101	98	128	114	128	116	120	132	1.235 (4%)
over 80 years old	47	40	31	38	34	44	37	44	43	41	46	445 (2%)

Source: Prepared by the authors.

Graph 1 – Total Confirmed Cases, by Year of Notification.



Source: Prepared by the authors.

Among men, positive results for tuberculosis have grown significantly over the years, reaching a total of 6,136 positive cases between 2013 and 2023.No the case of women, the numbers are lower compared to men, but no less significant. There were a total of 2,074 positive cases over the same period.

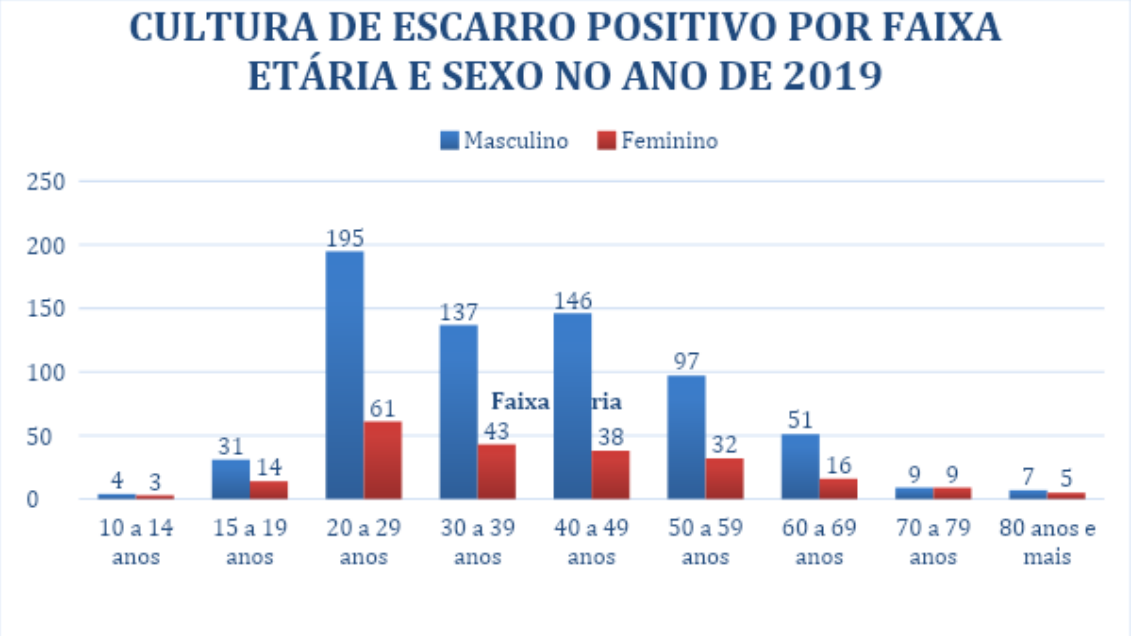
In addition, the results of both sexes from positive cultures reached 8,210 cases, a clear indication of the persistence of the disease in the population over the years.

Table 2 – Confirmed cases of sputum culture, according to year of notification.

ESCARRO CULTURE												
	Anus											**Total (%)**
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
	Male											
Positive	3320	4458	5503	5537	5571	6618	6677	5593	5574	6643	6642	66.136 (63%)
Negative	2282	3308	3349	3332	3334	3391	3320	3339	3313	3383	2235	33.586 (37%)
	Female											
Positive	1137	1160	1175	1170	2200	2224	2221	1183	1181	2229	1194	22.074 (59%)
Negative	1124	1154	1143	1150	1135	1154	1137	1130	1110	1138	887	11.462 (41%)

Source: Prepared by the authors.

Graph 2 – Positive Sputum Culture, by Age Group and Sex in 2019.



Source: The authors.

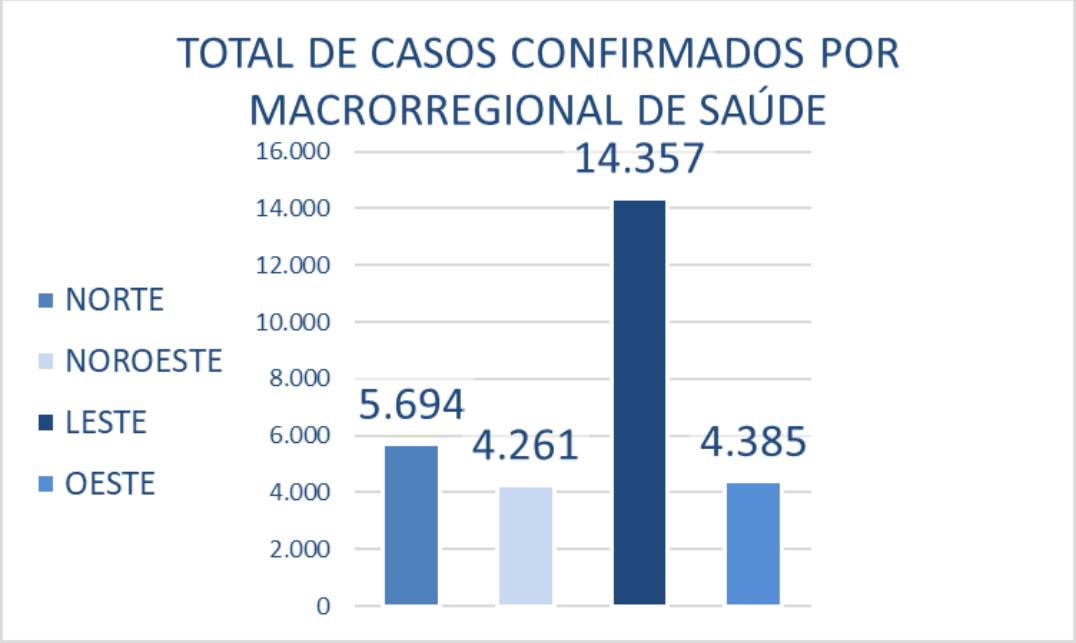
Table 3 shows that the confirmed cases are organized by health macro-regions of the state, which provides a regionalized view of the incidence of tuberculosis. The Eastern macro-region, over the years analyzed, consistently had the highest number of cases, with a total of 14,357. On the other hand, the North, Northwest and West macro-regions also have considerable numbers of cases, although on a smaller scale.

Table 3 – Confirmed Cases by year of notification according to macro-regional health of residence.

CONFIRMED CASES BY YEAR OF NOTIFICATION, ACCORDING TO MACRO-REGIONAL HEALTH OF RESIDENCE												
Macrorregional	**Anus**											**Total (%)**
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
North	465	438	430	492	470	548	540	499	531	579	702	5.694 (20%)
Northwest	386	361	328	358	394	422	390	424	367	401	430	4.261 (15%)
East	1.342	1.293	1.321	1.248	1.185	1.323	1.293	1.297	1.213	1.431	1.411	14.357 (50%)
West	366	453	403	347	343	443	437	370	360	432	431	4.385 (15%)
Ignorado - PR	-	-	1	-	-	-	-	-	-	-	-	1 (0%)

Source: Prepared by the authors.

Graph 3 – Total Confirmed Cases by Health Macro-region.



Source: Prepared by the authors.

With regard to the use of illicit drugs, there has been a substantial increase in confirmed cases of tuberculosis among men. The number of cases went from 24 in 2013 to 544 in 2023, totaling 3,898 cases over the eleven years analyzed. Among women, the scenario also shows an upward trend, although the numbers are lower, with 650 cases accumulated in the period, from 9 in 2013 to 101 in 2023.

The population with HIV is another important factor addressed in the table. Among males with HIV, it resulted in 2,457 cases over the period analyzed. Although a linear increase in the number of cases has not been observed over the years, there was an increase in 2023, when 294 confirmed cases were recorded. Among women, the total number of cases was 915, with peaks in 2015 (115 cases) and 2023 (116 cases).

The analysis of the prison population shows the prevalence of tuberculosis in highly vulnerable environments, such as prisons. Among men, 346 cases were registered between

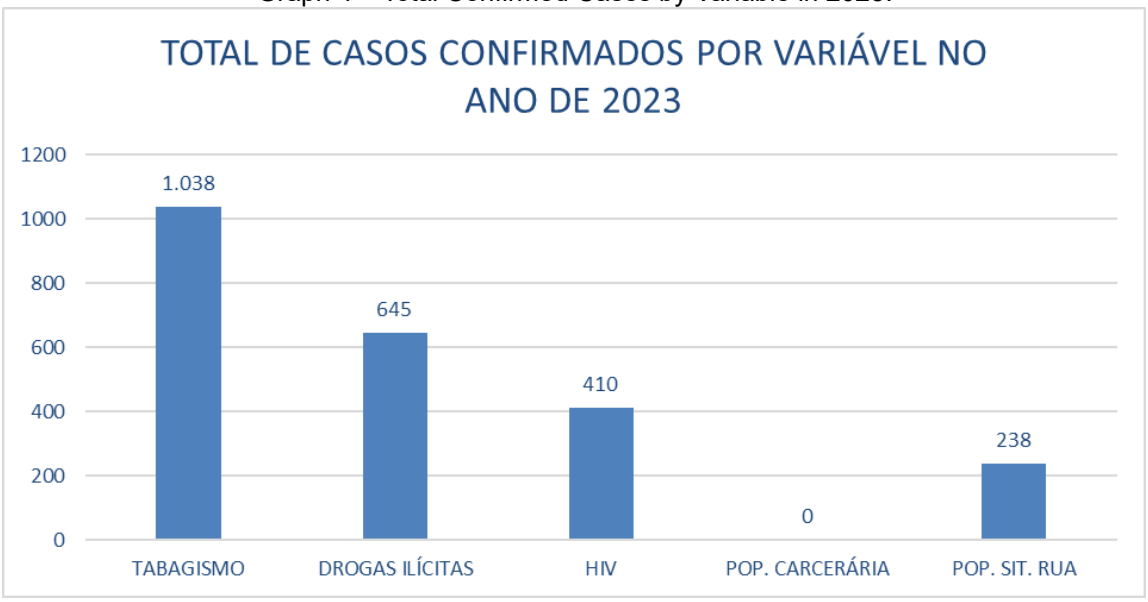
2013 and 2014, with no new records since 2015. Among women, there were only 38 cases until 2014, with no new cases reported in subsequent years. The homeless population also appears as a risk group highlighted in the table (1,218). Among men, the number of cases has increased significantly over the years, from 6 cases in 2013 to 193 in 2023, totaling 1,218 cases. Among homeless women, although the number of cases is lower, the increase is also significant, with 221 cases recorded in the period, rising from 1 case in 2013 to 45 in 2023. Smoking is another important factor related to tuberculosis. Among men, the number of cases was the highest among the variables analyzed, totaling 6,603 cases in the period from 2013 to 2023. Among women, smoking had 1,415 cases registered in the period. The increase was significant, from 11 cases in 2013 to 188 in 2023 (Table 4).

Table 4 – Confirmed cases by year of notification according to illicit drugs, HIV, prison population, homeless population, and smoking.

Variables	Anus											
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	**Total (%)**
	Male											
Illicit drugs	24	125	264	323	350	452	395	445	455	521	544	3.898 (27%)
HIV	235	255	228	220	203	209	175	195	216	227	294	2.457 (17%)
Prison population	207	139	0	0	0	0	0	0	0	0	0	346 (2%)
Homeless Population	6	43	72	93	100	117	112	159	156	167	193	1.218 (8%)
Smoking	54	235	539	575	594	735	731	734	685	871	850	6.603 (45%)
	Female											
Illicit drugs	9	26	53	54	59	76	57	58	73	84	101	650 (20%)
HIV	91	100	115	84	78	77	72	53	62	67	116	915 (28%)
Prison population	24	14	0	0	0	0	0	0	0	0	0	38 (1%)
Homeless population	1	4	25	15	19	16	21	21	22	32	45	221 (7%)
Smoking	11	51	130	119	119	149	168	155	157	168	188	1.415 (44%)

Source: Prepared by the authors.

Graph 4 – Total Confirmed Cases by Variable in 2023.



Source: The authors.

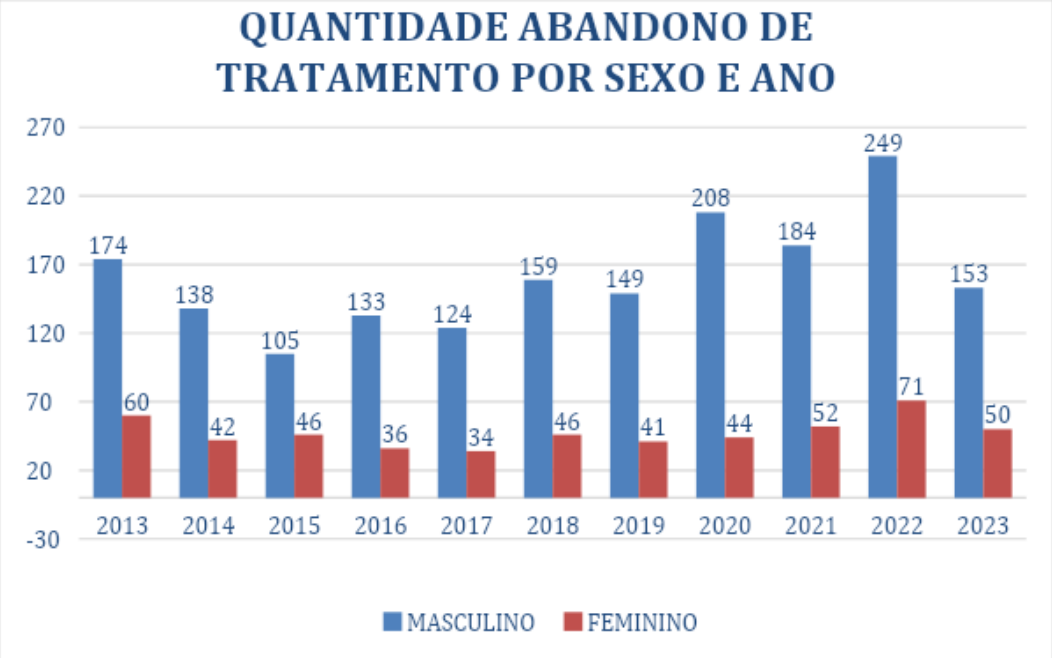
Among males, the number of readmissions to treatment was about four times higher (1,276), compared to females (324). (Table 5).

Table 5 – Confirmed cases by year of notification, according to tuberculosis treatment dropout and readmission after dropout

Anus												
Sex	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	**Total %**
	Input Type | Readmission after treatment abandonment											
Male	80	85	57	71	85	74	68	117	165	242	232	1.276 (80%)
Female	21	19	32	16	10	18	22	22	34	64	66	324 (20%)
Situation closed | Treatment abandonment												
Male	174	138	105	133	124	159	149	208	184	249	153 (%)	1.776 (77%)
Female	60	42	46	36	34	46	41	44	52	71	50	522 (23%)

Source: Prepared by the authors.

Graph 5 – Treatment Dropout, According to Sex and Year.



Source: The authors.

The number of deaths of males (943) was three times higher when compared to females (268). Likewise, there was a two-fold increase in the number of males (12,662) who evolved to cure compared to females (5,831).

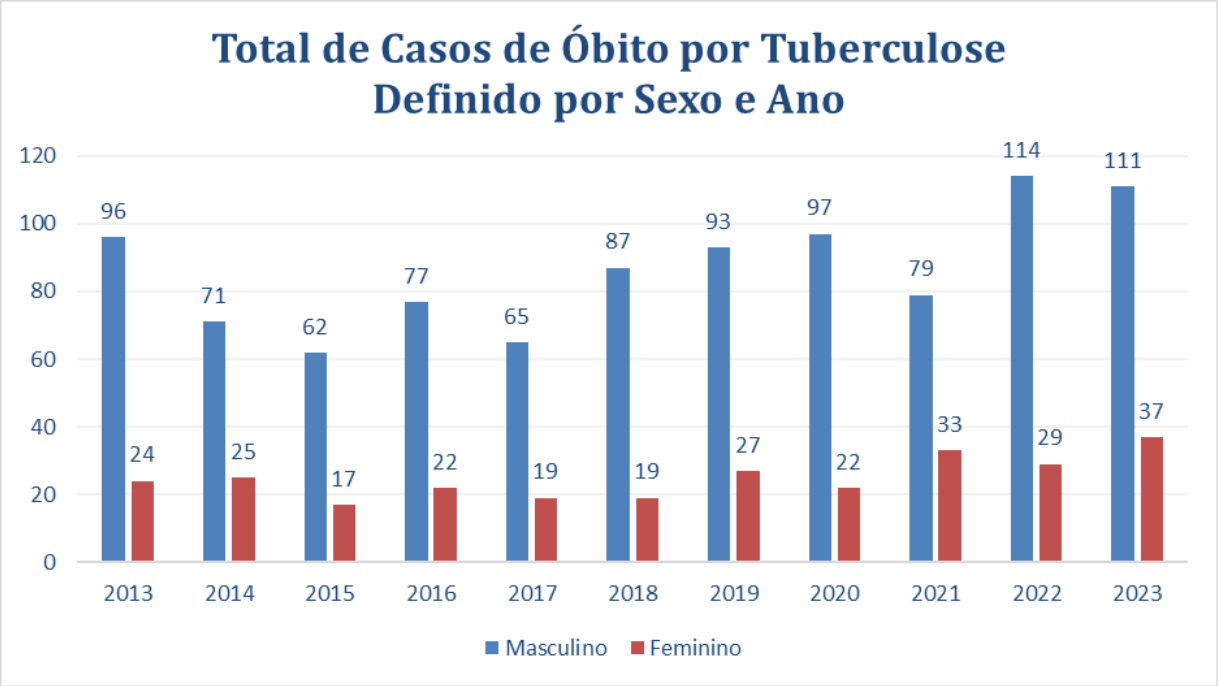
Table 6 – Confirmed cases by year of notification according to cure and death from tuberculosis.

Evolution	**Anus**											**Total (%)**
	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023	
	Male											
Care	1.275	1.281	1.296	1.216	1.140	1.344	1.285	1.131	1.012	1.093	589	12.662 (93%)
Death	96	71	62	77	65	87	93	96	79	114	103	943 (7%)
Female												
Care	630	639	581	556	533	594	594	490	459	514	241	5.831 (96%)

Death	24	25	17	22	19	19	27	22	31	29	33	268 (4%)

Source: Prepared by the authors.

Graph 6 – Total Cases of Death from Tuberculosis Defined by Sex and Year.



Source: The authors.

DISCUSSION

One study identified that the age group with the highest incidence of tuberculosis is between 20 and 39 years of age, with 44.44% of the cases, followed by the 40 to 59 age group, and with a predominance among men (68.32%), a fact that corroborates the findings of this study. (Carvalho, 2024).

Abandoning tuberculosis treatment is a major challenge. The influence of factors such as lack of information about the disease, alcohol and drug use, as well as social and cultural barriers can contribute to this problem. It is also important to emphasize that when there is treatment abandonment, there is the possibility of developing drug resistance that also aggravates this problem, making it difficult to control the disease (Fontes, 2019).

A 2021 study underscores the relevance of sputum microscopy, despite its limitations in terms of sensitivity, especially in developing countries. The ability of professionals to perform this exam directly impacts the accuracy of diagnoses, pointing to the need for constant training (Magalhães, 2021).

Findings of a study similar to the present study associated tobacco use and tuberculosis, especially in men between 40 and 60 years of age, with low education and precarious living conditions, such as homeless people and people deprived of liberty. (Tonin, 2021). This risk factor is also related to alcohol and drug use, highlighting the

intersection between risk behaviors and vulnerability to the disease (Tavares, 2021). It is also important to highlight that smoking predisposes the body to infections such as tuberculosis, as cigarette smoke reduces the hair cells of the respiratory tract, facilitating bacterial adhesion, making consumers more susceptible to infection (Lima, 2023).

In the present study, the male population had greater difficulty in adhering to tuberculosis treatment than did the female population. In a study conducted between 2015 and 2023 on the evolution of tuberculosis cases, 84.85% of patients were cured, while 9.51% abandoned treatment, and 5.63% died (Mendes, 2019). These numbers reflect the importance of adherence to treatment and strategies to reduce dropout.

A study that analyzed the regional distribution of tuberculosis in Paraná between 2018 and 2021 highlighted a higher incidence in the North and Northwest macro-regions, with high rates in Paranaguá and Foz do Iguaçu, and low rates in Irati and Francisco Beltrão. This regional panorama is essential to guide health policies and resource allocation (Barbosa, 2024).

The percentage of confirmed cases in this study was more significant in the eastern region of the state of Paraná. This result corroborates a similar study that highlighted the eastern macro-region of Paraná with the highest number of tuberculosis cases between 2012 and 2022, related to high population density. In addition, this region recorded a high incidence of cases of extrapulmonary tuberculosis, reinforcing the need for greater attention to this type of manifestation of the disease (Tonin, 2021).

In the literature, studies highlight the male gender dimension in tuberculosis illness, pointing out that men are twice as likely to contract the disease as women, data that are consistent with the findings of the present study (Carvalho, 2024), (Almeida, 2023).

In summary, the reviewed studies offer a comprehensive view of tuberculosis in Brazil, revealing how demographic, social, and regional factors influence the prevalence of the disease. Integrated approaches that encompass education, prevention, and addressing social inequalities are essential to improve tuberculosis control and eradication.

CONCLUSION

In the present study, we observed a higher percentage of tuberculosis notifications in the state of Paraná of males aged 20 to 29 years with positive sputum cultures for the disease, living in the eastern region of the state, and smokers who abandoned tuberculosis treatment. In addition, there was a predominance of males for cure and death during the ten years of notification of tuberculosis cases analyzed.

In the academic and scientific spheres, the study provides a detailed analysis of the groups most vulnerable to tuberculosis, including smokers, HIV carriers, the homeless population, and institutionalized individuals. Identifying these profiles is crucial to direct future research, which can explore risk factors and the effectiveness of specific interventions in these groups. In addition, the data presented serve as a basis for the production of new epidemiological theories and models, especially in regions with characteristics similar to those of Paraná.

In the field of nursing, this study reinforces the importance of an integrated approach to the care of patients with tuberculosis. It provides subsidies for nurses to implement more effective follow-up and treatment strategies, especially in relation to treatment adherence, which has proven to be a significant challenge. The regionalized analysis of the data also allows nursing professionals to develop more precise and contextualized interventions, considering the specificities of each health macro-region.

Regarding the elaboration of public policies, the study provides essential information for the planning of more efficient health actions. Data can guide decisions regarding the distribution of resources and efforts, prioritizing areas and groups that are most vulnerable. In addition, it highlights the need for policies that promote the continuity of treatment and improve social support for homeless individuals and prison populations. These interventions are essential to reduce treatment abandonment rates and prevent new infections, contributing to the effective fight against tuberculosis.

Therefore, the study not only expands knowledge about the epidemiological profile of tuberculosis, but also offers practical tools for improving health care and the formulation of public policies aimed at controlling the disease in Brazil.

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