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Analysis of the Epidemiological Profile of Tuberculosis in the Municipality of Belém do Pará during the Years 2019 to 2023

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Objective: To evaluate the epidemiological profile of patients with tuberculosis (TB) in the municipality of Belém from 2019 to 2023 and identify the main risk factors that contribute to the prevalence of TB in affected individuals.
Methods: This is an epidemiological, cross-sectional, retrospective, descriptive and quantitative study, using secondary data freely available on the TABNET/DATASUS platform, for the municipality of Belém, covering various variables.
Results: The results show a higher prevalence among males (63.31%), adults (69.38%), those with incomplete primary education (29.22%) and those of brown race (72.22%). In addition, the pulmonary form of the disease (83.75%) and the type of entry as a new case (80.67%) were the most prevalent.
Conclusions: It was concluded that the prevalence of tuberculosis in Belém is associated with specific sociodemographic characteristics, such as gender, age group, educational level and race. The pulmonary form of the disease and the predominance of new cases are the main aspects observed in the study and highlight the need to intensify Tuberculosis prevention and control strategies.

Keywords: Tuberculosis; public health; epidemiology.

1. INTRODUCTION

Tuberculosis (TB) is a respiratory disease caused by the agent Mycobacterium tuberculosis, which is among the ten most deadly diseases in the world today and is the leading cause of death among infectious diseases. Its transmission occurs through the inhalation of aerosols and leads to a granulosa infection in the lower respiratory tract. Its occurrence is associated with socio-economic factors, since, according to the UN, 95% of cases occur in middle and low-income countries and, at the top of the ranking of estimated cases and deaths from the disease, are the African continent and the Americas (Gioseffi et al., 2022).

Tuberculosis (TB) is a disease that can be prevented and usually treated. However, in 2022, TB became the second leading cause of death globally from a single infectious agent, second only to the coronavirus (COVID-19), and caused almost twice as many deaths as HIV/AIDS. Every year, more than 10 million people are infected

with tuberculosis. In addition, of the total number of people who are infected with tuberculosis, around 90% are adults, with more men infected than women. In untreated patients, the mortality rate is around 50%. With treatment currently recommended by the World Health Organization, around 85% of people with tuberculosis can be cured (World Health Organization, 2023).

Until the end of 2015, the World Health Organization prioritized the 22 countries with the highest disease burden in the world, including Brazil. For the period 2016-2020, a new classification of priority countries has been defined, according to epidemiological characteristics. Each list consists of 30 countries. Some countries appear on more than one list, thus adding up to a total of 48 priority countries for tackling tuberculosis. Brazil is on two of these lists, ranking 20th in terms of the burden of disease (TB) and 19th in terms of TB-HIV co-infection (TB-HIV). The country also stands out for its participation in the BRICS (a bloc made up of Brazil, Russia, India, China and South Africa), whose countries account for around 50% of the world's tuberculosis cases and mobilize more than 90% of the resources needed for tuberculosis control actions through domestic sources of funding (Brazil, Ministry of Health, 2017).

The WHO estimates that a total of 105,000 Brazilians fell ill with tuberculosis, of which 87,344 were diagnosed and treated. This represents 83% detection of people with the disease - 9.5% higher than in 2021, when the country's result was 75.8%. Another fact shown in the report is that some Brazilians don't finish their tuberculosis treatment, which lasts at least six months and can last up to 18 months. In 2021, only 65% of people diagnosed in Brazil completed their treatment and were cured. In the case of people living with HIV or AIDS, the percentage was 44% (Brazil, Ministry of Health, 2023).

After a decade and a half of reduction in the incidence of tuberculosis, from 2015 onwards, cases began to increase in Brazil, until the beginning of the COVID-19 pandemic, when there was a drop; since then, there has been a further increase in incidence until 2022. If this pattern is maintained, it is estimated that by 2030 the incidence will continue to rise, returning to the levels of the 2000s, the beginning of the historical series, which jeopardizes the national commitment to the tuberculosis targets included in the SDGs (Silva & Galvão, 2024).

The failure to diagnose and treat tuberculosis accurately and in a timely manner maintains the chain of transmission, thus increasing the number of hospitalizations, healthcare costs and even mortality rates. In addition, tuberculosis affects the active workforce and can therefore have a negative socio-economic impact. Hospitalization rates for tuberculosis are 33.3% in China and 66.5% in Spain, substantially higher than the rate in Brazil, and hospitalizations account for a significant portion of the total costs associated with the disease. In Brazil, hospitalizations for tuberculosis are avoided and are limited to special situations and patients with complications of the disease. On the other hand, hospitalization is a routine measure during the intensive phase of TB treatment in some Eastern European and Central Asian countries (Oliveira Cortez et al., 2021).

Improving the infrastructure and work process in TB care can contribute to more effective control of the transmissibility of the disease, resulting in a reduction in the morbidity and mortality of the affected population and promoting public health. Adequate infrastructure, with the necessary equipment and supplies, can enable early and accurate diagnosis of TB, as well as facilitating the performance of complementary tests and the supply of medicines to patients. Improving the work process, with the training of health professionals and the implementation of active case-finding strategies, can help raise awareness and increase the population's commitment to controlling the disease (Picanço et al., 2024).

In the state of Pará, tuberculosis is an endemic disease. The state government, through the State Program for Tuberculosis Control, promotes prevention and health promotion actions by monitoring and evaluating municipal actions, making medicines available for the treatment of the disease (currently, 13 types of medicines are passed on to all municipalities) and promoting workshops aimed at the management and control of the disease to all municipalities) and promoting workshops aimed at managing and controlling the disease (Vilanova, 2022).

Following the national pattern, Pará also showed a generalized increase in the incidence of tuberculosis in the years 2020 and 2021 in its

municipalities. However, the fact that the COVID-19 pandemic has overloaded services and, consequently, restricted access to case follow-up and access to treatment must be taken into account. This has resulted in cases being dammed up, not allowing for better control of the disease. Therefore, it is inferred that there were more cases in the period, but that they were not recorded in the health information systems (State Department of Public Health Pará, 2023).

In view of this, the research is justified by the relevance of a more in-depth examination of the epidemiological profile of the population of Belém between 2019 and 2023, especially given the challenges faced by the SUS in recent years, due to the SARS-Cov-2 pandemic. The aim of this study is to expand public health knowledge and contribute to improving tuberculosis control strategies in Pará.

2. METHODOLOGY

2.1 Study Design

The following research is a cross-sectional, retrospective, descriptive and quantitative epidemiological study with secondary data from the SUS Notifiable Diseases Information System (SINAN/SUS), using information from DataSUS on the indicators of tuberculosis cases in Pará, from 2019 to 2023.

2.2 Data Collection Methodology

A sample was selected on the profile of tuberculosis patients. To this end, the study used the analysis of indicators on medical records, which are freely accessible and available on the TABNET/DATASUS platform, which focuses on tuberculosis cases since 2001. The data was collected for the municipality of Belém, covering variables such as color/race, gender, schooling, age group, form of the disease and type of entry in order to draw up an epidemiological profile of patients diagnosed with the disease in question.

The data was presented in graphs and expressed in absolute and relative frequencies. For a more specific analysis, the incidence rates of tuberculosis per 100,000 inhabitants in the state of Pará will be calculated between 2019 and 2024, based on the data available from DATASUS, using the following formula: Incidence=(number of new cases in a given period)/(number of people exposed to risk in the same period)×100,000.

To determine the number of people exposed to risk, a population estimate was calculated. The calculation considered the growth rate, taking into account the data from the 2022 demographic census of the Brazilian Institute of Geography and Statistics (IBGE).

The tables and graphs were drawn up using the Excel program Microsoft Office 2020 in order to show the data concisely and objectively.

2.3 Inclusion and Exclusion Criteria

As inclusion criteria, secondary data obtained from the SUS Notifiable Diseases Information System (SINAN/SUS) provided by DATASUS was used to draw up the epidemiological profile of patients with tuberculosis.

The following eligibility criteria were defined: people living in the municipality of Belém in the state of Pará, with confirmed cases of tuberculosis (pulmonary and extrapulmonary) between 2019 and 2023. The tuberculosis cases covered the types of entry in the categories new cases, relapse, post-abandonment re-entry, transfer, post-death and cases that do not have the type of entry recorded.

Data outside the proposed time series, those not residing in the state analyzed, those imported from other states or countries and those whose notification did not include sufficient data for analysis were excluded.

2.4 Statistical Analysis

The statistical analysis of the data was based on the Chi-Square Test of Independence, with the aim of analyzing the existence of a relationship between the selected variables. The software Bioestat 5.3 was used, and a p-value of less than 0.05 was considered significant.

3. RESULTS

Between 2019 and 2023, 9,567 cases were reported in the municipality of Belém, representing approximately 34.59% of confirmed occurrences in the state of Pará in the period analyzed. The weighted average age of the individuals affected was 35.06 years.

Table 1 shows the prevalence of cases in males, with 6,057 records (63.31%), concentrated in the adult age group (69.38%), especially between 25 and 34 years old, which corresponds to 22% of all cases.

As for schooling, 29.22% of cases occurred in people with incomplete primary education. The brown race was the most affected, with 6,910 cases (72.22%). The pulmonary form of the disease was the most prevalent, with 8,013 cases (83.75%), and 80.67% of the cases were classified as new during the period.

Table 2 shows the distribution of cases based on schooling and gender. Incomplete secondary education was the most prevalent, concentrated in males with 1,894 cases (67.73%). The chi-square test of independence was carried out and resulted in X2=135.356 (gl = 10; p <0.0001), indicating a strong relationship between the variables.

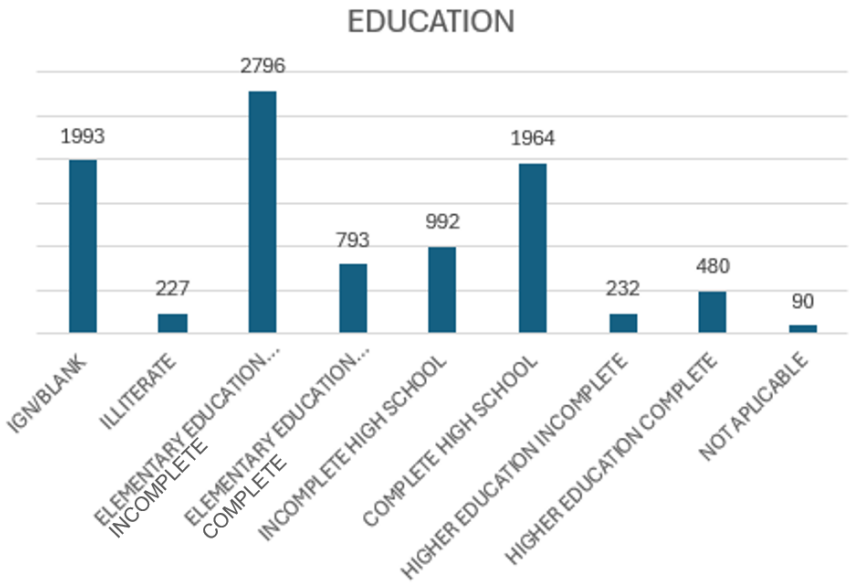

Fig. 1. Distribution of tuberculosis cases according to education level
Source: Authors, 2024-SINAN/SUS (SUS Notifiable Diseases Information System)

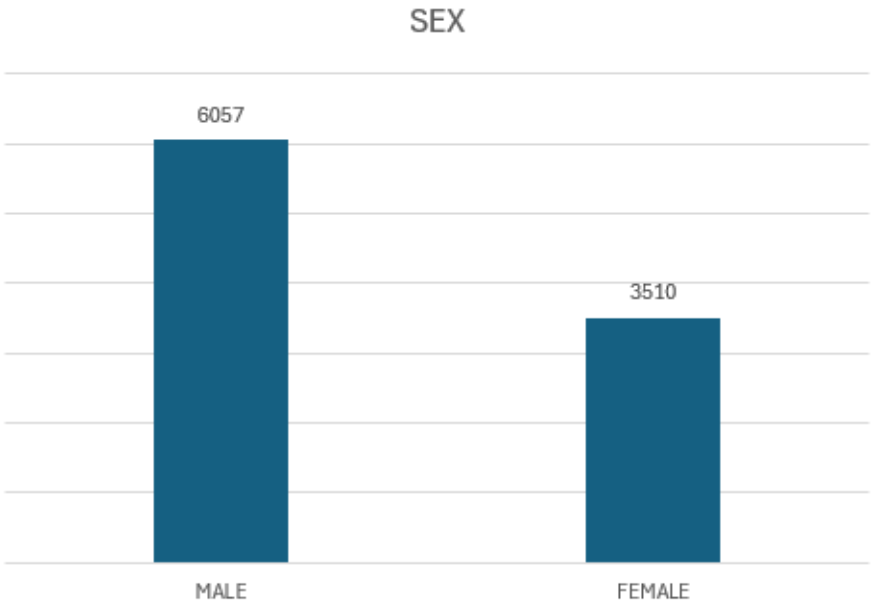

Fig. 2. Distribution of tuberculosis cases by sex
Source: Authors, 2024-SINAN/SUS (SUS Notifiable Diseases Information System)

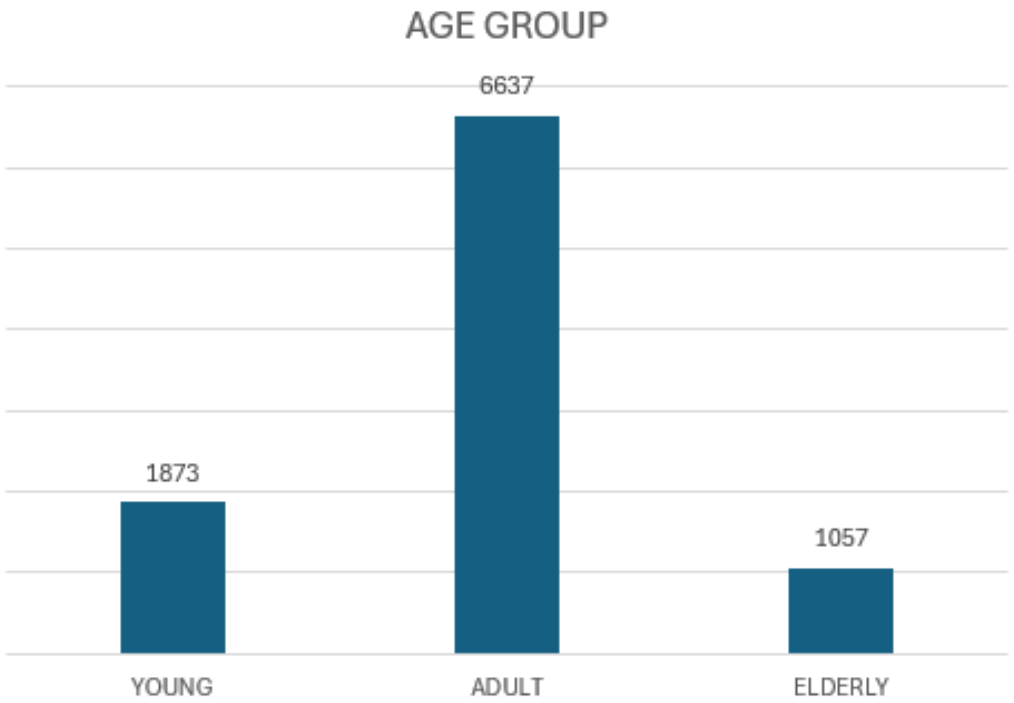

Fig. 3. Distribution of tuberculosis cases according to age group
Source: Authors, 2024-SINAN/SUS (SUS Notifiable Diseases Information System)

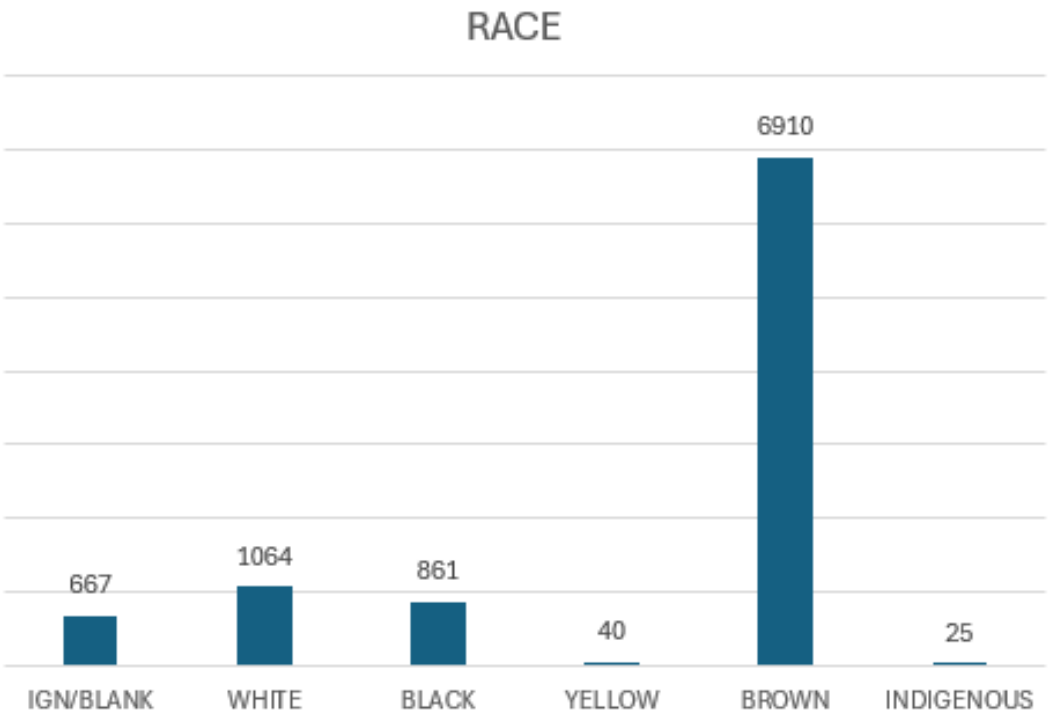

Fig. 4. Distribution of tuberculosis cases by race
Source: Authors, 2024-SINAN/SUS (SUS Notifiable Diseases Information System)

Table 1. Frequency of the variables analyzed between 2019-2023

Variable	N	%
SEX		
Male	6057	63,31
Female	3510	36,69
AGE RANGE		
Youth	1873	19,58
Adult	6637	69,38
Elderly	1057	11,04
SCHOOLING		
Ig/white	1993	20,83
Illiterate	227	2,37
Incomplete schooling	2796	29,22
Complete	793	8,18
incomplete MS	992	10,36
MS complete	1964	20,52
ES incomplete	232	2,42
ES complete	480	5,01
Not applicable	90	1,09
RACE		
Ig/white	667	6,97
White	1064	11,12
Black	861	9,00
Yellow	40	0,41
Brown	6910	72,22
Indigenous	25	0,28
FORM		
Pulmonary	8013	83,75
Extrapulmonary	1184	12,37
Pulmonary+Extra	370	3,88
TYPE OF ENTRY		
New case	7718	80,67
Recurrence	632	6,60
Re-entry after abandonment	852	8,90
Don't know	14	0,14
Transfer	330	3,44
Post-mortem	21	0,25

Source: Authors, 2024-SINAN/SUS (SUS Notifiable Diseases Information System)

Table 2. Distribution of cases based on the relationship between schooling and sex

Sex	Ign/ Blank	Illitarate	1st to 4th grade incomp-lete	Complete 4th grade	5th to 8th grade incomplete	Elementary school complete	High school incomp	Completed high school	Incompetent higher education	Higher education completed	Not applica ble	Tota l
Male.	1309	151	560	340	994	523	615	1179	122	215	49	6057
Fem.	684	76	264	124	514	270	377	785	110	265	41	3510
Total	1993	227	824	464	1508	793	992	1964	232	480	90	9567

Source: Authors, 2024-SINAN/SUS (SUS Notifiable Diseases Information System)

Table 3. Distribution of cases based on the relationship between schooling and age group

Age group	Ign/ Blank	Illitarate	1st to 4th grade incomplete	Complete 4th grade	5th to 8th grade incomplete	Elementary school complete	High school incomp	Completed high school	Incompetent higher education	Higher education completed	Not applicable	Total
0 to 14 years old	45	4	38	9	65	11	7	-	-	-	90	269
15 to 24 years old	301	12	43	42	257	110	354	373	95	17	-	1604
25 to 34 years old	442	20	112	96	313	162	218	529	72	144	-	2108
35 to 44 years old	361	37	148	105	256	139	152	413	26	129	-	1766
45 to 54 years old	334	45	168	79	270	132	131	318	24	92	-	1593
55 to 64 years old	259	49	143	58	193	121	77	195	12	63	-	1170
65 or +	251	60	172	75	154	118	53	136	3	35	-	1057
Total	1993	227	824	464	1508	793	992	1964	232	480	90	9567

Source: Authors, 2024-SINAN/SUS (SUS Notifiable Diseases Information System)

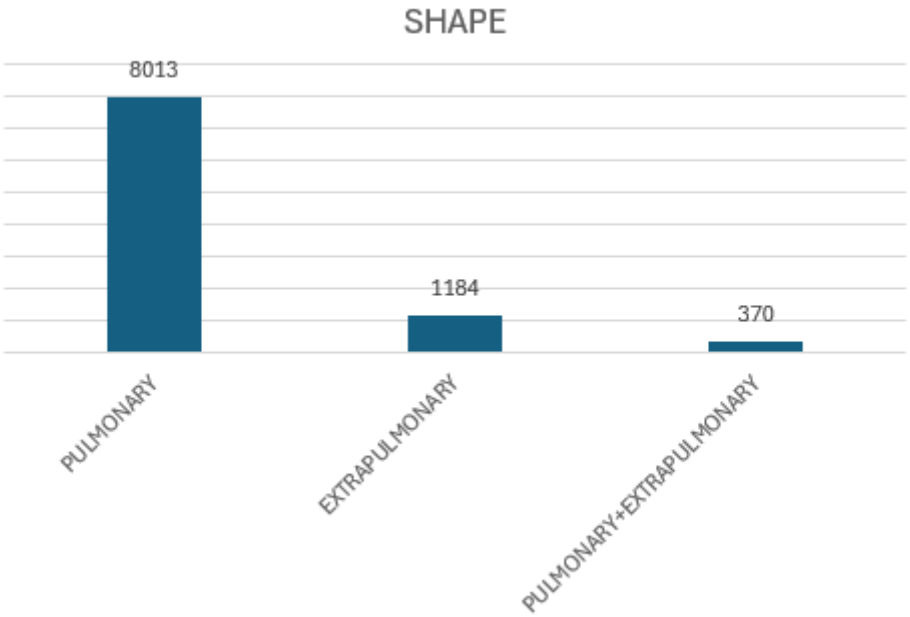

Fig. 5. Distribution of tuberculosis cases according to the shape of the disease
Source: Authors, 2024-SINAN/SUS (SUS Notifiable Diseases Information System)

Table 4. Distribution of cases based on the relationship between shape and race

Shape	Ign/Blank	White	Black	Yellow	Bronw	Indigenous	Total
PULMONARY	552	860	749	33	5799	20	8013
EXTRAPULMONARY	86	174	74	5	841	4	1184
PULMONARY + EXTRAPULMONARY	29	30	38	2	270	1	370
Total	667	1064	861	40	6910	25	9567

Source: Authors, 2024–SINAN/SUS (SUS Notifiable Diseases Information System)

Table 5. Distribution of cases based on the relationship between shape and sex

Shape	Male	Female	Total
PULMONARY	5064	2949	8013
EXTRAPULMONARY	738	446	1184
PULMONARY + EXTRAPULMONARY	255	115	370
Total	6057	3510	9567

Source: Authors, 2024–SINAN/SUS (SUS Notifiable Diseases Information System)

Table 3 shows that the 25 to 34 age group had the highest illiteracy rate, as well as a high prevalence of cases in individuals with incomplete primary education. The chi-square test of independence showed that X2 = 4157.802 (gl = 60; p<0.0001), suggesting that these variables are strongly related (p<0.0001).

Table 4 shows that the pulmonary form of the disease was predominant in the brown race, corresponding to 83.92% of cases, standing out in a discrepant way in relation to other races. The chi-square test of independence revealed that X2 = 30.756 (gl = 10; p = 0.0006), indicating that there is a strong relationship between these variables.

Finally, Table 5 shows that the pulmonary form was more frequent in males, with 63.19% of cases, compared to 36.81% in females. The chi-square test of independence was performed and revealed that X2 = 5.544 (gl = 2; p = 0.0626), this result indicates that the variables analyzed have a weak relationship (p = 0.0626).

4. DISCUSSION

This study sought to analyze the profile of tuberculosis cases in the municipality of Belém,

in the state of Pará, contributing to a broad understanding of the epidemiological situation related to this disease. Studying the factors associated with the prevalence of this public health problem is essential for planning control and prevention strategies that can overcome this issue.

Cases of tuberculosis in the municipality of Belém were more prevalent in men, corresponding to approximately 63.3% of notified cases. This result is not exclusive to the municipality of Belém, since other places have also reported a higher prevalence of this group compared to women, both in Brazilian cities and in other countries. In Vietnam, for example, the incidence of TB in the male population is around 3 times higher than in the female population (Nguyen et al., 2023). This result can be explained by behavioral, social, environmental, biological and measurement factors. In this sense, studies indicate that the reason for the discrepant occurrence between these groups is mainly related to the fact that female citizens are underreported and that there is a reporting bias with this gender (Horton et al., 2018; Thorson & Diwan, 2001). In contrast to the above, a meta-analysis by Horton et al showed that the global prevalence had an M:F ratio of 2.2, which was higher in Southeast Asia (3.4, 95% CI 2.8-4.0), suggesting a variation in the number of cases between these variables, regardless of notification (Horton et al., 2016; Nguyen et al., 2023). In this sense, the author justifies this point based on the assumption that men have different customs related to care, concerns and access to health compared to women, in addition to the different social roles that individuals assume (Horton et al., 2016; Silva et al., 2022; World Health Organization, 2020).

In addition, smoking and alcohol habits were found to be more prevalent in males, and these are considered risk factors for TB, which makes it more likely to occur in men (Anttonioni et al., 2022; Horton et al., 2020). In this sense, Table 5 indicates that the highest frequency of the pulmonary form of the disease is centered on males, which may be associated with the higher prevalence of smoking habits in men as it is a risk factor for the disease and deleterious to the respiratory tract (Horton et al., 2020; Van Minh et al., 2017). In addition, studies show that biological differences between the sexes may make males more susceptible to tuberculosis (Horton et al., 2016).

Analysis of the reported cases showed that there was a higher incidence of TB cases in people with incomplete primary education (29.22%), which was strongly related to age (Table 3) and gender (Table 2). This result is similar to that found in epidemiological studies carried out elsewhere, such as Paraná, which also had a higher number of cases in people without complete primary education (Nonato et al., 2022). The level of schooling in question tends to lead to a lower level of understanding of the pathology on the part of these patients, which culminates in lower adherence to treatment and, consequently, treatment abandonment (Anttonioni et al., 2022).

In this sense, there is a problem with the therapy aimed at this group, due to the low level of adherence on the part of these patients.

Regarding color/race, Belém do Pará shows the same pattern as most studies of the same nature, with a higher incidence of tuberculosis among brown people (72.22%). White people had the second highest incidence (11.12%) and black people had the third highest (9.00%).

In the capital of São Luís, in the state of Maranhão, the same pattern was observed. Between 2013 and 2023, 76.33% of tuberculosis cases affected brown people, a discrepant figure compared to black people (12.52%) and white people (9.83%) in the city in the same period (Santos et al., 2024).

In the state of Rio de Janeiro in 2014, the brown race also represented the highest incidence rate of tuberculosis, followed by the white race, but in a less significant proportion (45.3% of cases were brown people and 35.1% white people) (Oliveira et al., 2021).

In short, it can be seen that precarious conditions, limited access to health services and other social inequalities affect people living in poverty, many of whom are brown, which contributes to a higher risk of contracting tuberculosis. (Oliveira et al., 2020). This finding justifies, for example, the strong relationship between race and the type of entry shown in Table 4 ($p = 0.0626$).

In relation to the type of admission, the study was consistent with the national literature in showing that new cases were the most common type of admission (80.67%). This pattern was observed in the study by Pinto et al, which

defined the epidemiological profile of tuberculosis patients in a reference hospital in Alagoas between 2011 and 2020 (61.5% of the types of entry were reported as new cases).

In the capital of the state of Maranhão, São Luís, the percentage was even closer to the results obtained in Belém, with 78.57% of the cases registered between 2013 and 2023 being of the new case type (Santos et al., 2024).

In the state of Acre, the percentage of new tuberculosis cases between 2019 and 2023 was 87%, a higher rate than in Belém do Pará in the same period, as shown in the current study (Silva & Galvão, 2024).

However, Belém do Pará shows notable differences when it comes to the categories of post-dropout re-entry (8.9%) and relapse (6.6%). In relation to this, a reference hospital in Alagoas has post-dropout re-entry as the second most common type of entry (23.64%), similar to Belém do Pará. However, transfer cases in the same hospital are the third most common type of admission (7.53%), which in Belém do Pará represent only 3.44% of cases (Pinto et al., 2022). In addition, the state of Acre had 8% of tuberculosis cases presenting the relapse form of entry, while only 4% of cases were included in the post-abandonment re-entry category. These facts suggest a higher frequency of re-entry after abandonment of tuberculosis treatment in the city of Belém do Pará, which may reflect differences in access and adherence to treatment or in local health conditions.

In addition, the most prevalent age group for this disease was young adults, between 20 and 39 years old (Moraes et al., 2023), These results corroborate previous studies, such as Rossetto et al, 2019, a time lapse corresponding to economically active individuals, causing social impacts. Thus, these results raise questions about why this age group is the most commonly affected by tuberculosis, and the most accepted justification is related to the high social exposure of this group of individuals, which increases contact with other people, favoring the transmission of the agent that causes this disease. There is also exposure to other risk factors, such as stress, comorbidities that influence the immune system (HIV, for example), lack of an adequate sleep routine, poor diet, among others.

In terms of clinical variables, the most prevalent form in the municipality of Belém is the pulmonary form, although there are also records of cases of the ganglionic and bone forms (Freitas et al., 2016). According to the Ministry of Health, although this pathology can affect other organs, the pulmonary form is the most common due to its high rate of transmissibility, given that it occurs through the air, through the inhalation of aerosols released into the environment by people with active TB when talking, coughing or sneezing. This fact corroborates the tendency of this disease to affect mainly young adults, a population group that is more engaged in social interactions in various ways.

5. CONCLUSIONS

This study aimed to analyze the epidemiological profile of tuberculosis in the municipality of Belém, in the state of Pará, looking at data on gender, education, race, type of entry, age group and prevalent forms of TB. Thus, it was concluded that the majority of TB patients in the municipality analyzed were male (63.3%), brown (72.2%), with an average age of between 20 and 39 years (69.3%), and the majority had little schooling (29.2%). In addition, with regard to clinical variables, the study showed that new cases are the most common type of entry (80.6%), and the most prevalent form is pulmonary (83.7%).

Therefore, the results of this study highlight the need to intensify prevention and control strategies for this disease, especially for the public most affected, with a view to an exponential reduction in tuberculosis cases in the state.

CONSENT

It is not applicable.

ETHICAL APPROVAL

This study is in accordance with the Code of Medical Ethics in Research, which ensures the dignity of the human figure, and with Resolution 466/2012 of the National Health Council (CNS). The research data was obtained from a secondary database that is freely accessible to the public, without any intervention on the people studied or their identification. It is therefore unnecessary to submit the research for analysis by the Research Ethics Committee (CEP) of the State University of Pará.

DISCLAIMER (ARTIFICIAL INTELLIGENCE)

Author(s) hereby declare that NO generative AI technologies such as Large Language Models (ChatGPT, COPILOT, etc.) and text-to-image generators have been used during the writing or editing of this manuscript.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

Anttonioni, J. S., et al. (2022). Socioepidemiological profile of tuberculosis cases in the São Patrício II health region, Goiás, Brazil from 2001 to 2020. *Research, Society and Development*, *11*(4).

Brazil. Ministry of Health. (2017). *Brazil Free from Tuberculosis*. Brasília: Ministry of Health.

Brazil. Ministry of Health. (2023). Brazil recovers tuberculosis detection rate and improves patient treatment. Brasília: Ministry of Health. Retrieved from https://www.gov.br/saude/pt-br/assuntos/noticias/2023/dezembro/brasil-recupera-indice-de-deteccao-de-tuberculose-e-aperfeicoa-tratamento-de-pacientes

Freitas, W. M. T. M., et al. (2016). Clinical-epidemiological profile of tuberculosis patients treated at a municipal health unit in Belém, Pará State, Brazil. *Rev Pan-Amaz Saúde*, *7*(2), 45–50.

Gioseffi, Jr., Batista, R., & Brignol, S. M. (2022). Tuberculosis, vulnerability, and HIV in homeless people: Systematic review. *Public Health Journal*, *56*.

Horton, K. C., et al. (2016). Sex differences in tuberculosis burden and notifications in low and middle-income countries: A systematic review and meta-analysis. *PLOS Medicine*, *13*(9), e1002119.

Horton, K. C., et al. (2018). A Bayesian approach to understanding sex differences in tuberculosis disease burden. *American Journal of Epidemiology*, *187*(11), 2431–2438.

Horton, K. C., et al. (2020). Systematic review and meta-analysis of sex differences in social contact patterns and implications for tuberculosis transmission and control. *Emerging Infectious Diseases*, *26*(5), 910–919.

Moraes, A. C., et al. (2023). Epidemiological profile of tuberculosis cases in the State of Pará from 2018 to 2022. *Brazilian Journal of Implantology and Health Sciences*, *5*(5), 3899–3911.

Nguyen, H. V., et al. (2023). Influence of sex and sex-based disparities on prevalent tuberculosis, Vietnam, 2017–2018. *Emerging Infectious Diseases*, *29*(5), 967–976.

Nguyen, H. V., et al. (2023). Influence of sex and sex-based disparities on prevalent tuberculosis, Vietnam, 2017–2018. *Emerging Infectious Diseases*, *29*(5), 967–976.

Nonato, A. M., et al. (2022). Tuberculosis in Paraná: An analysis of the historical series based on descriptive epidemiology. *Espaç. Saúde*, 1–15.

Oliveira Cortez, A., et al. (2021). Tuberculosis in Brazil: One country, multiple realities. *Brazilian Journal of Pulmonology: Official Publication of the Brazilian Society of Pulmonology and Tisilogy*, e20200119.

Oliveira, G. C. A., et al. (2021). Epidemiological profile of the population with tuberculosis in the State of Rio de Janeiro. *Online Journal of Research Care is Fundamental*, *13*, 197–204.

Oliveira, H. B., et al. (2020). Tuberculosis and poverty: A systematic review of studies in Brazil. *Revista Panamericana de Salud Pública*, *44*, e36.

Picanço, L., Dutra, R. P., & Saes, M. O. (2024). Temporal trend in the evaluation of adequate management for diagnosis and treatment of tuberculosis in primary health care in Brazil between 2012-2018. *Public Health Notebook*, *40*(3).

Pinto, C. G., et al. (2022). Study of the epidemiological profile of tuberculosis and coinfection of HIV-seropositive patients in a reference hospital in the State of Alagoas. *Journal of Health Sciences*, *24*(1), 57–62.

Santos, D. A., et al. (2024). View of the epidemiological profile of tuberculosis cases in São Luís-MA between 2013 and 2023. *Cereus Journal*, *16*(2), 59–69.

Silva, M. T., & Galvão, T. F. (2024). Incidence of tuberculosis in Brazil: Time series analysis between 2001 and 2021 and projection until 2030. *Brazilian Journal of Epidemiology*, *27*, e240027.

Silva, M. T., & Galvão, T. F. (2024). Incidence of tuberculosis in Brazil: Time series analysis

between 2001 and 2021 and projection until 2030. *Brazilian Journal of Epidemiology*, *27*, e240027.

Silva, T. C., et al. (2022). Tuberculosis from the perspective of men and women. *Journal of the USP School of Nursing*, *56*, e20220137.

State Department of Public Health Pará. (2023). *Tuberculosis epidemiological bulletin 2023*. Pará: Coordination of the Tuberculosis Control Program.

Thorson, A., & Diwan, V. K. (2001). Gender inequalities in tuberculosis: Aspects of infection, notification rates, and compliance. *Current Opinion in Pulmonary Medicine*, *7*(3), 165–169.

Van Minh, H., et al. (2017). Prevalence of tobacco smoking in Vietnam: Findings from the Global Adult Tobacco Survey 2015. *International Journal of Public Health*, *62*(Suppl 1), 121–129.

Vilanova, R. (2022, March 21). SESPA program addresses the importance of correct treatment against tuberculosis. Belém: Pará State Secretariat of Public Health. Retrieved from http://www.saude.pa.gov.br/programacao-da-sespa-aborda-importancia-do-tratamento-correto-contra-a-tuberculose/

World Health Organization. (2020). *Global tuberculosis report 2020*. Retrieved from https://iris.who.int/bitstream/handle/10665/336069/9789240013131-eng.pdf?sequence=1

World Health Organization. (2023). *Global tuberculosis report 2023*. Retrieved from https://www.who.int/publications/item/9789240083851

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