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Epidemiological profile of tuberculosis cases in São Luís – MA between the years of 2013 and 2023

Perfil epidemiológico dos casos de tuberculose em São Luís-MA entre os anos de 2013 e 2023

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ABSTRACT

Introduction: Tuberculosis is an infectious-contagious disease caused by the etiological agent Mycobacterium tuberculosis or Koch's bacillus. **Objective**: To describe the epidemiological profile of the tuberculosis cases in São Luís between the years 2013 and 2023. **Methods**: It is about an ecological study with descriptive analysis accomplished in São Luís – MA; data from the SINAN (System of Information on Notification Grievance, in English) were used. The variables considered were sociodemographic data, clinical form, area of residence, and type of entry. **Results**: There was a prevalence of tuberculosis reporting in the male gender (68.47%), in the age group of 30 to 39 years old (48.40%), Fitzpatrick skin type IV — moderate brown — (76.3%), complete high school (24.33%), and, in the pulmonary clinical form (86.2%). Most of the questions about residential areas were ignored, being classified as Ignored or Non-filled (67%). **Conclusion**: The male gender has higher frequency of Tuberculosis cases; its tendency is more frequent in the economically active age group. Unlike other diseases that reach populations with a low level of study, such as leprosy, tuberculosis is present in those with a complete school education.

Keywords: Pulmonary Tuberculosis. Epidemiology. São Luís – MA.

RESUMO

Introdução: A tuberculose (TB) é uma doença infectocontagiosa ocasionada pelo agente etiológico Mycobacterium tuberculosis ou bacilo de Koch. **Objetivo**: Descrever o perfil epidemiológico dos casos de tuberculose em São Luís entre os anos de 2013 e 2023. **Métodos**: Trata-se de um estudo ecológico com análise descritiva realizado em São Luís – MA; foram utilizados dados do Sistema de Informação de Agravos de Notificação (SINAN). As variáveis consideradas foram: dados sociodemográficos, forma clínica, zona de residência e tipo de entrada. **Resultados**: Houve uma prevalência de notificação de tuberculose no sexo masculino (68,47%), na faixa etária de 20 a 39 anos (48,40%), etnia/cor parda (76,3%), a escolaridade de Ensino médio completo (24,33%), para a forma clínica pulmonar (86,2%). A maior parte das informações referentes à zona de residência não foram preenchidas, sendo classificadas na categoria Ignorado/Branco (67%). **Conclusão**: O sexo masculino possui maior frequência de casos de tuberculose, cuja tendência é mais frequente na faixa etária economicamente ativa. Diferentemente de outras doenças que atinge populações com baixos níveis escolares, como a hanseníase, a tuberculose está presente naqueles com ensino médio completo.

Palavras-chave: Tuberculose Pulmonar. Epidemiologia. São Luís-MA.

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1. INTRODUCTION

Tuberculosis is the infectious disease that causes the biggest number of deaths in the world; that is, it is one of the main causes of morbidity and mortality in various countries around the globe, becoming a public health problem (WHO, 2022). It is caused by Mycobacterium tuberculosis, also known as Koch's bacillus, which occurs with highest incidence in developing countries (PEREIRA, 2021).

Its transmission occurs through inhalation: the inhalation of aerosols triggers a granulomatous infection of the inferior respiratory system. Thus, its occurrence is linked to socioeconomic factors since, according to the United Nations (UN), 95% of the cases tend to happen in countries of medium and low income. Africa and the Americas are at the top of the case estimation ranking, and deaths by the disease (PRADO, 2021).

According to the World Health Organization (WHO), in 2018, there were about 10 million new cases in the world. In this same year, Brazil occupied the 20th position among the 30 countries that concentrate 90% of the worldwide cargo of tuberculosis, with more than 73 thousand cases (FUKUNAGA, 2021). There are two forms of presentation of tuberculosis: pulmonary and extrapulmonary. The pulmonary is responsible for 85% of the cases, being the main chain of transmission. However, in addition to the lungs, other organs can be affected, and the human being can be led to a picture of extrapulmonary tuberculosis, in which the dissemination of Koch's bacillus does not occur (BRUCE, 2021).

In 2018, the northeast stood out as one of the regions with the biggest incidence of tuberculosis in Brazil, with 33.1 cases per 100,000 inhabitants. Meanwhile, this mark is even smaller than the national incidence, which counts 34.8 cases per 100 thousand inhabitants. The state of Maranhão obtained the mark of 30.3 cases per 100 thousand inhabitants, and its capital, São Luís, registered the coefficient of 62.3 cases to each 100 thousand inhabitants, an expressive number when compared to the other data given by the research (ANDRADE et al., 2021).

In 2014, the World Health Organization took steps to combat tuberculosis and called it the End Strategy, to guarantee the eradication of the epidemic until the year 2035. Three were the basal pillars chosen as the strategy to achieve the objectified purpose: a) integrated attention and prevention, with a focus on the patient; b) bold policies and support systems; and c) intensification of research and innovation, centralizing science as the principal path to the suppression of the epidemic.

Each pillar is unique and irreplaceable on this trail against the disease, guaranteeing democratic access to diagnosis, treatment, and prevention (BARREIRA, 2018).

The symptoms of tuberculosis can vary depending on their intensity and presentation. The most common symptom is a persistent cough, possibly accompanied by the production of mucus or even blood. The patients can present a low-grade fever with nighttime presence, intense nighttime sweat, and an inexplicable weight loss. Furthermore, it is important to highlight that it can cause the appearance of fatigue and weakness in a lot of patients. In other advanced cases, tuberculosis may affect other organs, creating, in this way, other symptoms (BASTOS et al., 2019).

There is treatment and a cure for tuberculosis; however, the number of cases is still numerous due to non-adherence to the treatment. This decline in treatment causes consequences for the patient, providing chances of cure relapse, increasing the resistant risk of the disease to multiple drugs, and increasing the number of deaths. The difficulty and continuity of adhesion are given by the presence of collateral effects, skin manifestations, extensive treatment time, a lack of information from the family, social exclusion and misery, social inequality, and the use of alcohol and illicit drugs (PRADIPTA, 2018). Given the above, studies of the epidemiological profile of tuberculosis become relevant to trace specifical public health policies to the population of São Luís – MA.

2. METHODOLOGY

This is an ecological study of a descriptive nature aiming to trace an epidemiological profile of tuberculosis in São Luís – MA, for the period between 2013 and 2023. Therefore, the research is part of the public domain. The study was accomplished based on the precepts of the Declaration of Helsinki and of the Nuremberg Code, respecting the Norms of Research Involving Human Beings (Res. 466/12) of the Conselho Nacional de Saúde (National Health Council, in English) (MATOS, 2021).

São Luís – MA, the capital of the state of Maranhão, has an estimated population of 1,115,932 people, a population density of 1,215.69/km² (IBGE, 2021), and a Human Development Index of 0.768 (IBGE, 2021). The city is in the north of the state of Maranhão, around the cities of Raposa, Paço do Lumiar, and São José do Ribamar.

The data was acquired from the SINAN (System of Information on Notification Grievance, in English), available on DATASUS (Department of Informatics of the Unified

Health System, in English). So, the variables considered were sociodemographic data, clinical form, area of residence, and type of entry.

On the tables and graphics was applied the descriptive statistic; the data obtained was organized in electronic tables on the software Microsoft Excel® and analyzed on the software IBM® SPSS 28.0 (2021).

3. RESULTS

The epidemiological variables referring to tuberculosis cases are presented in Table 1. There was a significant prevalence in the male gender (68.47%), age gap of 20 to 39 years old (48.40%), Fitzpatrick skin type IV – moderate brown - (76.33%), and complete high school (24.33%).

Table 1. Relative and absolute frequencies of reported cases of tuberculosis by gender, age gap, skin type, and schooling in the period between 2013 and 2023 in São Luís – MA.

Variable	N	%
Gender		
Male	7,875	68.47
Female	3,626	31.53
Age Gap		
Non-filled/Ignored	4	0.03
<1	63	0.55
1-4	47	0.41
5-9	48	0.42
10-14	120	1.04
15-19	619	5.38
20-39	5,567	48.40
40-59	3,490	30.35
60-64	519	4.51
65-69	331	2.88
70-79	501	4.36
80+	192	1.67
Skin Color		
White	1,131	9.83
Black	1,440	12.52
Yellow	66	0.57
Brown	8,779	76.33
Indigenous	42	0.37
Non-filled/Ignored	43	0.37
Schooling		

Non-filled/Ignored	315	2.74
Illiterate	527	4.58
1st to 4th incomplete grade of Elementary School	1,560	13.56
4th complete grade of Elementary School	815	7.09
5th to 8th incomplete grade of Junior High School	2,425	21.09
Complete Elementary and Junior High	953	8.29
Incomplete High School	1,175	10.22
Complete High School	2,798	24.33
Incomplete Higher Education	334	2.90
Complete Higher Education	460	4.00
It does not apply	139	1.21

Source: Ministério da Saúde/ Sistema de Informação de Agravos de notificação (SINAN), respectively.Ministry of Health and System of Information of Notification Grievance. Ignored**

During the analysis, absolute and relative frequencies were found for the variable clinical form with an expressive value for the pulmonary clinical form (86.20%), as described in Table 2.

Table 2. Absolute and relative frequencies of reported cases of tuberculosis by clinical form. São Luís – MA.

Clinical form	N	%
Pulmonary	9,914	86.20
Extrapulmonary	1,479	12.86
Pulmonary + Extrapulmonary	106	0.92
Non-filled/Ignored	2	0.02

Source: Ministry of Health and System of Information of Notification Grievance.

In Table 3, the cases are divided by area of residence, where the prevalence was higher than the value described as “Non-filled/Ignored”, pointing to a possible failure to fill in the information during the notification. Among the areas of residence, it is observed the predominance of the urban area, with 2.864 cases in absolute numbers, which means 24.90% of the sample in the period studied.

Table 3. Absolute and relative frequencies of reported cases of tuberculosis by area of residence. São Luís – MA.

Area of residence	N	%
Urban	2,864	24.90
Rural	858	7.46
Peri-urban	75	0.65
Non-filled/Ignored	7,704	66.99

Source: Ministry of Health and System of Information of Notification Grievance.

Table 4, shown below, presents the absolute and relative frequencies of cases reported by type of entry. Thus, it is observed that for new cases there, was a higher prevalence, followed by re-entry after abandonment. Both results point to the need for public health planning and management to prevent tuberculosis in São Luís – MA.

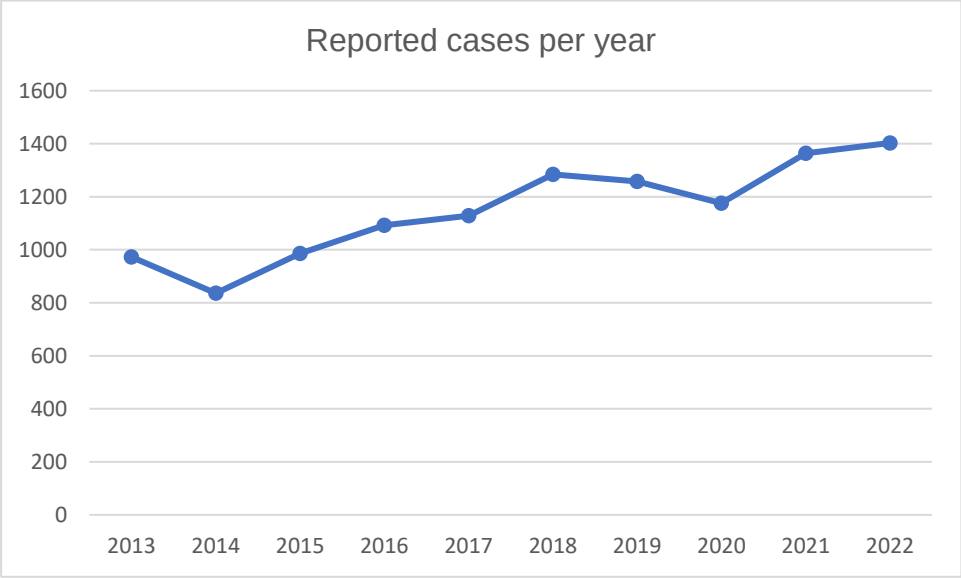
Table 4. Absolute and relative frequencies of reported cases of tuberculosis by type of entry. São Luís - MA.

Type of entry	N	%
New cases	9,036	78.57
Recurrence	783	6.81
Re-entry after abandonment	1,245	10.83
Do not know	10	0.09
Transference	287	2.50
Post *mortem*	140	1.22

Source: Ministry of Health and System of Information of Notification Grievance.

Graph 1 below, describes the number of cases of tuberculosis from 2013 to 2023 in São Luís – MA. There are fluctuations within the period studied, with 2014 having the lowest index (836) and 2022 having the highest index (1,403). It is valid to highlight that during the

COVID-19 pandemic period in 2020, 1,176 cases were presented. However, various diseases were underreported including tuberculosis. Therefore, it is believed that the numbers could have been higher (FORMIGOSA; BRITO; NETO, 2022).



Graph 1. Number of tuberculosis cases reported from 2013 to 2023. São Luís –MA

Source: Ministry of Health and System of Information of Notification Grievance.

According to the TB/COVID-19 Global Study Group (2022), public health services were focused on combating the new coronavirus, which complicated the reporting of various diseases, as well as its hospital and assistive care, including tuberculosis. With the advent of mass vaccination, compulsory notification diseases are now treated, notified, and attended to on health services more frequently (SILVA; MELO; MIGLIORI, 2022), which reveals an increase in the years 2021 and 2022 of 1,304 and 1,403, respectively.

4. DISCUSSION

From the results obtained, there was a higher prevalence of tuberculosis in the male gender (68.47%), twice the value registered for females (31.52%), in the age gap of 20 to 39 years old, considered economically active, moderate brown (Fitzpatrick skin type IV), and with complete high school. Thus, these results corroborate the results of other national studies (TAVARES et al., 2020; BASTOS et al., 2019).

The prevalence of cases in the population with complete high school found in this research diverges from the findings found at the state level, as realized by Oliveira et al.

(2018). In Oliveira's study about the epidemiological profile in the state of Maranhão, there was a higher prevalence in individuals with incomplete high school, with 68.5%.

Still, about the variable described previously, individuals with complete high school have had a higher prevalence of coinfection by tuberculosis-HIV in the state of Pará, as described by Silva et al. (2022), carrying out a temporal and epidemiological study about the coinfection by Tuberculosis and Human Immunodeficiency Virus (TB-HIV) in the state of Pará from 2010 to 2020.

The high number of contaminated adults reflects a prevalence in the economically active population. Considering these findings, it is a problem in the Brazilian socioeconomic field since this disease can ward off the worker from his sphere of work, affecting the income obtained through him, and it can, sometimes, be the only one in the residence (FARIAS et al., 2022; VITOR et al., 2023).

Aragão et al., carrying out the occurrence of tuberculosis registered in São Luís – MA, corroborate the findings described above. There were 2,306 cases in 378 residential districts. Therefore, the age gap with higher prevalence was between 20 and 34 years old, entering the gap found in this research. When analyzing tuberculosis in the city of Teresópolis over the last ten years, Motta et al. (2020) also found a higher prevalence in the economically active population, corroborating the findings of this study.

In the present study, it was not possible to identify information about income because of the absence of this variable in the database of DATASUS (Department of Informatics of the Unified Health System, in English). Nevertheless, education level was considered a socioeconomic indicator, as pointed out by Rosseto et al. (2019).

The clinical forms estimated in this study were: pulmonary, with a higher prevalence (82.2%), followed by extrapulmonary (13%). As well as a diagnosis with the combination of both (0.92%), is considered rare in the city of the study because its prevalence is lower than one percent. Such results corroborate the findings of Jesus et al. (2021) as they analyze the comportment of the situation of closures of reported tuberculosis cases and their pattern of morbidity and mortality in a municipality in the south of Bahia.

In this line, it is known that the pulmonary form is the most important on an epidemiological level, by its higher infectivity, so that it increases with the degree of positive sputum smear microscopy. Still, about this clinical form, it is known that it presents signs of

persistent, productive cough, low-grade fever, nighttime sweats, and weight loss (BLASCO et al., 2022).

In addition, the results of Santos et al. (2019), as they analyze the clinical and epidemiological profile of tuberculosis in Alagoas, also found a higher prevalence of the pulmonary form. This result reflects the fact that Mycobacterium tuberculosis is a strictly aerobic bacterium and finds in the lungs a high concentration of oxygen, an ideal accommodation condition (JUNIOR; ROCHA; SOARES, 2019).

When it comes to the area of residence, the urban zone presented high levels of prevalence, with 25% of the total. However, the higher index of the results went to “Non-filled/Ignored”, with 67%. According to Jesus et al. (2021), this scenario points to the incompleteness of notification sheet fields. A high index to this variable was also found in a study about the epidemiological profile of the dengue cases in São Luís, evidencing the same difficulty of the absence of data on the reporting of neglected diseases (ALVES et al., 2023).

5. CONCLUSION

The male population is more vulnerable to tuberculosis involvement in comparison to the female population. Moreover, socioeconomic factors contribute to its increased proliferation, being most common in areas with social inequity and lower schooling levels. Meanwhile, the present study points to a higher prevalence among those with complete high school.

The Brazilian population, because it was formed by a miscegenation process, has a greater self-declared tendency for moderate brown race; thus, the data confers more prevalence on the same. As for the most common clinical form, the pulmonary one is verified due to its greater infectivity, so it increases with the degree of positive sputum smear microscopy.

REFERENCES

ARAGÃO, Francisca Bruna Arruda et al. Análise epidemiológica da tuberculose em São Luís-MA. **Medicina (Ribeirão Preto)**, v. 53, n. 3, p. 252-259, 2020.

BLASCO, E. Ruíz et al. Tuberculosis extrapulmonar. Formas clínicas en pacientes en situaciones especiales. **Medicine-Programa de Formación Médica Continuada Acreditado**, v. 13, n. 53, p. 3088-3099, 2022.

BRUCE, Alexandre Tadashi Inomata. Variação espacial nas tendências temporais para incidência da tuberculose pulmonar e extrapulmonar concomitante em áreas de risco, Manaus (Brasil). 2021. Dissertação (Mestrado em Enfermagem em Saúde Pública) - **Escola de Enfermagem de Ribeirão Preto**, University of São Paulo, Ribeirão Preto, 2021. doi:10.11606/D.22.2021.tde-23052023-150000. Acesso em: 2023-07-27.

FARIAS, Alessandra Nunes et al. Epidemiologia da tuberculose e sua distribuição espacial na região metropolitana de Recife entre 2019 e 2020. **The Brazilian Journal of Infectious Diseases**, v. 26, p. 101980, 2022.

FORMIGOSA, Caio de Araújo Corrêa; BRITO, Caio Vinícius Botelho; NETO, Oscar Sampaio Mello. Impacto da COVID-19 em doenças de notificação compulsória no Norte do Brasil. **Revista Brasileira em Promoção da Saúde**, v. 35, p. 11-11, 2022.

FUKUNAGA, Rena et al. Epidemiology of tuberculosis and progress toward meeting global targets—worldwide, 2019. Morbidity and Mortality Weekly Report, v. 70, n. 12, p. 427, 2021.
JESUS, Giselle Adryane da Silva et al. Acompanhamento e situação de encerramento de casos de tuberculose notificados. **Rev. enferm. UFPE on line**, p. [1-16], 2021.

JÚNIOR, Claudio José; ROCHA, Thiago José Matos; SOARES, Valquíria. Aspectos clínicos e epidemiológicos da tuberculose em pacientes com HIV/aids. **Medicina (Ribeirão Preto)**, v. 52, n. 3, p. 231-238, 2019.

MOTTA, Luis Claudio; OLIVEIRA, Nathalia Corrêa Cardoso; BOMFIM, Samela Duarte Lima. “A TUBERCULOSE NO MUNICÍPIO DE TERESÓPOLIS: UMA INVESTIGAÇÃO EPIDEMIOLÓGICA DOS ÚLTIMOS 10 ANOS. **Revista da JOPIC**, v. 3, n. 7, 2020.

OLIVEIRA, Mara Sílvia Rocha et al. Perfil epidemiológico dos casos de tuberculose no estado do Maranhão nos anos de 2012 a 2016. **Revista Prevenção de Infecção e Saúde**, v. 4, 2018.

PEREIRA, Thamiris Vilela; NOGUEIRA, Mário Círio; CAMPOS, Estela Márcia Saraiva. Spatial analysis of tuberculosis and its relationship with socioeconomic indicators in a medium-sized city in Minas Gerais. **Revista Brasileira de Epidemiologia**, v. 24, 2021.

PRADIPTA, Ivan Surya et al. Risk factors of multidrug-resistant tuberculosis: A global systematic review and meta-analysis. **Journal of Infection**, v. 77, n. 6, p. 469-478, 2018.

PRADO Junior, José Carlos; MEDRONHO, Roberto de Andrade. Spatial analysis of tuberculosis cure in primary care in Rio de Janeiro, Brazil. **BMC Public Health**, v. 21, p. 1-15, 2021.

ROSSETTO, Maíra et al. Perfil epidemiológico dos casos de tuberculose com coinfecção HIV em Porto Alegre, Brasil. **Revista Brasileira de Enfermagem**, v. 72, p. 1211-1218, 2019.

SANTOS, José Gilmar Costa et al. Perfil clínico e epidemiológico da tuberculose em Alagoas de 2008 a 2017. **Revista Saúde e Desenvolvimento**, v. 13, n. 14, p. 35-48, 2019.

SILVA, Denise Rossato; MELLO, Fernanda Carvalho de Queiroz; MIGLIORI, Giovanni Battista. Efeitos da COVID-19 no controle da tuberculose: passado, presente e futuro. **Jornal Brasileiro de Pneumologia**, v. 48, 2022.

SILVA, Taynara et al. Análise temporal e epidemiológica da coinfecção Tuberculose-HIV no Estado do Pará, 2010-2020. **Revista Eletrônica Acervo Saúde**, v. 15, n. 2, p. e9844-e9844, 2022.

TAVARES, Clodis Maria et al. Tendência e caracterização epidemiológica da tuberculose em Alagoas, 2007-2016. **Cadernos Saúde Coletiva**, v. 28, p. 107-115, 2020.

TEIXEIRA, Amanda Queiroz et al. Tuberculose: conhecimento e adesão às medidas profiláticas em indivíduos contatos da cidade do Recife, Pernambuco, Brasil. **Cadernos Saúde Coletiva**, v. 28, p. 116-129, 2020.

VITOR, Pedro et al. Hiv/aids e sua principal coinfecção-tuberculose: panorama de uma década de um estado do nordeste brasileiro e suas semelhanças à sociodemografia subsaariana. **Arquivos de Ciências da Saúde da UNIPAR**, v. 27, n. 6, p. 2641-2660, 2023.

WORLD HEALTH ORGANIZATION et al. Global Tuberculosis Report 2021 [Internet]. Geneva: World Health Organization; 2021. 2022.