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Article

Tuberculosis in an endemic area in Bahia, Brazil: a decade trend analysis

Tuberculose em área endêmica na Bahia, Brasil: análise de tendência de uma década

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ABSTRACT: *Objective:* To describe the tuberculosis cases, based on clinical-epidemiological profile and geographic distribution, from 2010 to 2020 in an endemic area in Bahia, Brazil. *Method:* It was a study based on secondary data obtained of individual tuberculosis reporting forms from a reference center in Paulo Afonso municipality, Bahia, Brazil. Reported tuberculosis cases between 2010 and 2020 were included and submitted to statistical analysis and spatial distribution. *Results:* Among the 391 cases, 90.8% had a pulmonary form with a mean of 25.9 cases per 100,000 inhabitants in the historical series. Of all cases, 69.8% were male, 49.6% were aged between 31 and 59 years, mean age 43.4 ± 17.7 years, 62.1% were smear-positive and most of the cases were new (81.6%). At the end of TB treatment, 75.7% had a successful outcome (cured) and 48.8% patients received directly observed therapy. In the spatial distribution, we observed agglomerates in the insular and south macrozones in Paulo Afonso municipality. *Conclusion:* Tuberculosis remains a significant public health problem in the municipality, and measures to improve early diagnosis and treatment are crucial, especially following the onset of the COVID-19 pandemic, considering the epidemiological profile and spatial distribution of the disease.

KEYWORDS: Tuberculosis; Epidemiology; Geographic Information Systems; Temporal Trend; Health Information Systems.

RESUMO: *Objetivo:* Descrever os casos de tuberculose, com base no perfil clínico-epidemiológico e na distribuição geográfica, no período de 2010 a 2020, em uma área endêmica da Bahia, Brasil. *Método:* Estudo realizado a partir de dados secundários obtidos mediante consulta às fichas de notificação de tuberculose de um centro de referência no município de Paulo Afonso, Bahia, Brasil. Os casos notificados de tuberculose entre 2010 e 2020 foram incluídos e submetidos à análise estatística e distribuição espacial. *Resultados:* Dos 391 casos, 90,8% foram diagnosticados como tuberculose pulmonar, com média de 25,9 casos por 100.000 habitantes na série histórica. Do total de casos, 69,8% eram do sexo masculino, 49,6% tinham idade entre 31 e 59 anos, média de idade 43,4 ± 17.7 anos, 62,1% eram bacilíferos e a maioria dos pacientes foram categorizados como casos novos (81,6%). Ao final do tratamento da TB, 75,7% apresentaram um resultado bem-sucedido (curado) e 48,8% dos casos receberam terapia diretamente observada. Na distribuição espacial, observou-se aglomerados nas macrozonas insular e sul no município de Paulo Afonso. *Conclusão:* A tuberculose persiste como significativo problema de saúde pública no município e medidas para melhorar o diagnóstico precoce e o tratamento são essenciais, principalmente após a pandemia da COVID-19, considerando o perfil epidemiológico e a distribuição espacial da doença.

DESCRITORES: Tuberculose; Epidemiologia; Sistemas de Informação Geográfica; Tendência Temporal; Sistemas de Informação em Saúde.

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INTRODUCTION

Tuberculosis is a chronic infectious disease caused by *Mycobacterium tuberculosis* that usually affects the lungs and, in this case, it is referred to as pulmonary tuberculosis (PTB). However, it can affect other organs and systems and is referred to as extrapulmonary tuberculosis (EPTB)[1,2]. Although the EPTB accounts for only about 10% of all tuberculosis cases, its incidence increases in people living with human immunodeficiency virus (HIV), especially those severely immunosuppressed[2].

Even with treatment, tuberculosis is one of the main causes of death from infectious diseases. The second most important infectious agent, after the coronavirus disease 2019 (COVID-19). In 2021, an estimated 10.6 million individuals fell ill with tuberculosis worldwide[1]. In that same year, 71,870 new tuberculosis cases were notified in Brazil, corresponding to an incidence of 33.6 cases per 100,000 inhabitants, a decrease of 10.2% from the 37.4 cases per 100,000 inhabitants reported in 2019[3,4], probably because the underreporting caused by the COVID-19 pandemic[5].

Regarding the regional distribution, in 2021, the Northeast is the third region of Brazil with the highest number of new tuberculosis cases notified and whose incidence rate is 30.1 cases per 100,000 inhabitants. Of the nine Northeastern States, Bahia had an incidence rate 23.5 per 100,000 inhabitants, making it an important region in the control of tuberculosis[3].

Out of the 417 municipalities in Bahia, Paulo Afonso - the municipality of this study - stands out as one of the priority municipalities for tuberculosis, ranking 15th in terms of number of new cases between 2007 and 2020[6]. Furthermore, the region is vulnerable to several other infectious diseases, such as HIV and leprosy[7-9].

Although tuberculosis is a curable disease, late diagnosis and/or inadequate treatment increase its severity, which may be associated with higher mortality rates. It also raises the risk of transmission of infection and development of drug resistance. To reach tuberculosis elimination by 2035, it will be necessary to strengthen strategies for early diagnosis and management, which in turn require an active search for cases by primary healthcare systems, successful treatment outcomes, screening of household contacts for latent tuberculosis infection, and training of qualified health professionals for regional demands, and improve notification of cases. Furthermore, with the advent of the COVID-19 pandemic, planned strategic actions consistent with different local realities have become essential to reduce social inequities in the community and, thus, achieve more adequate results[1,2,10].

In view of these facts, epidemiological studies play a fundamentally important role, as they allow for the evaluation of health care facilities, identification of areas with a higher risk of disease occurrence, vulnerable groups, and ultimately, guide healthcare practice in the region for managing tuberculosis[10-12]. In addition, there is no data about the status of tuberculosis in Paulo Afonso municipality, which reinforces the relevance of the study and its potential contribution. Thus, the objective of this study was to describe the tuberculosis cases, based on clinical-epidemiological profile and geographic distribution from 2010 to 2020 in an endemic area in Bahia, Brazil.

METHODS

Type of study and setting

An observational and descriptive study was conducted using secondary data on tuberculosis cases collected from the Serviço de Dermatologia e Pneumologia Sanitária (SEDERPAS), located in Paulo Afonso, Bahia, during the period of 2010 to 2020.

The municipality is located approximately 471 km from the capital of the Bahia State with an approximate area of 1,544,388 km^2. Paulo Afonso is divided into rural and urban areas. The urban zone is subdivided into three macrozones named insular, northwest and south. The unit of analysis in this study is based on the division into census sectors provided by the Brazilian Institute of Geography and Statistics (IBGE), which represent mapping units collected in a systematic way and according to the national political-administrative division (Figure 1).

Figure 1 – Subdivisions of the urban area of the Paulo Afonso municipality into south, northwest, and insular macrozones, and their corresponding census sectors

Study participants

The study population refers to a set of records of tuberculosis cases attending in secondary health care (SEDERPAS). Since 2004 the National Tuberculosis Control Program (PNCT) has recommended the decentralization of services for Primary Health Care as an effective coping strategy of tuberculosis[2]. However, in Paulo Afonso municipality, all tuberculosis cases are still referred to SEDERPAS, which operates as an ambulatory care type that offers services such as clinical and laboratory assessment in prevention, passive case detection and active case finding; and provides medication for treatment.

As inclusion criteria, all tuberculosis cases notified from 2010 to 2020 in SEDERPAS were considered. Tuberculosis patients were defined by positive sputum smear microscopy, newly diagnosed by Ziehl-Neelsen staining and/or by criteria clinical/radiological tests for suspected tuberculosis confirmed by trial treatment. No exclusion criteria were used.

The study was approved by the Research Ethics Committee of the Centro Universitário do Rio São Francisco (UniRios) in Paulo Afonso, Brazil, with the number 4,858,939, according to Resolution no. 466/2012 of the Brazilian National Health Council.

Data collection

The data referred to tuberculosis patients were collected by consulting the Registration and Monitoring of Treatment of Tuberculosis Cases and the tuberculosis notification/investigation form by two trained researchers from August to September 2021 and tabulated in Excel® spreadsheet.

The variables of interest in study were age, gender, race/color, address, year of diagnosis, residential zone, education, clinical form, type of entry into the service, presence of comorbidities, chest X-ray, bacilloscopy (smear), sputum culture, type of treatment and treatment outcome. Furthermore, addresses of tuberculosis patients were also collected for the purposes of georeferencing. The addresses information was converted into geographical coordinates (latitude and longitude) using the Google Earth Pro tool. The cartographic bases and the census sector grids were obtained through the portal of the IBGE[13].

In addition, the incidence coefficient of tuberculosis was first calculated, considering the number of new cases in the numerator and the total population of the municipality per year (and multiplying by 100,000 inhabitants). The population data were extracted from IBGE.

Statistics analysis

The data were analyzed using GraphPad Prism 8.0 (GraphPad Inc., San Diego, CA) and geographical coordinates were georeferenced using QGIS 2.18 software. Categorical variables were described as relative (%) and absolute (n) frequency. The temporal trend of the incidence coefficients was analyzed by the segmented log-linear regression model using the Joinpoint Regression Program (US National Cancer Institute, Bethesda, MD, USA). The annual percent change (APC) and the average annual percent change (AAPC) were calculated with a 95% confidence interval (95% CI). The chi-square test was used to assess the association between categorical variables. The value of $p < 0.05$ was considered significant for all statistical analysis. To evaluate the spatial behavior of the tuberculosis cases, the kernel point density estimation was used, which allowed the verification of the presence of clusters of tuberculosis cases, also called clusters or "hot areas" and indicating vulnerable areas.

RESULTS

Trends in tuberculosis incidence

A total of 391 tuberculosis cases were reported including new cases, relapses, dropout, and others. Overall, the incidence rates based on the 319 new cases between 2010 and 2020 ranged from 16 cases per 100,000 inhabitants (in 2020) to 30.4 cases per 100,000 inhabitants (in 2010). Joinpoint regression models were fitted to identify any periods of significant change and these results are listed in Table 1. There were no statistical trends in the incidence of tuberculosis during the period. Analysis of the entire study period, although not significant, suggest a slight decline in the incidence coefficient with a mean rate of 25 cases per 100,000 inhabitants in the historical series. Furthermore, the slopes of both curves regarding the clinical form (%PTB, %EPTB) were non-significantly different since their confidence intervals were very wide.

Spatial distribution of tuberculosis cases

In the density distribution of the 391 total cases (all input types), 99 (25.3%) were excluded because of lacking/ignored and/or there was no detailing of the addresses for distribution analysis. Thus, for this analysis, 292 (74.7%) cases were georeferenced, allowing the visualization of well-defined clusters, highlighted by the red color, Figure 2. The high-density clusters were observed in the insular and south macrozones of the municipality urban area. It should be noted that in the southern macrozone, in its eastern portion, there was a cluster that corresponds to the location of Paulo Afonso's Penal Set, and which presents a considerable number of cases in the analyzed period (24 cases, corresponding to 6.1%) (Figure 2A).

Of the 292 georeferenced cases, 267 (91.4%) and 25 (8.6%) correspond to PTB and EPTB cases, respectively. Similarly, the highest density of PTB cases was identified in the insular and south macrozones (Figure 2B). Regarding EPTB, it has a sparser distribution, predominantly in the insular and northwestern macrozones (Figure 2C).

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Table 1 – Joinpoint regression analysis of the incidence (per 100,000 inhabitants) and clinical forms (%) by tuberculosis in Paulo Afonso municipality, Bahia, Brazil, 2010-2020 (N=319)

Indicator	Trend 1		Trend 2		Trend 3		AAPC (95% CI)
	Year	APC (95% CI)	Year	APC (95% CI)	Year	APC (95% CI)	
Incidence	2010-2014	-10.9 (-23.8 to 4.3)	2014-2018	12.4 (-12.4 to 44.1)	2018-2020	-19.4 (-51 to 32.5)	-4.2 (-12.8 to 5.4)
%PTB	2010-2014	-11.1 (-23.0 to 2.5)	2014-2018	12.7 (-10.1 to 41.3)	2018-2020	-23.8 (-51.5 to 19.7)	-5.2 (-13.1 to 3.3)
%EPTB	2010-2012	-48.8 (-95.5 to 485.3)	2012-2015	14.9 (-89.9 to 1,212)	2015-2020	27.3 (-26.1 to 119.5)	2.9 (-41.6 to 81.3)

APC: Average Percentual Change; AAPC: Average Annual Percentual Change; 95% CI: Confidence interval of 95%.

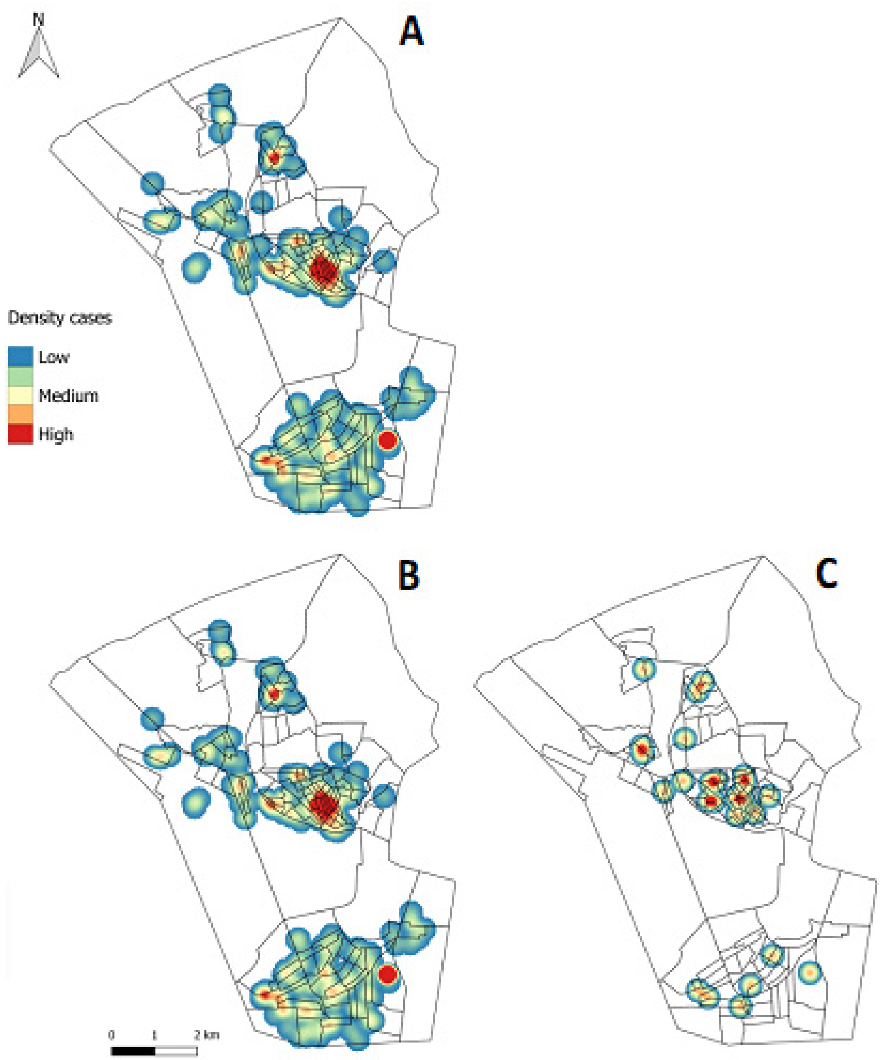

Figure 2 – Density distribution of tuberculosis cases diagnosed from 2010 to 2020 in urban area of Paulo Afonso municipality, Brazil. All (A), pulmonary tuberculosis (B) and extrapulmonary tuberculosis cases (C)

Evaluation of the frequency of tuberculosis in relation to sociodemographic and comorbidities

For this analysis, 391 cases were enrolled, that is, new cases, relapse, dropout and other, of which 355 (90.8%) presented PTB and 36 (9.2%) EPTB. The most frequent forms of EPTB observed were peripheral ganglion (n=14, 38.9%) and pleural (n=8, 22.2%). Of those 391 cases, 69.8% were male, 49.6% were aged between 31 and 59 years, mean age 43.4 ± 17.7 years, 69.1% declared themselves brown, 45.5% had primary education, and 85.2% lived in the urban area. There were no statistically significant differences in age, gender, race/color and zone among PTB and EPTB ($p > 0.05$). On the other hand, primary and complete high school education were more prevalent in PTB and EPTB, respectively ($p < 0.0001$; Table 2). Furthermore, alcoholism ($p = 0.009$) and smoking ($p = 0.039$) occurred frequently among patients with PTB (Table 3).

Table 2 – Sociodemographic characteristics of tuberculosis cases in Paulo Afonso municipality, Bahia, Brazil, 2010-2020

Variables	**PTB**	**EPTB**	**Total**	***p* value**
		n (%)		
N	355 (90.8)	36 (9.2)	391 (100)	
Age (years, mean ± SD)	43.6 ± 17.7	41.0 ± 17.9	43.4 ± 17.7	0.408
Age				
0-14 years	4 (1.1)	1 (2.8)	5 (1.3)	0.805
15-30 years	96 (27)	11 (30.6)	107 (27.4)	
31-59 years	177 (49.9)	17 (47.2)	194 (49.6)	
≥ 60 years	78 (22)	7 (19.4)	85 (21.7)	
Gender				
Female	103 (29)	15 (41.7)	118 (30.2)	0.129
Male	252 (71)	21 (58.3)	273 (69.8)	
Race/color				
White	74 (20.8)	9 (25)	83 (21.2)	0.574
Black	25 (7)	1 (2.8)	26 (6.6)	
Brown	246 (69.3)	24 (66.7)	270 (69.1)	
Other/ignored	10 (2.8)	2 (5.6)	12 (3.1)	
Zona				
Urban	306 (86.2)	27 (75)	333 (85.2)	0.158
Rural	28 (7.9)	6 (16.7)	34 (8.7)	
Ignored	21 (5.9)	3 (8.3)	24 (6.1)	
Education				
Illiterate	61 (17.2)	3 (8.3)	64 (16.4)	**<0.0001**
Primary	169 (47.6)	9 (25)	178 (45.5)	
Incomplete high school	20 (5.6)	2 (5.6)	22 (5.6)	
Complete high school	33 (9.3)	11 (30.6)	44 (11.3)	
Incomplete undergraduate	4 (1.1)	2 (5.6)	6 (1.5)	
Complete undergraduate	2 (0.6)	4 (11.1)	6 (1.5)	
Ignored	66 (18.6)	5 (13.9)	71 (18.2)	

PTB: Pulmonary tuberculosis; EPTB: Extrapulmonary tuberculosis.

Table 3 - Comorbidities of tuberculosis cases in Paulo Afonso municipality, Bahia, Brazil, 2010-2020

Variables	N	PTB n (%)	N	EPTB n (%)	Total n (%)	*p* value
Alcoholism	(340)		(32)			
Yes		75 (22.1)		1 (3.1)	76 (20.4)	**0.009**
No		265 (77.9)		31 (96.9)	296 (79.6)	
Diabetes	(339)		(33)			
Yes		42 (12.4)		2 (6.1)	44 (11.8)	0.401
No		297 (87.6)		31 (93.9)	328 (88.2)	
Mental disorders	(342)		(33)			
Yes		10 (2.9)			10 (2.7)	0.999
No		332 (97.1)		33 (100)	365 (97.3)	
Smoking	(165)		(15)			
Yes		56 (33.9)		1 (6.7)	57 (31.7)	**0.039**
No		109 (66.1)		14 (93.3)	123 (68.3)	
HIV/AIDS	(339)		(36)			
Yes		10 (2.9)		3 (8.3)	13 (3.5)	0.119
No		329 (97.1)		33 (91.7)	362 (96.5)	
Illicit drug use	(164)		(15)			
Yes		28 (17.1)		-	28 (15.6)	0.133
No		136 (82.9)		15 (100)	151 (84.3)	

PTB: Pulmonary tuberculosis; EPTB: Extrapulmonary tuberculosis; HIV: Human immunodeficiency virus; AIDS: Acquired immunodeficiency syndrome.

Clinical and laboratory characteristics

As for the clinical and laboratory characteristics, of the 391 total cases analyzed, there was a predominance of new cases (81.6%) with unknown/ignored sputum smear (89.2%), using directly observed therapy (48.8%), and who were cured (75.7%), according to clinical criteria. No significant difference was observed between PTB and EPTB in each characteristic described in Table 4 ($p > 0.05$). However, radiological findings compatible with active tuberculosis and normal chest X-ray were more prevalent in PTB and EPTB, respectively ($p < 0.0001$). The positive acid-fast bacilli (AFB) smear was more common in PTB while most cases of EPTB were unknown or not performed ($p < 0.0001$).

DISCUSSION

The municipality of Paulo Afonso, northeast of Bahia, is a tuberculosis endemic area whose mean incidence rate during the study period (25/100,000 inhabitants) was below the national mean from 2006 to 2015 (36.8/100,000 inhabitants)[14]. Meanwhile, the average incidence in the state of Bahia (2014-2019; 23.4/100,000 inhabitants) and other Bahia's municipalities as Guanambi (2008-2018; 11.7/100,000 inhabitants) were below the observed in this study[15,16].

The trend analysis showed no significant differences in the incidence rate of the tuberculosis during the period studied. This result confirms that tuberculosis still represents an important public health problem in Paulo Afonso municipality and, therefore, it is worth considering as an important area of uncontrolled tuberculosis transmission. It is worth noting that there was a slight decrease in pulmonary tuberculosis cases between 2010 and 2014, although this decrease was not statistically significant. However, no changes were observed in the local health service that could explain the decrease in tuberculosis cases. Globally, those decrease might be related, in part, to the introduction of ethambutol in 2009 and of the fixed-dose combination tablets, which could have increased patient adherence to treatment and consequently contributing to the reduction of the transmission rate[1].

In 2020, during the COVID-19 pandemic, the incidence rate was 20.3 per 100,000 inhabitants, representing a decrease of 52.2% compared to the previous year. This downward trend also occurred at the national, regional, and state levels, with drops of 15.5%, 9.6%, and 20.9%, respectively[3,4]. Notwithstanding this reduction was also observed in other diseases[17,18].

Table 4 - Clinical and laboratory characteristics of TB cases in Paulo Afonso municipality, Bahia, Brazil, 2010-2020

Variables	PTB	EPTB	Total	*p* value
	n (%)			
Type of entry				
New case	290 (81.7)	29 (80.6)	319 (81.6)	0.194
Relapse	24 (6.8)	-	24 (6.1)	
Dropout	17 (4.8)	2 (5.6)	19 (4.9)	
Other	24 (6.8)	5 (13.9)	29 (7.4)	
Chest X-ray				
Normal	2 (0.6)	14 (38.9)	16 (4.1)	**<0.0001**
Suspected tuberculosis	298 (83.9)	9 (25)	307 (78.5)	
Another pathology	1 (0.3)	-	1 (0.3)	
Unknown/not done	54 (15.2)	13 (36.1)	67 (17.1)	
Acid-fast bacilli smear				
Positive	243 (68.5)	-	243 (62.1)	**<0.0001**
Negative	81 (22.8)	11 (30.6)	92 (23.5)	
Unknown/not done	31 (8.7)	25 (69.4)	56 (14.3)	
Sputum culture				
Positive	14 (4)	-	14 (3.6)	0.431
Negative	26 (7.3)	2 (5.6)	28 (7.2)	
Unknown/not done	315 (88.7)	34 (94.4)	349 (89.2)	

PTB: Pulmonary tuberculosis; EPTB: Extrapulmonary tuberculosis.

The reasons for the global variation in infectious diseases reporting are associated with the emergence COVID-19 pandemic. Since the beginning of the health crisis, the tuberculosis control program has been affected by restrictions related to COVID-19. Thus, in addition to the provision of all control and diagnostic services being seriously compromised, the population's concern about the risk of moving to health centers and being exposed to the virus and/or the fear of being stigmatized given the similarity of the symptoms resulted in a large drop in the reported number of people diagnosed (under-reporting). In turn, the immediate impact of this underdiagnosis is an increase in mortality from the disease[1].

Regarding the georeferencing of tuberculosis cases, when evaluating the spatial distribution of other infectious diseases in the municipality, such as leprosy, similar patterns can be seen regarding the disposition of cases[7]. Similarly, the clusters were in close proximity in the same macrozones. Thus, the results show that the municipality maintains an overlap of high-risk areas for both leprosy and tuberculosis. Given that this co-occurrence, the integration of control activities regarding both these diseases should be considered.

According to Pang *et al.* (2019)[19] from the 20.534 tuberculosis cases inpatients in Beijing Chest Hospital, China, 62.6% had PTB, while 31.3% had EPTB, greater than triple than it was recorded in this study (PTB = 90.8%, EPTB = 9.2%). In contrast, in other studies conducted at other locations in Brazil, the frequency of EPTB reported was 14.5%, and 10%[20,21], similar values to those found in Paulo Afonso municipality. Peripheral ganglion (38.9%) was the most frequent type of EPTB in our study. This result is comparable with other studies, which have reported that ganglionic tuberculosis is involved in the majority of the EPTB cases[22,23].

Both PTB and EPTB showed a greater percentage of cases in men, 68.2% and 58.1%, respectively[19]. This was also evidenced in others studies[15,24]. Is it hypothesized that the reasons are related to social, economic and cultural factors, involving greater occupational exposure to the bacillus and poor self-care[25,26]. The majority of TB cases were in the 31- to 59-year age group, in both groups PTB and EPTB. These data are consistent with the results of other studies from Cuba and other municipalities in Brazil[24,27,28]. Although the role of race/color in tuberculosis is not yet clearly defined, tuberculosis involvement was reported to be more common among brown. This is because the race/color brown are the majority in Paulo Afonso's population and more likely to have tuberculosis risk factors that can increase the chance of developing the disease, such as low-level education as reported in our study[2,13].

In this study, there is a positive association between the prevalence of alcoholism and smoking and high rates of PTB. Corroborating to these findings, consumption of alcohol and smoking represent a higher risk of contracting tuberculosis[1,2]. Furthermore, radiographic findings compatible with tuberculosis and positive sputum smear microscopy were statically more frequent in PTB due to the pathological mechanisms related to the pulmonary involvement. It is known that a person with baciliferous tuberculosis case to be associated with a high sputum bacillary load and increased radiographic extent of disease[29]. On the other hand, EPTB was diagnosed using various diagnostic procedures, such as image exams (such as radiography, computed tomography, magnetic resonance imaging), analysis of bodily fluids, biopsy, among others[2,30].

In regard to the treatment outcome, the cure and treatment abandonment rate in tuberculosis patients were close to 76% and 8%, respectively, values which do not reach the goals that are recommended by the World Health Organization (WHO) and the Brazilian Ministry of Health, of higher or equal at 85% for cure and less than 5% for abandonment[9]. Other studies point to cure rates ranging from 40% to 67.8%, and abandonment from 6.7% to 21.7%[31-33]. It should be noted that both the WHO and the Brazilian Ministry of Health indicates the directly observed treatment (DOT) in order to reduce the number of cases of abandonment and increase adherence to treatment[2,34,35]. However, in the Paulo Afonso municipality this strategy was performed in only 48.8% patients; increasing DOT strategy may reduce the treatment dropout rate in the municipality.

The main limitation of this study was using secondary data, making it impossible to use other variables. Furthermore, 25% of the tuberculosis patients were removed in spatial distribution due to missing of address data. Lastly, the Paulo Afonso municipality still does not have access to real-time nucleic acid amplification technology for rapid and simultaneous detection of tuberculosis and rifampicin resistance (Xpert MTB/RIF)[36], being therefore considered only AFB smear microscopy and culture results. However, we hope that this study may contribute to its fields of knowledge, stimulating discussions among the region managers and health professionals, so that new goals for the control and future elimination of tuberculosis cases in the Paulo Afonso are achieved.

Finally, tuberculosis presents as an important and still persistent problem in the municipality of Paulo Afonso. It is important that the responsible sectors join efforts to improve the early diagnosis and effective treatment, especially after the COVID-19 pandemic, including screening, active search, prevention, and health promotion actions together with the local population. Thus, the decentralization of services with an active role of Primary Health Care is important for greater effectiveness of these actions.

In addition, areas with the highest number of cases should receive special attention, such as the penal complex of the municipality, which has a cluster of cases and confirms the need to support the early diagnostic by the implementation of Xpert MTB/RIF. In last case, the insertion of the municipality in a laboratory network that allows the establishment of sample flows may directly benefit the penal complex and help controlling the disease in the study region.

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