Time series of the health system dynamics for the diagnosis of tuberculosis in a metropolitan region of the Brazilian Northeast (2010-2020)

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ABSTRACT

Objective: To analyze the dynamics of the health system for the diagnosis of tuberculosis in a metropolitan region of a Northeast Brazilian state. **Methods:** Ecological time series study conducted in São Luís, Maranhão State, Northeast region of Brazil. The study population was composed of tuberculosis cases notified in the Notifiable Diseases Information System (SINAN) in the period from 2010 to 2020. The descriptive statistics of the cases was performed using absolute and relative frequency measures, and Pearson's Chi-square test was used to compare the frequencies between the cases notified in Primary Health Care (PHC) and hospital units and the sociodemographic and clinical characterization. For time series analysis, the Prais-Winsten autoregression model was used, followed by the decomposition method called Seasonal-Trend decomposition using LOESS (STL), ending with the time trend prediction for the next years. The data were analyzed using the resources of the computer programs named Stata, version 17 (StataCorp, College Station, TX, USA) and R, version 3.5.2 (R Core Team, 2020). **Results:** A total of 7,948 cases diagnosed with tuberculosis were notified, of which 1,608 were notified in Primary Care units and 6,340 in hospital units. The Chi-square test resulted in a relative frequency calculated considering the total number of patients who had results from each examination with statistically significant differences ($p < 0.05$). **Conclusion:** It was possible to observe different time trends between diagnoses performed by PHC and hospitals. In the time analysis and modeling, there was an increase in cases notified in PHC and stationary in hospitals; however, in the time modeling, there was a reduction in the number of cases in hospitals.

Descriptors: Public health. Tuberculosis. Time series studies.

INTRODUCTION

Tuberculosis (TB) is among the top 10 leading causes of death in the world and in Brazil, where 75,717 new cases of the disease were diagnosed in 2018. In turn, in 2019, the country recorded approximately 96 cases per 100,000 inhabitants[1,2]. The Northeast region was considered one of the Brazilian regions with the highest number of occurrences for this disease, including in this analysis the same conditions for the Maranhão State[1,3].

Early diagnosis is the main action for controlling the disease, and prevention is still the main basic strategy for eliminating TB in cases of first contact, reinfection or latent reactivation of the disease[4]. Contact tracing is important in terms of determining the primary source of the disease and identifying infected people for immediate treatment. In this regard, bacteriological and imaging examinations are essential for diagnostic confirmation[5,6].

As a strategy for strengthening TB prevention, it is essential to engage the individual for preventive treatment in cases of latent TB and ensure that programs are in line with their needs, improving the quality of care and, finally, even optimizing the participation on the part of patients in the treatment process by minimizing the number of visits they have with health professionals[7].

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Nationally, TB is considered a condition sensitive to Primary Health Care. Although the organization of health services is different in each region, it corresponds on average to a percentage of 71% of the population that depends on the Brazilian Unified Health System (SUS, as per its Portuguese acronym) and, consequently, on Primary Health Care (PHC), which most of the time is the entrance door that these people have to the service[8].

There is a proposed strategy for fighting TB (End TB Strategy) that aims to eradicate the disease by 2035 and is composed of three pillars: 1) joint patient-centered care and prevention, 2) policies and support systems for affected patients, and 3) intensified research and innovation. Each of these pillars brings together interventions focused on ensuring access to early diagnosis, treatment and prevention for all[9,10]. Knowledge about how TB diagnosis occurs makes it possible to identify untimely access to health care. Even with the limited role of health care delivery to the population, it is still a priority to understand the models of care delivery for better planning and orientation of health actions.

In light of the foregoing, this study aims to analyze the dynamics of the health system for TB diagnosis in a metropolitan region of a Northeast Brazilian state.

MATERIALS AND METHODS

Study design and site

Ecological time series study[6] conducted in the city of São Luís, capital of Maranhão State, Northeast region of Brazil.

São Luís has a demographic density of 1,328.5 inhab/km^2 and an estimated population of 1,108,975 inhabitants in 2021.

Data source and study population

The study population was composed of TB cases notified in the Notifiable Diseases Information System (SINAN, as per its Portuguese acronym) from 2010 to 2020.

As exclusion criteria, the study did not include notifications of diagnosed cases with addresses in other cities of the Maranhão State or those without a complete address on the notification form. In situations with duplicate cases, the most recent data entry was considered.

For time series analysis, the projections of population data extracted from the 2010 Census[7] were considered, as shown in Chart 1 below:

Chart 1
Population estimate from 2010 to 2020 in São Luís, Maranhão.

Year	Population
2010	1,014.837
2011	1,027.430
2012	1,039.610
2013	1,053.922
2014	1,064.197
2015	1,073.893
2016	1,082.935
2017	1,091.868
2018	1,094.667
2019	1,101.884
2020	1,108.975

Source: IBGE (2010).

Categorization of the study variables

After validation and standardization of the database, the cases were separated according to the unit of notification, categorizing them into two groups, PHC or hospital diagnosis. Subsequently, the cases were analyzed according to their sociodemographic characteristics: age and gender; and clinical variables: chest X-ray, form, sputum-smear microscopy, culture, histopathology, entry type, rapid molecular test, sensitivity test, supervised treatment and HIV.

For time series analysis, cases were quantified monthly for each year of study according to the location of TB diagnosis (PHC or hospital).

Data analysis

Descriptive statistics were performed using absolute and relative frequency measures. Pearson's

Chi-square test was used to compare frequencies between cases notified in PHC and hospital units and sociodemographic and clinical variables. Data were analyzed using the computer programs named Stata, version 17 (StataCorp, College Station, TX, USA) and R, version 3.5.2 (R Core Team, 2020).

For time series analysis, based on the number of cases and population projection, the monthly incidence rate of TB cases was calculated, according to its place of diagnosis performed in PHC or hospital.

The Prais-Winsten autoregression model was used to classify the time trend into increasing, decreasing or stationary, followed by the decomposition method called Seasonal-Trend decomposition using LOESS (STL), ending with the five-year forecast of the time trend (until 2025), using the R software forecast package.

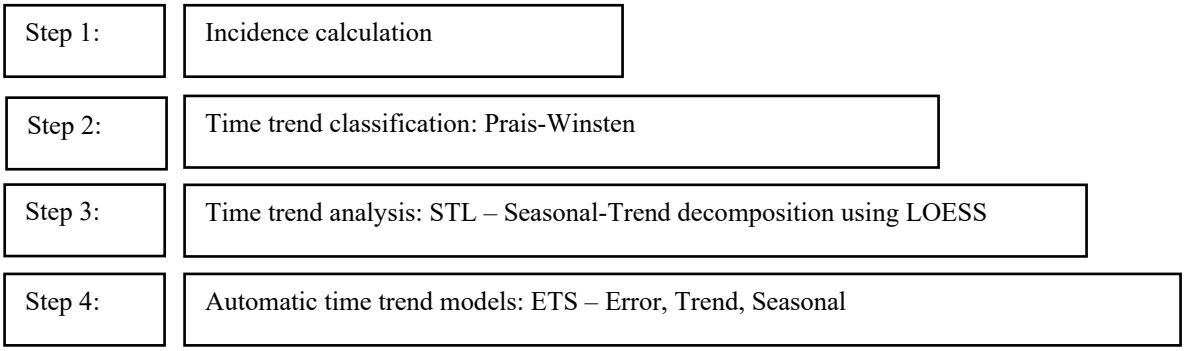


Figure 1: Time analysis flow.

Ethical aspects

The study was approved by the Research Ethics Committee (REC) of the Ribeirão Preto School of Nursing, under CAAE nº 08069319.5.0000.5393, issued on August 19, 2020, and the Certificate of Presentation for Ethical Appreciation, under Opinion nº 08069319.5.0000.5393.

RESULTS

Between 2010 and 2020, 7,948 cases were reported in São Luís, Maranhão. Of these, 7,948 cases diagnosed with TB were considered for this study, following the inclusion and exclusion criteria.

Most of the cases notified involved male individuals (65.0%), being 64.2% and 65.2% in the PHC and hospital units, respectively, and with a predominant age group between 30 and 39 years, with 23.2 and 24.0%, in these units, respectively, with a statistically significant difference (p=0.018) (Table 1).

Of the evaluated cases, most were recorded in hospital units (79.8%); and, of these, 83.8% are new cases. High prevalence also observed in PHC units (66.9%), with statistically significant distribution (p<0.001). Similarly, regarding the presence of HIV, which occurred in 13.4% of cases in hospitals and 10.5% in PHC units (p=0.004), and regarding the diagnosis of chest X-ray, where 95.4% of cases are derived from hospitals and 90.5% from PHC units are suspected, but a higher prevalence of normal cases is observed in PHC units (8.4%) and 4.0% in hospital units (p<0.001) (Table 2).

The other distributions did not show statistically significant difference (p>0.05), with the pulmonary form being the most frequent (85.6% in both PHC and hospital units), the rapid molecular test showing a predominance of sensitivity to rifampicin, with 75.5% in hospital units and 74.7% in PHC units, and the sensitivity test being the most sensitive in both types of units, with 91.4% and 80.5% in PHC and hospital units, respectively.

Table 1

Demographic distribution of notified TB cases in the city of São Luís according to type of health unity.

Variables	Total		Type of health unit				p
			PHC		Hospital		
	n	%	n	%	n	%	
Gender							
Male	5,164	65.0	1,033	64.2	4,131	65.2	0.491
Female	2,784	35.0	575	35.8	2,209	34.8	
Age group							
0–9 years	58	0.7	22	1.4	36	0.6	0.018*
10–19 years	136	1.7	31	1.9	105	1.7	
20–29 years	1,289	16.2	269	16.7	1,020	16.1	
30–39 years	1,893	23.8	373	23.2	1,520	24.0	
40–49 years	1,721	21.7	334	20.8	1,387	21.9	
50–59 years	1,336	16.8	262	16.3	1,074	16.9	
60–69 years	777	9.8	158	9.8	619	9.8	
70 years or older	721	9.1	152	9.5	569	9.0	
Ignored	17	0.2	7	0.4	10	0.2	
TOTAL	7948	100.0	1,608	20,2	6,340	79.8	

PHC = Primary Health Care.

Source: Authors (2023).

Absence of statistically significant difference (p>0.05) was also observed in relation to histopathology, with prevalence of positive BAAR results in 59.6% in PHC and 66.0% in hospital units, as occurred in the analysis of positive culture, with 60.1 and 59.5%, respectively in PHC and hospital units. Positive sputum-smear microscopy was predominant in 64.4% of PHC cases and 66.6% of hospital cases; and, in these units, the presence of supervised treatment was observed, 89.1% and 89.2%, respectively (Table 2).

Table 2

Distribution of the epidemiological and clinical investigation variables in the sample of notified TB cases according to the type of health unity.

Variables	Total		Type of health unit				p
			PHC		Hospital		
	n	%	n	%	n	%	
Entry type							
New case	5,752	72.4	1,073	66.9	4,679	73.8	<0.001*
Recurrence	631	7.9	249	15.5	382	6.0	
Re-entry after abandonment	716	9.0	103	6,4	613	9.7	
Transfer	173	2.2	43	2,7	130	2.1	
Post-death	643	8.1	135	8,4	508	8.0	
Do not know/Ignored	28	0.4	2	0,1	26	0.4	

Continue...

Table 2

Continuation.

Variables	Total		Type of health unit				p
			PHC		Hospital		
	n	%	n	%	n	%	
Form[1]							
Pulmonary	6,801	85.6	1,377	85.6	5,424	85.6	
Extrapulmonary	1,080	13.6	212	13.2	868	13.7	0.225
Pulmonary + extrapulmonary	67	0.8	19	1.2	48	0.8	
RMT[1]							
Sensitive to rifampicin	1,442	74.8	283	75.5	1,159	74.7	
Resistant to rifampicin	118	6.1	16	4.3	102	6.6	0.331
Not detectable	335	17.4	68	18.1	267	17.2	
Inconclusive	32	1.7	8	2.1	24	1.5	
Sensitivity test[1]							
Resistant to isoniazid	20	4.3	2	2.9	18	4.5	
Resistant to rifampicin	17	3.6	1	1.4	16	4.0	
Resistant to isoniazid and rifampicin	31	6.6	2	2.9	29	7.3	0.282
Resistant to other first-line drugs	16	3.4	1	1.4	15	3.8	
Sensitive	385	82.1	64	91.4	321	80.5	
HIV test[1]							
Positive	899	12.9	136	10.5	763	13.4	0.004*
Negative	6,090	87.1	1,165	89.5	4,925	86.6	
Chest X-ray[1]							
Suspected	6,740	94.5	1,213	90.5	5,527	95.4	
Normal	343	4.8	112	8.4	231	4.0	<0.001*
Other pathology	52	0.7	15	1.1	37	0.6	
Histopathology[1]							
Suggestive of TB	136	31.8	36	34.6	100	30.9	
Positive BAAR	276	64.5	62	59.6	214	66.0	0.306
Not suggestive of TB	16	3.7	6	5.8	10	3.1	
Culture[1]							
Positive	999	59.6	179	60.1	820	59.5	0.869
Negative	676	40.4	119	39.9	557	40.5	
Sputum-smear microscopy (diagnosis)[1]							
Positive	3,313	66.1	665	64.4	2,648	66.6	0.198
Negative	1,697	33.9	367	35.6	1,330	33.4	
ST/DOTS[1]							
Yes	420	10.8	95	10.9	325	10.8	
No	3460	89.2	775	89.1	2,685	89.2	0.919
TOTAL	7,948	100.0	1,608	20.2	6,340	79.8	

PHC = Primary Health Care. TB = Tuberculosis. HIV = Human Immunodeficiency Virus. RMT = Rapid Molecular Test. ST/DOTS = Supervised Treatment/Directly Observed Treatment. [1]Relative frequency calculated considering the total number of patients who had results of each test in SINAN. *Statistically significant differences ($p < 0.05$).

Source: Authors (2023).

For spatial analysis, the monthly incidence rate in PHC and hospital units was initially calculated, based on the population projection, where it was observed an average of 1.14 cases per thousand inhabitants in PHC units and 4.53 cases per thousand inhabitants in hospital units (Table 3).

Using the Prais-Winten technique, the time trend of TB incidence was classified as increasing in PHC units and stationary in hospital units from 2010 to 2020.

In the time modeling, the time trend of TB incidence is graphically observed, where it was possible to verify an increased rate of diagnosis in PHC units and a stationary trend in hospital units (Figure 2A – B), corroborating the results obtained with the Prais-Winsten analysis.

In the time trend prediction analysis, it was possible to observe a decreased rate in diagnoses both in PHC and in hospital units by the year 2025 (Figure 2C – D).

Table 3

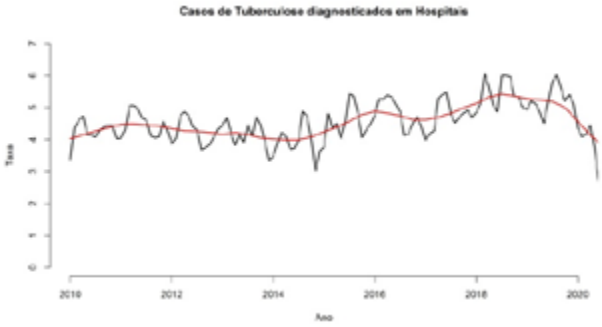
Number of cases and incidence of notified TB cases according to type of health unity.

YEAR	Nº of cases		Incidence (Average)	
	PHC	Hospital	PHC	Hospital
2010	145	525	1.19	4.31
2011	163	554	1.32	4.49
2012	105	517	0.84	4.14
2013	142	535	1.12	4.23
2014	116	494	0.90	3.86
2015	134	597	1.03	4.63
2016	120	631	0.92	4.85
2017	127	623	0.96	4.75
2018	163	707	1.24	5.38
2019	123	643	1.01	5.30
2020	270	514	2.02	3.86
Total	1,608	6,340	1.14	4.53

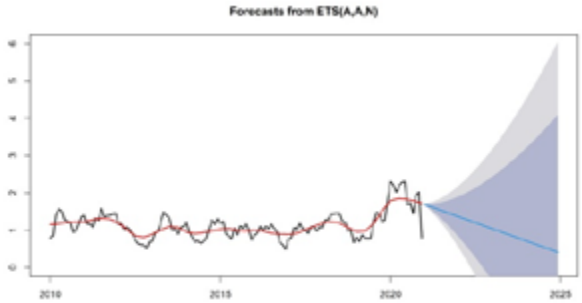
Source: Authors (2023).

A. Tuberculosis Cases – PHC

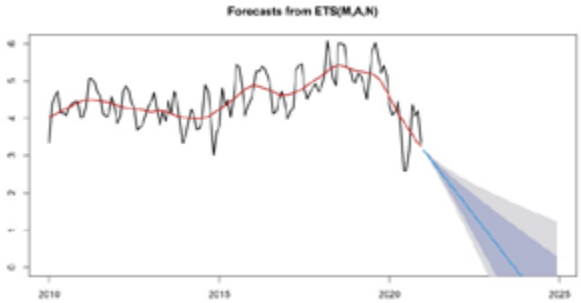
B. Tuberculosis Cases – Hospital



C. Diagnostic Prediction in PHC – 2021 to 2025



D. Diagnostic Prediction in Hospitals – 2021 to 2025



Source: Authors (2023).

Figure 2: Time analysis.

DISCUSSION

In the current study, it was found that TB diagnosis increased between 2010 and 2020 in PHC, while it decreased in hospital units.

In the analyzed records, most notifications were identified in the hospital units, although there was a high prevalence in the PHC units; and, of the verified cases that had the presence of HIV, the occurrences in the hospital and PHC units were also significant. The highest prevalence identified in this survey was in the diagnosis with X-ray, but the highest prevalence of normal cases was observed in PHC. The age group with the highest prevalence is between 30 and 39 years, predominantly men.

In the time analysis, there was an increasing trend in PHC units and a stationary trend in hospital units, as shown in the analysis of the health system dynamics for notified TB diagnoses.

As for the limitations of this study, facts must be considered that relate to the characteristic bias of time series studies, which is information bias, where the findings of this study cannot be interpreted or transferred casuistically to the individual level, since they are only representative for populations. In addition, for the determined sample, there is still the possibility of subnotification in the files that were accessed, either due to lack of sufficient information when filling out the forms or because of patients who did not seek care even when faced with symptoms.

Although SINAN operates comprehensively in terms of monitoring TB cases with quantitative and qualitative information used as a basis for calculating clinical, epidemiological and operational indicators, about 3.6 million cases escape notification of the system, and this occurs when some part of the cases are not diagnosed by the health units and/or when some cases that are diagnosed are not notified in the disease information system[11,12].

According to Silva et al.[11], the difficulties faced by the information system end up limiting the epidemiological analysis of TB cases in some parts of the country. Among other factors, this may occur because this phenomenon is related to the lack of understanding of health professionals in terms of filling out the forms that feed the system.

The age group identified with the highest prevalence was between 30 and 39 years old, and the identification regarding the predominance by gender was male. Studies show that the determinants associated with TB in relation to gender and age are distinct, for example, cases where alcoholism and abuse of other drugs are more predisposing in men[12,13], and they usually have more difficulty in terms of accessing treatment if compared to women[14]; in turn, women are more affected by stigmas[15].

With regard to gender, the literature points out that lifestyle habits, insertion and work routine, greater exposure to infectious and harmful agents are factors that make men more susceptible if compared to the opposite gender, where the lack of cooperation of the individual with himself/herself make him/her not adhere to preventive measures of protection against the disease, in order to reduce the clinical manifestations, thus explaining the gap with self-care, as well as little engagement with the care monitoring, in addition to the fact that they are of working age and assume the main responsibility for the family's financial support. All these factors together make diagnosis more difficult, thus making it more time-consuming and aggravating the symptoms, often making it impossible to reverse them[16,17,18,19,20].

Studies indicate that male individuals are more likely to trigger the disease; and, as they delay the identification of their installed clinical condition, they usually require hospitalization in more advanced stages, which explains the common discrepancy when the situation is compared with females, since they do not take care of their health with the same regularity as women, who always seek health services, thus becoming more exposed to risk factors and, even, having a higher frequency of treatment abandonment[21,22,23,24].

For this reason, the literature points out that there is a predominance in the detection of cases in males, and this rate may be related to behavioral factors, such as the fact that there is resistance in terms of seeking medical care as soon as symptoms appear, lack of priority because of working hours, difficulty of access to health services or even a lack of health policy focused on men, which undermines the information accessed by them[25,26].

This gender-related trend refers to the living conditions of patients, who usually have low income and low education, live in risky areas, with greater exposure to infectious and contagious diseases, poor nutrition and housing far from primary health services, making these men are more exposed to germs, with habits of consumption of alcohol, tobacco and illegal drugs[27,28,19,29].

Another issue to be considered is related to the socioeconomic and cultural aspects that corroborate the greater contamination of this part of the population and manifest themselves mainly because of the stigmas attached to the health-disease process and their greater reluctance to accept their state of illness, added to the belief of not getting sick and thinking they do not need care, even due to their lack of knowledge about the pathology[30,17].

According to the studies conducted by Martins et al.[29], the State identified, between 2017 and 2020, that TB affected people mainly in the age group that corresponds to 20 to 39 years old, followed by the age group between 40 and 59 years old, the age range of greatest productivity (20-60 years old). As for its clinical form, pulmonary tuberculosis was predominant in men, with 6,160 cases, against 3,048 in women. One of the biggest obstacles encountered was treatment abandonment, which could guarantee total cure[18,31,29].

The focus on this age group may be related to socioeconomic factors such as, for example, the exposure of these individuals to environments with greater movement of people and, consequently, greater risk of dissemination and contamination of the disease, as established by the Social Determinants of Health (SDH), based on the WHO definitions that points to social, economic, cultural, racial-ethnic, psychological, environmental and behavioral factors that end up influencing the occurrence of diseases with risk factors to the population, and these include age, gender, lifestyle, access to information, availability and supply of food, as well as access to health care services[2].

In the health services offered in São Luís, there are three strategic priorities for TB prevention and control: the identification and termination of treatment for people with active TB to process their status as non-infectious; tracing of people who have had contact with TB patients to identify whether they already have active TB or have been infected with *Mycobacterium Tuberculosis*; for children and other people at high risk; tracing, testing and treatment for people and populations at high risk of TB with latent infection[5].

There are a few reasons why most diagnoses are made in hospitals, one of them being the difficulty in terms of adhering to the therapeutic scheme, either because the patient has adverse reactions to the treatment, lack of support from the health service, the stigma of the disease, causing abandonment and discontinuation of the treatment, which results in its long duration, bacterial multiresistance, or psychological and social suffering of the patient. The fact is that patients who are notified in hospitals more often have a delay in diagnosis, comorbidities and higher rates of resistance to anti-TB4 drugs, which entails increased rates of unfavorable outcomes, either because of these mentioned factors or because of the severity of the cases, or even discontinuation of treatment after hospital discharge[32].

Although treatment in a hospital care unit provides greater surveillance of the treatment, facilitating the Directly Observed Treatment (DOT), the hospital infection control teams (CCIH) may face difficulties with the lack of resources, such as, for example, antibiotics, basic tests to continue the treatment and monitoring of remissions in more severe cases, and also technical and operational problems for the functioning of this dynamics[32].

Many factors that cause the worsening of the diagnosis in males in the hospital setting have been addressed, but the most aggravating is because this group is more exposed to risk factors, is more careless with its own health and does not seek care since the appearance of the first symptoms[19].

In TB cases in childhood that occur in the hospital setting, there are many difficulties faced by professionals when it comes to diagnosis, because it is a cycle where the lack of diagnosis leads to low suspicion, not to mention the low valuation of the child when contact networks are investigated. TB diagnosis in childhood is still very difficult, because it is only identified when there

are few symptoms, X-ray alterations, tuberculine festing (TF) and epidemiological history, although there are auxiliary forms of identification, such as tests (inflammatory activity tests, sputum-smear microscopy, cultures, molecular tests, antigen research, Interferon Gamma Release Assay [IGRA] and anatomopathological examination)[33].

There is still a barrier in terms of knowledge and professional practice that often derives from a lack of preparation when it comes to treating the pediatric universe in relation to TB, because practitioners still do not understand very well the specificities of these subjects. Moreover, there are still ethical or operational difficulties, which lead them to seek knowledge through treatment with adults, in order to be able to treat children, because, even when there are specific protocols and literature, they are often not properly consulted, and therefore this causes uncertainty both in the clinical treatment and in the look in relation to the child audience[33].

As for the diagnoses made in PHC and hospital units, sputum-smear microscopy, if done correctly, has a sensitivity of 50% and specificity of 80%, revealing great epidemiological importance, considering that the cases with positive sputum-smear microscopy are the most responsible for sustaining the transmission chain[1].

Among the rules validated in this study, the ones with the best performance for diagnosing pulmonary tuberculosis observed the most frequent pulmonary form (85.6% in both PHC and hospital settings). Among adults assisted in primary care, the use of X-ray images is more common, but sputum-smear microscopy still has some difficulty in terms of expediting early diagnosis, where the contribution of PHC in this regard is still incipient[34].

In turn, in the hospital setting, the hospital time for diagnosis is very important, especially in places with higher occurrence of TB cases, that is, if patients are diagnosed early in PHC, with sputum-smears and X-ray examinations, this information will alert physicians to possible more serious diagnostic difficulties, which may reduce cases where there is no real need for hospitalization[1,35].

The scope of the End TB Strategy, as mentioned earlier in this study, consists of a certain proposal for confronting this disease with the aim of eradicating the epidemic by 2035, and its goals depend on investments, innovations and political decision, consisting of care and prevention, policy to support those affected, as well as research and innovation[9,10].

Contextualizing with the Northeast Region, the predominance of TB cases consists of males, young adults, browns, with low education, with comorbidities, smoking habits and alcoholism, having the socioeconomic factor predominant for the disease, where health strategies should be reinforced in the prevention, early diagnosis and treatment of the disease. Furthermore, when observing the health services offered in São Luís, there are three strategic priorities for TB prevention and control: the identification and termination of treatment for people with active TB to process their status as non-infectious; tracing of people who have had contact with TB patients to identify whether they already have active TB or have been infected with *Mycobacterium Tuberculosis*; for children and other people at high risk; tracing, testing and treatment for people and populations at high risk of TB with latent infection[36,5].

Such service is carried out by primary health units. Currently, the reference in health care is held by the Fátima Health Center – SAE (as per its Portuguese acronym), where prevention is still the main basic strategy for the elimination of TB cases in situations of first contact, reinfection or latent reactivation of the disease, and contact tracing is important in terms of determining the primary source of the disease and identifying patients who are secondarily infected for immediate treatment. In this regard, it should be noted that imaging examinations that guide aspirations for biopsies and provide guidance for the therapeutic drainage of pathological fluid collections are essential[37,6,7].

As a strategy for strengthening the prevention of TB casees, the city of São Luís invests in campaigns such as the one on March 24, World Tuberculosis Day. The health education actions occur in partnership between the State (State Department of Health [SES] Epidemiology and Disease Control) and the Municipal Government of São Luís, where the Family Health Program has intensified the training in terms of strengthening the actions to fight against tuberculosis[38].

As for policy and support, there are many challenges intrinsic to combating TB in that State, as indicated to be addressed, national TB programs or their equivalents should always seek multisectoral engagement to establish an enabling policy and a planned environment for the development of national and local policies and standard operating procedures that can facilitate the implementation of the recommendations in these guidelines. This may include promotion of universal health coverage and prioritization of risk groups based on TB epidemiology, as well as the establishment of robust health care[39].

Regarding research and innovation, in a study conducted in Maranhão about the use of primary health care services in that State, according to the context of the implementation of the Family Health Program and its process in each territory, there are variables in the impact of this program on health indicators, added to the socioeconomic characteristics and public policies of each city. Nonetheless, in a study carried out in São Luís – Maranhão, the Family Health Strategy (FHS), in relation to the entrance door, was still not satisfactory, but the use of FHS services is still a priority to enter the SUS context[40,41].

When there is subnotification, it hampers the epidemiological surveillance of TB cases and, consequently, affects the allocation of resources and the planning of actions for its confrontation, thus undermining the real identification of the epidemiological situation of TB cases and the planning of actions for its control[11,24].

CONCLUSION

In the notifications of TB incidence rates in the Maranhão State between 2010 and 2020, in the time analysis, an expansion trend was observed in PHC units, but it remained stable in hospital units, without considerable increase. Nevertheless, the time modeling followed the same trend of increase in PHC units, but there was a decrease in hospital units.

In the investigated State, there must be effectiveness in the strategies focused on improving the control of the disease in question, in a way that truly allows the reduction of its dissemination and, therefore, the number of deaths caused by it.

For further research on the addressed topic, it is suggested that new studies be carried out with a larger sample, thus obtaining access to sufficient information regarding the proper filling out of patients' records by professionals, as well as information about patients who did not seek hospital care despite the manifested symptoms.

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