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Original Article

SPATIAL ANALYSIS OF TUBERCULOSIS DISTRIBUTION IN MANAUS, AMAZONAS

ANÁLISE ESPACIAL DA DISTRIBUIÇÃO DOS CASOS DE TUBERCULOSE EM MANAUS, AMAZONAS

ANÁLISIS ESPACIAL DE LA DISTRIBUCIÓN DE LOS CASOS DE TUBERCULOSIS EN MANAUS, AMAZONAS

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Objective: to analyze the epidemiological distribution of new cases of tuberculosis in the city of Manaus, Amazonas, identifying the neighborhoods with higher incidence in the period from 2009 to 2017. Method: analytical study of quantitative, ecological, retrospective and territorial approach, using secondary data from the epidemiological notification forms of the Notifiable Diseases Information System. Results: in the period from 2009 to 2017, 21,935 cases of tuberculosis were reported in Manaus, with an increase in the number of cases each year, except for 2016, in which there was a decrease compared to 2015, with an expressive increase of 14% the following year (2017), the largest in the studied period. Conclusion: the neighborhoods with the highest incidence of cases belong to the south, west and north regions of Manaus, Amazonas, and these regions are the most affected neighborhoods: Beta, Center, Colônia Oliveira Machado, Students, Morro da Liberdade, Raiz, São Lázaro and Vila da Prata.

Descriptors: Spatial Analysis. Tuberculosis. Epidemiology. Incidence. Epidemiologic Factors.

Objetivo: analisar a distribuição epidemiológica dos casos novos de tuberculose no município de Manaus, Amazonas, identificando os bairros de maior incidência no período de 2009 a 2017. Método: estudo analítico de abordagem quantitativa, ecológico, retrospectivo e de base territorial, utilizando dados secundários das fichas de notificação epidemiológica do Sistema de Informação de Agravos de Notificação. Resultados: no período de 2009 a 2017 foram notificados 21.935 casos de tuberculose em Manaus, verificando-se aumento no número de casos a cada ano, exceto no ano de 2016, em que houve decréscimo em comparação a 2015, com aumento expressivo de 14% no ano seguinte (2017), o maior no período estudado. Conclusão: os bairros de maior incidência de casos pertencem às regiões sul, oeste e norte de Manaus, Amazonas, e destas regiões, os bairros mais afetados são: Bêtania, Centro, Colônia Oliveira Machado, Educandos, Morro da Liberdade, Raiz, São Lázaro e Vila da Prata.

Descritores: Análise Espacial. Tuberculose. Epidemiologia. Incidência. Fatores Epidemiológicos.

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Objetivo: analizar la distribución epidemiológica de los nuevos casos de tuberculosis en el municipio de Manaus, Amazonas, identificando los barrios de mayor incidencia en el período 2009 a 2017. Método: estudio analítico de enfoque cuantitativo, ecológico, retrospectivo y territorial, Utilizando datos secundarios de las fichas de notificación epidemiológica del Sistema de Información de Enfermedades de Notificación. Resultados: en el período de 2009 a 2017 se notificaron 21.935 casos de tuberculosis en Manaus, comprobándose un aumento en el número de casos cada año, excepto en el año 2016, En el que hubo una disminución en comparación con 2015, con un aumento expresivo del 14% en el año siguiente (2017), la mayor en el período estudiado. Conclusión: los barrios de mayor incidencia de casos pertenecen a las regiones sur, oeste y norte de Manaus, Amazonas, y de estas regiones, los barrios más afectados son: Beta, Centro, Colonia Oliveira Machado, Educandos, Morro da Liberdade, Raíz, San Lázaro y Vila da Prata.

Descriptores: Análisis Espacial. Tuberculosis. Epidemiología. Incidencia. Factores Epidemiológicos.

Introduction

In the data released in 2022, by the World Health Organization (WHO), 10.6 million people fell ill with tuberculosis (TB) in 2021, registering an increase of 4.5% (10.1 million) compared to the previous year [2020], and with 1.4 million deaths estimated due to this disease[1]. TB is an infectious and transmissible disease that primarily affects the lungs, but can affect other organs and systems, has cure and its treatment has a minimum time of six months, offered free of charge by the Unified Health System (UHS)[2-4].

Considered a global public health problem, the WHO has created End Tuberculosis Global Strategies by 2035. Brazil has joined these strategies, launching the National Plan for the End of Tuberculosis as a Public Health Problem, which provides ways of coping with this disease according to criteria established by the WHO[1-3]. This plan is based on three pillars, in which each pillar presents objectives and strategies aimed at achieving the desired goals. The pillars are: prevention and integrated care focused on the person with tuberculosis; bold policies and support system; intensification of research and innovation[3-4].

In Brazil, in the year 2022, 68,754 new cases of TB diagnosed and 16,561 retreatments initiated were reported, with an incidence coefficient of 36.3 cases per 100,000 inhabitants and a mortality rate of 2.38 deaths per 100,000 inhabitants. There is variability between national and state indicators, these even had higher incidence coefficients than the national coefficient, as in the case of Amazonas, in which the incidence rate in the same year was 84.1 cases per 100,000 inhabitants and, in its capital, Manaus, was 115.8 cases per 100,000 inhabitants, that is, 36.3 and 79.5 times higher than the national rate, respectively. It also differs in the percentage of treatment abandonment, with a national average of 12.7%, while in Amazonas it was 16.1% in treatments started in 2020[5-6].

The geographic space is a substrate of the health-disease process. Knowing its organization and modifications allows a better understanding of the epidemiology of diseases and conditions, as well as their process in different populations. Based on the geographical space, it is possible to study the spread of diseases using geoprocessing techniques and spatial data analysis, allowing the interpretation of diseases and their dynamics in a locality, neighborhood, municipality, state or country[7-8].

Geoprocessing is defined as the manipulation of spatially referred information through computational techniques, allowing the mapping of diseases and planning health actions, to minimize their negative impacts on the population. The use of software and geographic information systems (GIS) are increasingly used by health services to obtain information, such as programs of epidemiological surveillance of diseases, contributing in their studies and actions for the creation of more effective health policies, providing support for state intervention in preventive actions

aimed at reducing morbidity and mortality from communicable diseases such as TB[7-9].

Given the current panorama of the incidence rate of TB in the state of Amazonas, as well as the mortality coefficient of 3.6 per 100,000 inhabitants, one of the highest in the country, it is extreme important to perform this study. The geoprocessing of TB is a technique that can contribute to the planning of health services, being a resource that allows improvement, This study favors the production of information that can be used in executive and managerial decision-making by managers to facilitate the control and monitoring of TB. This article aimed to analyze the epidemiological distribution of new cases of tuberculosis in the city of Manaus, Amazonas, identifying the neighborhoods of greater incidence in the period from 2009 to 2017.

Method

Analytical study of quantitative, ecological, retrospective and territorial approach using secondary data. An analytical ecological study is understood as the one in which the unit of observation is a group of people and not the individual, allowing the comparison of the occurrence of disease/condition related to health and exposure of interest among aggregates of individuals (populations of countries, regions or municipalities) to verify the possible existence of association between them[10-11].

In this study, the observation units were the regions of the city of Manaus, located in the Northern Region of Brazil, capital of the state of Amazonas, located at 03º06'07"S latitude and 60º01'30"W longitude. As one of the most populous capitals in the federation, Manaus has its region organized into seven zones: north, south, center-south, east, west, midwest and rural[12-13].

Data collection was performed from the epidemiological notification sheets of the Notifiable Diseases Information System (SINAN), made available by the Municipal Health Department. This information refers to the address of the cases of tuberculosis residing in Manaus, from 2009 to 2017.

The inclusion criteria were TB cases reported in the years 2009 to 2017 and that contained in the epidemiological notification form the correct address with the three necessary information for the georeferencing: neighborhood, street and house number. The cases reported with incorrect address and the notifications from rural areas of the city were excluded. The data was processed using the program Microsoft Office Excel, 2016.

For georeferencing, spatial distribution and map elaborations, the program Google Earth, 2018 was used. The georeferencing of individual cases reported in the period from 2009 to 2017 used the following information: neighborhood, street and house number. In addition, using the program Qgis, version 3.4.12, the spatial distribution of georeferenced cases was carried out, being necessary the map of the city of Manaus in digital format, Brazilian Institute of Geography and Statistics (IBGE).

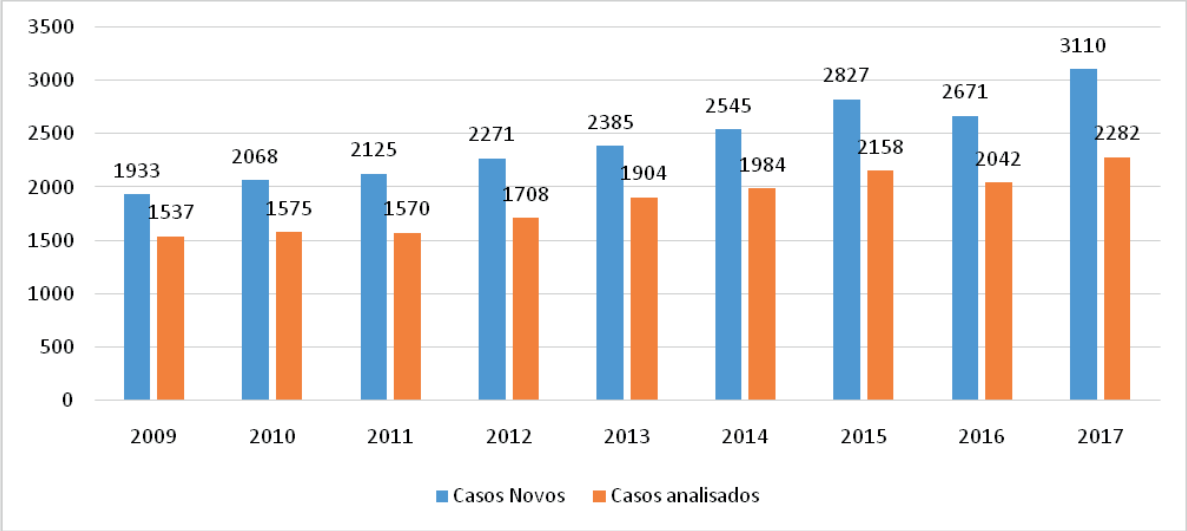
Thus, the distribution of cases by neighborhoods was carried out, identifying the number of reported cases in each neighborhood. The spatial density patterns were sought, through spatial statistical analysis, in which, according to the smoothing technique, the Kernel intensity estimator is obtained[14], which allowed the elaboration of thematic maps and heat maps for each year from 2009 to 2017.

This study was approved by the Research Ethics Committee of the *Universidade Federal do Amazonas*, Certificate of Presentation for Ethical Appreciation (CAAE) n. 04710918.5.0000.5020, issued on December 20, 2018.

Results

In the period from 2009 to 2017, 21,935 new cases of tuberculosis were reported in Manaus, of which 5,175 (23.6%) were excluded because they did not meet the inclusion criteria (neighborhood, street and house number), remaining 16,760 new cases for analysis, as shown in Graph 1.

Graph 1 – New cases of tuberculosis reported and analyzed, according to the municipality of residence. Manaus, Amazonas, Brazil – 2009-2017



Source: created by the author.

Tradução da figura: blue - New Cases. orange - Analyzed cases.

Table 1 below details the differences in the number of TB cases reported per year, from 2009 to 2017, and those that actually had the necessary data (neighborhood, street and house number) for the analysis of the disease by region of the city of Manaus.

Table 1 – Total reported cases and cases present in the database. Manaus, Amazonas, Brazil – 2009-2017. (N=21,935)

Year	Notified cases	Cases analyzed in the database (notified with the information: neighborhood, street and house number)	
	n	n	%
2009	1933	1537	79.5
2010	2068	1575	76.1
2011	2125	1570	73.8
2012	2271	1708	75.2
2013	2385	1904	79.8
2014	2545	1984	77.9
2015	2827	2158	76.3
2016	2671	2042	76.4
2017	3110	2282	73.3
Total	21,935	16,760	76.4

Source: created by authors.

After georeferencing the cases per year, the spatial distribution of TB cases by neighborhoods of Manaus was performed (Table 2). These neighborhoods are distributed within the regions of the municipality, being 17 neighborhoods in the western region: Alvorada, Compensa, Da Paz, Dom Pedro I, Glória, Lírio da Vale, Nova Esperança, Planalto, Ponta Negra, Redenção, Santo Agostinho, Santo Antônio, São Jorge, São Raimundo, Tarumã, Tarumã-Açu and Vila da Prata.

There are 25 neighborhoods in the southern region: Adrianópolis, Aleixo, Betânia, Cachoeirinha, Centro, Chapada, Colônia Oliveira Machado, Crespo, Distrito Industrial I, Educandos, Flores, Japiim, Morro da Liberdade, Nossa Senhora Aparecida, Nossa Senhora das Graças, Parque 10 de Novembro, Petrópolis, Praça 14

de Janeiro, Presidente Vargas, Raiz, Santa Luzia, São Francisco, São Geraldo, São Lázaro and Vila Buriti.. With all these neighborhoods, the southern region has the largest population, 519,252 inhabitants, being administratively responsible for 65 Health Care Establishments.

The northern region covers 10 neighborhoods: Cidade de Deus, Cidade Nova, Colônia Santo Antônio, Colônia Terra Nova, Lago Azul, Monte das Oliveiras, Nova Cidade, Novo Aleixo, Novo Israel and Santa Etelvina. The eastern region covers 11 neighborhoods: Armando Mendes, Colônia Antônio Aleixo, Coroado, Gilberto Mestrinho, Jorge Teixeira, Mauazinho, Puraquequara, São José Operário, Distrito Industrial II, Tancredo Neves and Zumbi dos Palmares.

Table 2 – Spatial distribution of the number of reported tuberculosis cases by neighborhoods distributed by year. Manaus, Amazonas, Brazil – 2009-2017. (N=21,935) (continued)

N.	Neighborhood	Number of cases distributed by neighborhood and year								
		2009	2010	2011	2012	2013	2014	2015	2016	2017
1	Planalto	18	11	14	11	16	12	8	11	14
2	Ponta Negra	-	1	-	3	2	1	3	1	-
3	Nova Esperança	20	16	15	11	14	26	36	33	35
4	Lírio do Vale	17	19	20	18	22	23	29	23	30
5	Alvorada	44	46	54	53	81	70	77	55	83
6	Redenção	21	24	19	22	42	32	33	41	44
7	Da Paz	8	19	14	12	12	11	11	10	19
8	Raiz	25	25	29	23	19	27	21	20	31
9	Cachoeirinha	14	13	17	21	26	19	23	26	24
10	São Francisco	13	12	13	15	11	20	21	18	26
11	Praça 14 de Janeiro	14	17	9	19	15	8	6	10	8
12	Coroado	57	40	55	40	85	62	84	71	86
13	Educandos	25	27	25	31	32	31	42	38	42
14	Santa Luzia	11	5	9	9	5	6	13	7	13
15	Betânia	13	12	13	16	14	19	18	17	18
16	São Lázaro	21	19	17	10	16	14	12	17	14
17	Morro da Liberdade	25	27	20	18	22	31	27	19	22
18	Petrópolis	47	39	39	45	56	40	50	49	54
19	Centro	58	51	59	64	63	71	57	74	73
20	Nossa Senhora Aparecida	7	6	12	13	10	10	9	10	10
21	Presidente Vargas	17	10	14	5	9	13	4	10	10
22	São Raimundo	30	23	22	15	26	16	28	15	21
23	Glória	12	26	19	17	14	10	11	6	9
24	Santo Agostinho	6	13	17	8	19	21	12	16	25
25	Vila da Prata	12	15	20	12	10	19	29	24	22
26	Santo Antônio	15	22	17	24	19	34	29	22	27
27	São Jorge	18	30	28	25	34	26	22	33	35
28	Chapada	6	2	2	8	8	2	3	5	4
29	São Geraldo	12	8	9	9	6	7	10	8	7
30	Dom Pedro	15	21	11	21	7	17	16	14	14
31	Colônia Oliveira Machado	13	26	18	12	27	19	23	23	23
32	Vila Buriti	1	1	-	1	-	-	-	-	1
33	Mauazinho	31	27	23	27	24	30	34	26	37
34	Adrianópolis	5	3	2	15	11	6	11	8	4
35	Aleixo	13	12	15	21	17	18	17	21	25
36	Colônia Santo Antônio	12	10	10	13	14	17	14	20	15
37	Novo Israel	17	19	21	14	16	23	23	19	24
38	Colônia Terra Nova	22	33	27	46	39	38	72	47	67

Table 2 – Spatial distribution of the number of reported tuberculosis cases by neighborhoods distributed by year. Manaus, Amazonas, Brazil – 2009-2017. (N=21,935)

(conclusion)

N.	Neighborhood	Number of cases distributed by neighborhood and year								
		2009	2010	2011	2012	2013	2014	2015	2016	2017
39	Santa Etelvina	20	18	18	18	36	31	37	39	29
40	Nossa Senhora das Graças	22	12	5	12	11	15	10	8	14
41	Monte das Oliveiras	27	23	25	52	34	39	39	36	54
42	Armando Mendes	32	27	32	19	27	28	42	41	44
43	Zumbi dos Palmeiras	28	28	3	35	37	32	40	32	52
44	Tancredo Neves	42	30	38	50	36	53	61	55	67
45	Crespo	8	16	12	17	20	19	25	17	18
46	Distrito Industrial I	4	1	3	7	8	7	3	1	2
47	Tarumã	15	19	30	16	33	37	39	42	36
48	Tarumã-açu	5	4	4	4	5	8	9	18	8
49	Japiim	49	65	49	47	44	41	51	49	68
50	Parque 10 de Novembro	24	19	24	28	29	20	28	22	28
51	Flores	23	35	26	50	30	32	45	54	47
52	Compensa	98	118	124	72	121	130	148	124	115
53	São José Operário	61	81	59	48	82	80	90	72	57
54	Gilberto Mestrinho	38	28	25	32	53	50	60	60	58
55	Jorge Teixeira	77	75	96	114	108	110	131	124	136
56	Colônia Antônio Aleixo	25	24	17	15	23	32	24	35	42
57	Novo Aleixo	56	69	65	86	79	105	85	94	129
58	Nova Cidade	12	32	27	31	38	29	37	45	37
59	Puraquequara	2	2	3	2	1	5	2	4	2
60	Lago Azul	3	-	-	2	2	17	14	12	11
61	Distrito Industrial II	1	2	3	3	2	3	2	6	3
62	Cidade de Deus	38	34	46	72	57	83	68	69	76
63	Cidade Nova	112	83	108	129	125	128	129	116	133

Source: created by the authors.

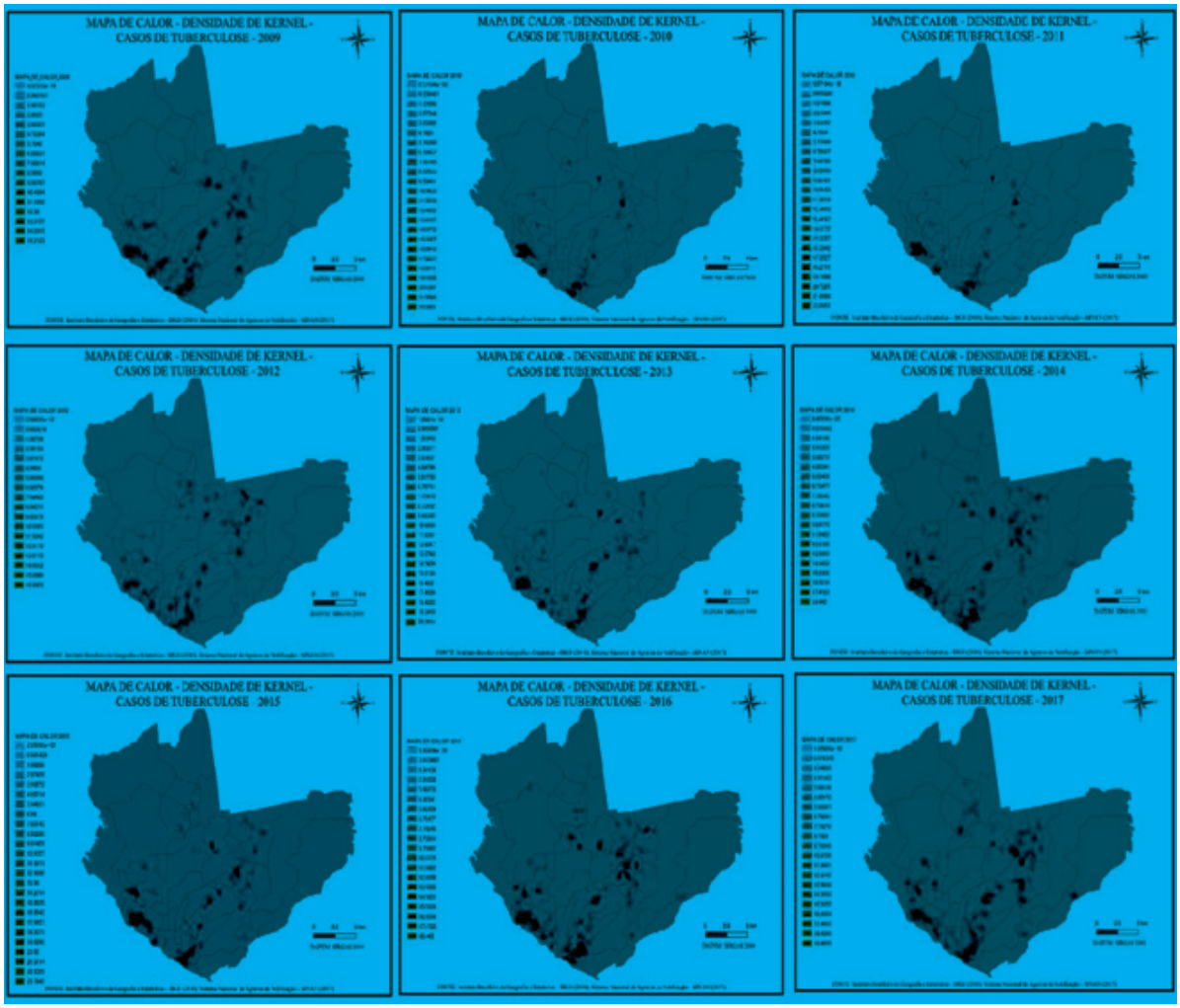
Note: Conventional sign used:

- Numeric data equal to zero not resulting from rounding.

When analyzing the cases by sex in 2009, 61.20% of the cases correspond to males and 38.8% to females. Cidade Nova was the neighborhood that presented the highest number of cases notified, followed by Compensa, Jorge Teixeira, São José Operário, Centro, Cororado; the neighborhoods of Distrito Industrial II and Ponta Negra did not have reported cases. It is noteworthy that in 2017 there was an increase in cases, but the difference between the sexes remained, with 63.65% of cases corresponding to males and 36.35% to females. Jorge Teixeira remained as the neighborhood that presented the largest number of cases notified, followed by Cidade Nova, Novo Aleixo, Compensa, Coroado, Alvorada, Cidade de Deus, Centro, Japiim, Tancredo Neves; the neighborhood of Vila Buriti did not report any cases this year.

After the spatial distribution of TB cases, it was possible to elaborate heat and density maps of Kernel, estimating and identifying the regions of the city that presented the highest incidence of TB cases from 2009 to 2017 (Figure 1).

Figure 1 – Heat and Kernel Density Maps of tuberculosis cases living in Manaus, Amazonas, Brazil – 2009-2017



Source: Brazilian Institute of Geography and Statistics [13].

The heat and density maps of TB cases, from 2009 to 2017, according to the regions of the city of Manaus, showed that the higher density of cases of this disease in three zones remains: south, west and north. Of these regions, specifically, the most affected neighborhoods in the city that presented higher intensity of reported cases were the neighborhoods: Bêtania, Centro, Colônia Oliveira Machado, Educandos, Morro da Liberdade, Raiz, São Lázaro and Vila da Prata.

There was an increase in the number of cases per year. Only the year 2016 showed a decrease compared to 2015, but in the following year, 2017, there was an increase of 14% in notifications, the largest in the period studied.

Discussion

TB is a serious global public health problem, and Brazil is one of the countries with the highest number of cases in the world. In the Amazon region, the state of Amazonas and its capital Manaus have the highest incidence rate in the country, making this state priority in the political agenda for the implementation of the National Plan for the End of TB until 2035, through the execution of surveillance, detection, notification, appropriate and timely diagnosis and treatment, with case monitoring through the analysis of information systems data[1].

By means of information systems, which provide reliable information, it is possible to

describe the epidemiological aspects, in addition to monitoring and evaluating the performance of health programs and service management, provision of care services linked to diseases of importance in public health[14-16].

When analyzing the epidemiological reality of the city of Manaus by SINAN, in the period from 2009 to 2017 (Table 1), there were cases reported (21,935) and present in the database (16,760). This difference occurs due to inadequate completion of notification forms, mainly due to data not being filled in or filled out incorrectly, generating incompleteness of data in the system databases[17-19].

The incompleteness of the TB case data in Brazil was also identified in another study of the country's microregions with higher TB cases by SINAN, emphasizing that this can occur due to problems in three different phases of the care line: access to the health system, inadequate diagnosis of TB and inadequate filling of the notification in the information system[17].

Analyzing the historical series of incidence coefficient of Manaus in the period from 2009 to 2017, and comparing with the data of the current Epidemiological Bulletin of Tuberculosis of 2023, the number of notifications by states in 2022, it is observed that the incidence coefficient of Amazonas (84.1 cases per 100,000 inhabitants) remains the highest, The ratio is much higher than in Brazil (36.3 cases of TB per 100,000 inhabitants). When reported by capital, Manaus has the highest incidence rate (115.8 cases of TB per 100,000 inhabitants), a situation that has increased over time, despite the underreporting of cases[5].

It is noteworthy that, due to the COVID-19 pandemic, TB notifications decreased worldwide due to the preventive and restrictive measures adopted to contain the virus, added to the similarity between TB and COVID-19 symptoms, which may have interfered in the proper clinical management of both diseases. The great social impact contributed further to the underreporting in the systems, due to the difficulties encountered by both the population with TB access to health services, as the failure in diagnosis[2,18].

In the national and regional data, the disparity in the performance of states in TB control is highlighted, which further reinforces the emphasis of the National Plan for the End of Tuberculosis. In the detailed analysis of epidemiological contexts and prioritization according to the characteristics of the scenarios and subscenarios of each territory, the urgency of a timelier online database is further highlighted. Despite the monitoring strategies developed through SINAN, Laboratory Environment Manager (LEM) and Special Tuberculosis Treatment System (SITE-TB), there is the absence of more timely reporting tools and case monitoring has become increasingly necessary[20-22].

Studies conducted on the proportion of data incompleteness of drug-resistant tuberculosis (DR-TB), based on the data from GAL and SITE-TB, also show divergence of data, proving data by inadequate filling of the variables. It is noteworthy that the incompleteness of data affects the notification that did not evolve positively, remaining evident the considerable proportion of records without information (data ignored or blank), which compromises the role of SINAN in supporting strategies for monitoring TB in public health[17,19].

This context affects the maintenance of the TB transmission chain and the increase in primary resistance, resulting in overloading the health system, to which these patients will return with worsening of the condition and reduced chances of cure[17,19-20].

The prevalence of males (greater than 60%) in all years analyzed is highlighted as a relevant data in the analysis of TB cases in the city of Manaus. This datum is similar to other studies conducted in several regions of Brazil, where new cases of TB were more frequent in males[20-21]. International studies also corroborate these results[22-23].

The literature justifies the difference in the incidence of TB between the sexes, affecting more the male sex than the female, explaining that men have less concern and care for their health and, therefore, they are more predisposed to infections. Moreover, the disease

is associated with the living conditions of the patient. Generally, they are individuals of low income, who perform professional activities equivalent to the level of education they have, do not eat properly, live in risk places, which often do not have basic services[21-23].

The neighborhoods that presented the highest incidence rates of TB cases in Manaus were: Cidade Nova, Compensa and Jorge Teixeira. These neighborhoods also presented a higher number of cases associated with a troubled process of irregular land occupation, urban segregation and low income[24].

It is noteworthy that the neighborhoods with higher incidence of TB cases have population density at a medium level and low level of verticalization. Studies[24-25] indicate that as important as individual characteristics, population density represents a risk of TB illness. Furthermore, the thematic maps identify the neighborhoods with higher incidence of TB cases, but do not identify the regions that have higher incidence in each neighborhood. Such identification is possible by producing heat maps, estimating the density and identifying the regions of the city and neighborhoods with a higher incidence of TB cases[14,24].

The heat maps show not only the neighborhoods with higher incidence of TB cases, but also the specific regions of each neighborhood in the city of Manaus. In addition, it is possible to note that the points where they present greater intensification of reported cases are in the western and southern regions of the city, in the neighborhoods Bêtania, Centro, Colônia Oliveira Machado, Educandos, Morro da Liberdade, Raiz, São Lázaro and Vila da Prata, neighborhoods with low population density and level of verticalization also low.

The study[26] carried out in the Amazon region also verified that the neighborhoods of the western and southern region of Manaus had a higher incidence of TB, with high death rates in the characteristics of this place, which favor this public health problem, the southern zone is the region where the oldest neighborhoods of Manaus and the main water port of the city are located, as well as concentrates the commercial activities related to the commercial center of the free zone. It is an area with high population density (286.4 thousand inhabitants), marked by unequal occupations and presence of pockets of poverty, with average income per inhabitant of 805.00 BRL, which may represent explanatory elements for the incidence and high distribution of deaths from TB in this scenario.

A study cites the insertion of research as a strategic component in the direction of policies to confront TB, an important tool that helps to identify and highlight potentially problematic areas that require greater intervention from the state[25]. Moreover, the studies highlight the increased risk of TB disease in regions with high population density, with large flow of people, public transport and precarious housing[22-28].

Although the results of this study are relevant, there were some limitations, which include the use of secondary data, which can lead to research bias due to gaps in some variables, and for only analyzing data from the city of Manaus. However, this study contributes to a spatial and temporal analysis that has been used as an important tool to assist in the process of understanding the complexity of TB. It brings advances in scientific knowledge by evidencing the relationship between disease and health inequities, especially in a complex scenario like Manaus, the leading capital city for TB incidence in Brazil. Furthermore, the results presented are aligned with other international productions, showing the relationship between social determinants and TB.

Conclusion

This work shows the distribution of TB cases in the city of Manaus, Amazonas, highlighting the neighborhoods and regions with higher incidence of cases: the south, west and north. From these regions, the most affected neighborhoods of the city that presented greater intensity of reported cases are: Bêtania, Centro, Colônia Oliveira Machado, Educandos, Morro da Liberdade, Raiz, São Lázaro and Vila da Prata.

Many variables of mandatory or essential filling in SINAN are not filled, generating incomplete data, demonstrating a lack of knowledge and/or training of health professionals on the importance of correctly completing the notification form, this being one of the obvious causes for the low quality of the notifications, which enables an incomplete data analysis and does not reflect the total reality, making it difficult to make necessary interventions based on the reality of the data.

It is evident that, for the elimination of TB as a public health problem, this disease needs to be monitored and evaluated taking into account its spatial distribution with reliable data, essential for the elaboration of public policies aimed at the health of the population. Thus, its elimination overlaps the issue of new drugs and vaccines, but includes, above all, social determinants and their forces in the progression chain.

Collaborations:

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Competing interests

There are no competing interests.

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