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Tuberculosis in Brazil: consultations in primary health care in Brazil from 2015 to 2024

Abstract

Introduction: Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis, with a high morbidity and mortality rate in Brazil, reflecting a serious public health problem, in view of this, the World Health Organization recommends the organization and performance of services in the health promotion of the population, thus, Primary Health Care (PHC), being the gateway to the SUS, it is essential in epidemiological surveillance, early detection, and adherence to TB treatment.

Objective: to study the profile of TB consultations in PHC Health in Brazil from 2015 to 2024.

Results: TB consultations in PHC totaled n=68964 consultations, with a mean=6896.40 (±11132.6) and Coefficient of Variation (CV)=161.43%; Consultations with the identification of new cases resulted in n=45159 consultations, and n=23805 consultations were carried out with patients cured of tuberculosis under supervised treatment. As for gender, males predominate, representing 60% of the sample, and the age group from 30 to 34 with n=4783 had more consultations, followed by the age group from 20 to 24 with n=4740 consultations.

Final Considerations: In view of this, it was observed that Brazil has high rates of tuberculosis and the number of consultations in primary care, especially of new cases, but also of cured cases, leads us to the need for actions to prevent the disease, as well as the need to strengthen PHC in Brazil to the point of meeting the spontaneous demand that shows a growing trend of need for consultations of new cases and treated cases, but above all, in the fulfillment of one of its purposes that is still being exercised in an immature way, which is health promotion, aiming at the prevention of tuberculosis cases, given the importance of PHC in the control of epidemics, outbreaks and endemics, with emphasis on the control of infectious-contagious diseases in order to prevent the spread of diseases such as TB.

Keywords: tuberculosis, primary care, collective health

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Camila Carneiro dos Reis,[1] Luana Fontinele Silva,[2] Gleydstone Teixeira Almeida,[2] Bruna Cristina Cunha Leite,[2] Lucas Moura de Oliveira,[3] Walterdan e Silva Miranda,[2] Daniel Portela Aguiar da Silva,[2] Eduardo Gomes Ferreira,[2] José Carlos Gomes Patriota Neto,[2] Ana Carolina Ribeiro de Araujo e Araujo,[2] Almir José Guimarães Gouveia,[2] Consuelo Penha Castro Marques[2]

[1]Medicine, IESVAP- Instituto de Educação Superior do Vale do Parnaíba, Brazil
[2]Federal University of Maranhão, Medicine Course, Pinheiro, Maranhão, Brazil
[3]Medicine, Centro Universitár io FACID Wyden, Brazil

Correspondence: Consuelo Penha Castro Marques, Universidade Federal do Maranhão, Brasil, Tel (98) 99100-7752

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Introduction

Tuberculosis (TB) is an infectious disease caused by Mycobacterium tuberculosis, with a high morbidity and mortality rate in Brazil, reflecting a serious public health problem.[1] Transmission occurs through the air, through aerosols, mainly in precarious socioeconomic conditions, malnutrition and immunosuppression.[2,3] Despite the availability of diagnosis and treatment through the Unified Health System (SUS), its incidence in the country is still high, due to the difficulty of accessing health services in the country, low adherence to treatment and fewer diagnostic and treatment options in remote areas, such as in the North region.[4]

The World Health Organization (WHO) highlights the need for organization and performance of services in promoting population health. Thus, Primary Health Care (PHC), the gateway to the SUS, is essential for epidemiological surveillance, early detection, and therapeutic adherence to TB (Souza et al., 2020). Population health monitoring strategies in PHC allow the identification of respiratory symptoms, enabling early diagnosis through tests such as the Rapid Molecular Test (RMT-TB) or Xpert MTB/RIF test, sputum smear microscopy, and culture, among which the Rapid Molecular Test is highlighted in the literature as the best diagnostic alternative, with high sensitivity and overall accuracy, to analyze possibly infected patients who obtained an insufficient amount of sputum in the sample or negative sputum smear microscopy.[5–6]

Treatment in Brazil is provided free of charge by the SUS, with a minimum duration of six months, initially using four medications: rifampicin, isoniazid, pyrazinamide and ethambutol.[8] A cure is achieved when treatment is carried out following medical guidelines in full, for the entire required period, which requires monitoring to coordinate assistance and comprehensive care for the individual, with these demands being met by the PHC, given that it is the gateway to the SUS.[9,10]

Tuberculosis consultations that occur in Primary Care are highly relevant for initial care of the disease and as a preventive measure to stop the spread of TB among the population, understanding the socioeconomic parameters involved in the possible location of contagion and planning intervention actions in the community exposed to the focus of infection with risk of pathogen involvement, to avoid incidence of cases. In this perspective, this research aimed to study the epidemiological profile of tuberculosis consultations in Primary Health Care in Brazil from 2015 to 2024.

Methodology

An epidemiological, exploratory, cross-sectional and descriptive time-series study was conducted, covering the period from 2015 to 2024, with secondary data from the SUS information system, Brazilian Ministry of Health, called DATASUS, through TABNET-DATASUS, Outpatient Information System SIA/SUS.

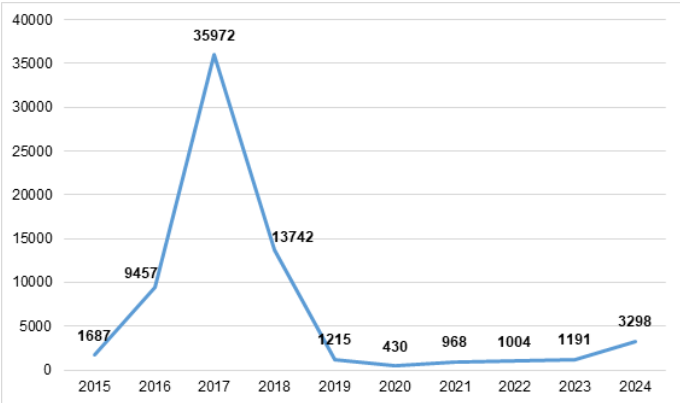
The following procedures were studied: 0301010021 Consultation with Identification of New Cases of Tuberculosis and 0301010013 Consultation with Patient Cured of Tuberculosis (Supervised Treatment). The variables studied were: tuberculosis, Brazil, region, year, procedure 0301010021 Consultation with Identification of New Cases of Tuberculosis, procedure 0301010013 Consultation with Patients Cured of Tuberculosis (Supervised Treatment), sex and age group, by place of residence.

The data were extracted from the DATASUS System, in the Health Care tab, outpatient production sub-tab (SIA/SUS), geographic scope: Brazil by region and federation unit, by place of residence. These data were exported to Excel and tabulated and graphs and tables were created. The Excel data were then exported to the Bioestat 5.3 program, which is a free statistical program available on the Mamirauá Institute for Sustainable Development platform, where the statistical study was performed and descriptive measures of central tendency were extracted. The results were expressed in absolute numbers and frequencies and presented in graphs and tables.

This study does not require submission and approval by a Research Ethics Committee, as it is a study with secondary data from a public and official SUS system, which provides epidemiological data on the Brazilian population, not allowing the extraction of individual data, therefore, without access to private information. Thus, it complies with the Brazilian resolutions on Human Research, based on Law n° 14.874 of 2024 and international legislation on human research, such as the Declaration of Helsinki (1964) and the Nuremberg Code (1949).

Results

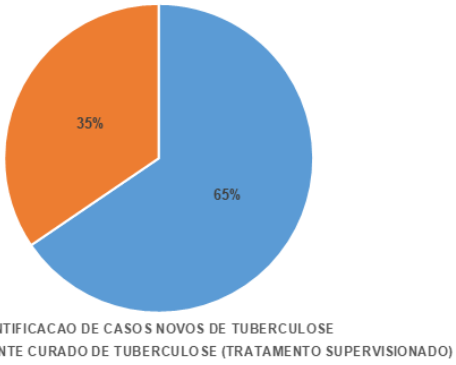
Primary Health Care in Brazil provides consultations to identify new cases of tuberculosis and consultations to patients cured of tuberculosis under supervised treatment, totaling n=68964 consultations, from 2015 to 2024. Consultations peaked in 2017 with n=35972 consultations and the lowest number in 2020, with n=430 consultations, resulting in an average=6896.40 (±11,132.6) and Coefficient of Variation (CV)=161.43% (Graph 1).



Graph 1 Distribution of consultation procedures to identify new cases of tuberculosis and consultations to patients cured of tuberculosis under supervised treatment, in Primary Care, in Brazil, from 2019 to 2024.

Source: Prepared by the authors, with data from the Ministry of Health - SUS Outpatient Information System (SIA/SUS), 2025.

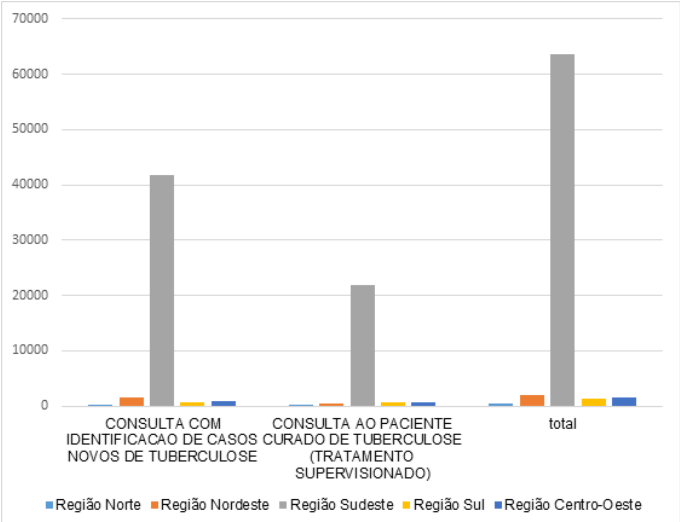
Regarding the distribution by type of procedure, the procedure of consultations with identification of new cases of tuberculosis in Brazil in the period under study totaled n=45159 consultations in PHC, and the procedure of consultation of patients cured of tuberculosis under supervised treatment in Brazil in this period, n=23805 consultations were carried out in PHC. This shows that the vast majority of TB consultations in PHC refer to new cases of this pathology (Graph 2).



Graph 2 Distribution of consultation procedures with identification of new cases of tuberculosis and consultation of patients cured of tuberculosis, in Primary Care, in Brazil, by region, from 2015 to 2024.

Source: Prepared by the authors, with data from the Ministry of Health - SUS Outpatient Information System (SIA/SUS), 2025.

Regarding the region (Graph 3), consultations with identification of new cases of tuberculosis predominated in the Southeast region with n=41821 consultations, equivalent to 93% of cases, the Northeast with n=1476 consultations, representing 3%, the Central-East with n=896 consultations of new cases equivalent to 2% and the South region with n=688, equivalent to 1% and the North with n=278 also with approximately 1%. In relation to cases of consultation of patients cured of tuberculosis in supervised treatment, the Southeast region predominated with n=21877 consultations, equivalent to 92% of cases, the South with n=652 equivalent to 3%, the Central-West with n=627 equivalent to 2%, the Northeast with n=438 equivalent to 2% and the North with n=211 consultations equivalent to 1%. Adding together consultations for new and cured cases of tuberculosis, the Southeast had n=63,698 (92%), the Northeast n=1,914 (3%), the Central-West n=1,523 (2%), the South n=1,340 (2%), and the North n=489 (1%), thus demonstrating the same frequency profile.



Graph 3 Distribution of consultation procedures with identification of new cases of tuberculosis and consultation of patients cured of tuberculosis, in Primary Care, in Brazil, by region, from 2015 to 2024.

Source: Prepared by the authors, with data from the Ministry of Health - SUS Outpatient Information System (SIA/SUS), 2025.

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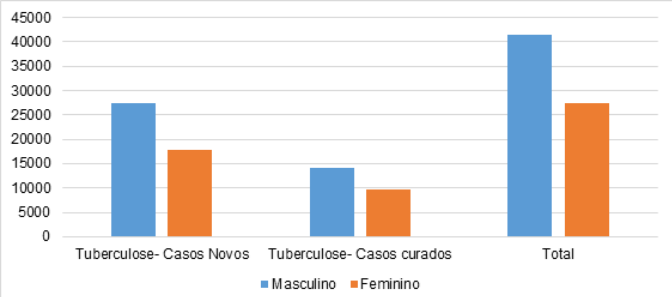
Regarding the distribution by sex (Graph 4), it can be observed that in relation to the total number of consultations for tuberculosis in Primary Care, the highest number occurred in males with n=41,484 consultations, equivalent to 60% and n=27,480 consultations for females, equivalent to 40%. Males predominated both for consultations of new cases of tuberculosis with n=27,329, representing 61% and for cured cases (under supervised treatment) with n=14,155, representing 59%. Females had n=17,830 consultations for new cases, representing 39% and for cured cases n=9,650, representing 41%.



Graph 4 Distribution of consultation procedures with identification of new cases of tuberculosis and consultation of patients cured of tuberculosis, in Primary Care, in Brazil, by sex, in the period from 2015 to 2024.

Source: Prepared by the authors, with data from the Ministry of Health - SUS Outpatient Information System (SIA/SUS), 2025.

Regarding the age group (Table 1), consultations of new tuberculosis cases in primary care were more frequent in Brazil, in general, in the age group of 30 to 34 years with n=4783 consultations, followed by 20 to 24 years with n=4740 consultations. In relation to the regions, variations were observed in terms of the age groups affected. In the Southeast region, there were more consultations with identification of new cases in the age groups of 20 to 24 years old with n = 4,606 consultations and from 25 to 29 years old with n = 4,029 consultations. In the Northeast region, the most affected age group was 15 to 19 years old with n = 963 consultations. In the Central-West region, it was 30 to 34 years old with n = 737. In the South region, the age group of 30 to 34 years old with n = 78 consultations was most affected. In the North region, more consultations were carried out with identification of new cases in the age group of 10 to 14 years old with n = 31 consultations.

Still in relation to the age group (Table 1), consultations for patients cured of tuberculosis (supervised treatment) in Brazil were more frequent in the age group of 25 to 29 years with n = 2695 consultations, followed by the age group of 20 to 24 years with n = 2518 consultations, in relation to the region, in the Southeast region the predominant age group was 25 to 29 years with n = 2501 consultations, followed by the age group of 20 to 24 years with n = 2378; in the Central-West region the age groups of 25 to 29 years with n = 94 consultations and of 30 to 34 years with n = 81 consultations predominated; in the South region more of these consultations occurred in the age group of 55 to 59 years with n = 60 consultations; In the Northeast region, the age group with the most consultations with cured patients was 45 to 49 years old with n=40 consultations and in the North region the predominant age groups were 25 to 29 years old with n=28 and 50 to 54 years old, also with n=28 consultations.

Table 1 Distribution of consultation procedures with identification of new cases of tuberculosis and consultation of patients cured of tuberculosis, in Primary Care, in Brazil, by age group, in the period from 2015 to 2024.

Region	North Region	Northeast Region	Southeast Region	South Region	Midwest Region	Total
Consultation with identification of new cases of tuberculosis						
Under 1 year	5	10	80	6	4	105
1 to 4 years	20	15	399	13	11	458
5 to 9 years	24	9	442	14	4	493
10 to 14 years	31	7	577	9	3	627
15 to 19 years	25	963	2544	47	4	3583
20 to 24 years	19	43	4606	56	16	4740
25 to 29 years	15	51	4029	55	18	4168
30 to 34 years	10	45	3913	78	737	4783
35 to 39 years	22	48	3974	49	11	4104
40 to 44 years	24	40	3441	63	18	3586
45 to 49 years	21	45	3586	45	11	3708
50 to 54 years	9	26	3561	61	21	3678
55 to 59 years	17	35	3367	51	20	3490
60 to 64 years	14	44	2904	49	5	3016
65 to 69 years	4	31	1872	35	9	1951
70 to 74 years	11	22	1062	26	2	1123
75 to 79 years	3	18	818	14	1	854
80 years and more	4	24	646	17	1	692
Consultation with a patient cured of tuberculosis (supervised treatment)						
Under 1 year	2	15	112	4	4	137
1 to 4 years	1	35	413	10	8	467
5 to 9 years	4	23	210	16	13	266
10 to 14 years	7	20	394	19	10	450
15 to 19 years	16	27	1362	41	18	1464
20 to 24 years	22	24	2378	48	46	2518

Citation: Reis CC, Silva LF, Almeida GT, et al. Tuberculosis in Brazil: consultations in primary health care in Brazil from 2015 to 2024. *MOJ Public Health.* 2025;14(1):116–120. DOI: 10.15406/mojph.2025.14.00480

Table 1 Continued.....

25 to 29 years	28	29	2501	43	94	2695
30 to 34 years	10	29	1900	58	81	2078
35 to 39 years	22	14	1987	41	27	2091
40 to 44 years	9	37	1629	40	55	1770
45 to 49 years	13	40	1698	58	40	1849
50 to 54 years	28	30	1890	45	46	2039
55 to 59 years	17	29	1647	60	60	1813
60 to 64 years	17	23	1395	57	23	1515
65 to 69 years	6	26	963	47	51	1093
70 to 74 years	3	17	545	28	18	611
75 to 79 years	2	10	518	20	15	565
80 years and more	4	10	335	17	18	384

Source: Prepared by the authors, with data from the Ministry of Health - SUS Outpatient Information System (SIA/SUS), 2025.

Discussion

As evidenced by Santos et. al.,[11] Brazil is among the 20 countries with the highest TB burden, a fact that reveals the great need for government action to reduce the number of individuals sickened by this pathology in the country. Thus, the Ministry of Health[8] developed the National Plan to End Tuberculosis as a Public Health Problem, with strategies for the years 2021 to 2025, based on three pillars: prevention and comprehensive care for people with TB, bold policies and support systems, and intensified research and innovation, so that these measures contribute to early diagnosis, associated with better adherence to treatment and maintenance of the social life of these citizens, linked to the search for therapeutic innovations that improve the quality of life and prognosis of patients and allow the reduction of TB epidemiological rates in Brazil.

In this context of tuberculosis epidemiology in the national territory, the data analyzed on outpatient TB treatment in PHC reveal a large variation in the number of consultations between 2015 and 2024. During the period under study, 68,964 consultations were observed, including new diagnoses and supervised treatments, with significant variation, which reflects the impact of external factors, such as the COVID-19 pandemic, which began in Brazil in 2020. This scenario reduced the search for primary care services and overloaded the health system, making it difficult to track and monitor tuberculosis cases in the country in subsequent years.[12,13]

To combat COVID-19, the Ministry of Health (MS) adopted the Non-Pharmacological Action Plan (PANF), which consisted of restricting the movement of people, closing public spaces and home isolation, with the aim of reducing the spread of the virus.[14] Although this strategy was essential to contain the advance of the pandemic, it had consequences for primary care, reducing the search for routine consultations and exams, in addition to human and material resources, which were allocated to controlling COVID-19.[12,13]

In 2017, in turn, there was the highest number of consultations for tuberculosis patients, which can be explained by changes in the National Primary Care Policy (PNAB) and the economic crisis faced that year.[15] Due to the financial recession, the National Congress approved a constitutional amendment that limited public spending to combat the crisis, directly impacting PHC.[15,16] In contrast, the 2017 PNAB provided greater flexibility for municipalities to reorganize services, which is associated with the increase in the volume of consultations motivated by the objective of guaranteeing municipal financing, amid the context of fiscal austerity.[16,17]

Regarding prevalence in Brazilian regions, the Southeast is the main region in terms of identifying new cases of tuberculosis, followed by the Northeast, Central-West, South and North. According to Carvalho Campos et al.,[18] in the period from 2013 to 2023, the regional distribution of tuberculosis cases was predominant in the Southeast, where 45% of confirmed cases are concentrated - linked to population density and greater urbanization, which favors the process of dissemination of the disease - followed, respectively, by the Northeast, South, North and Central-West. In this sense, the predominant identification of TB cases in the Southeast and Northeast regions is intrinsically related to the greater number of new cases in these locations.

Regarding cured patients, the Southeast region accounted for 92% of cases, followed by the South, Central-West, Northeast, and North regions with 2% of cases. In the research carried out by Cortez et al.,[1] during the years 2006 to 2015, the North region had the lowest average coverage of Primary Health Care, an aggravating factor for ensuring correct tuberculosis treatment, validating this region as the location with the lowest percentage of cured patients. This same study also points out that the South region had the lowest frequency of abandonment of tuberculosis treatment in the years 2006 to 2015, a pattern maintained from 2013 to 2023, which correlates with the highest rates of therapeutic success, as evidenced by this research.

Access to consultations and the diagnosis of new tuberculosis cases were more frequent among male individuals. Alves et al.[19] point out that, between 2015 and 2020, 72.36% of the cases studied occurred in men, which can be explained, in part, by the lower use of health services and greater exposure to risk factors. Furthermore, this vulnerability is also reflected in adherence to treatment, with 77% of cases of abandonment of tuberculosis therapy involving male patients, highlighting challenges in ensuring comprehensive care, due to the neglect of Brazilian men regarding health.[18]

Regarding the age group, the data found are in accordance with the literature and epidemiology of the disease, with the highest concentration of consultations in young adults, who are the most affected by the disease, regardless of the region, especially due to their insertion in the job market (intense working hours with often inflexible schedules that prevent consultations in PHC, since these operate during the same period that individuals are working), in addition to greater exposure to crowds due to lifestyle and difficulty in early access to health services.[20–22] Furthermore, Santos et al.[11] reveal in their study that the abandonment rate is higher in individuals aged between 15 and 59 years, and that this group is 3.32 times more likely to abandon treatment than the others.

The age distribution of consultations to identify new cases of tuberculosis varies significantly between regions, reflecting different socioeconomic contexts and access to health care. In the North region,

there is a higher concentration of cases in younger age groups, which may be linked to the socioeconomic vulnerability of the population and exposure to potentially contaminated environments, especially in indigenous communities and areas with difficult access to health services. The study by Ferreira et al.[23] shows that the indigenous population has a high prevalence of tuberculosis, especially in Brazilian Amazonian groups, which can be up to 20 times higher than that of the general population.

The Northeast, in turn, showed a significant peak in consultations between 15 and 19 years of age, suggesting an earlier onset of infection, potentially related to low vaccination coverage, which fell considerably between 2015 and 2020, with vaccination coverage of Bacillus Calmette and Guérin (BCG) - which protects against severe forms - falling by 31% in this period.[24] According to Cortez et al.,[1] other conditions, such as the low quality and effectiveness of health services, impact tuberculosis screening in the region, and imply difficulties in epidemiological control and in the implementation of strategies to combat the disease.

Final considerations

In view of this, it was observed that Brazil has high rates of tuberculosis and the number of consultations in primary care, especially of new cases, but also of cured cases, leads us to the need for actions to prevent the disease, as well as the need to strengthen PHC in Brazil to the point of meeting the spontaneous demand that shows a growing trend of need for consultations of new cases and treated cases, but above all, in the fulfillment of one of its purposes that is still being exercised in an immature way, which is health promotion, aiming at the prevention of tuberculosis cases, given the importance of PHC in the control of epidemics, outbreaks and endemics, with emphasis on the control of infectious-contagious diseases in order to prevent the spread of diseases such as TB.

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Conflicts of interest

The authors declare there is no conflict of interest.

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References

1. Cortez AO, Melo AC de, Neves L de O, et al. Tuberculosis in Brazil: one country, multiple realities. *Brazilian Journal of Pulmonology*. 2021;47:e20200119.
2. Santos FL dos, Souza LLL, Bruce ATI, et al. Patients' perceptions regarding multidrug–resistant tuberculosis and barriers to seeking care in a priority city in Brazil during COVID–19 pandemic: a qualitative study. *PloS One*. 2021;16(4):e0249822.
3. Ranzani OT, Rodrigues LC, Bombarda S, et al. Long–term survival and cause–specific mortality of patients newly diagnosed with tuberculosis in São Paulo state, Brazil, 2010–15: a population–based, longitudinal study. *The Lancet Infectious Diseases*. 2020;20(1):123–132.
4. Melo MC de, Barros H, Donalisio MR. Temporal trend of tuberculosis in Brazil. *Cadernos de Saúde Pública.* 2020;36:e00081319.
5. Rabelo JVC, Navarro PD de, Carvalho W da S, et al. Evaluation of the performance of primary health care services in tuberculosis control in a metropolis in southeastern Brazil. *Cadernos de Saúde Pública.* 2021;37(3):e00112020.
6. Rasool G, Khan AM, Mohy-Ud-Din R, et al. Detection of mycobacterium tuberculosis in AFB smear–negative sputum specimens through MTB culture and GeneXpert® MTB/RIF assay. *International Journal of Immunopathology and Pharmacology*. 2019;33:2058738419827174.
7. Brito GMX de, Thiago TM, Marcelo RA, et al. Diagnostic performance of the Xpert MTB/RIF assay in BAL fluid samples from patients under clinical suspicion of pulmonary tuberculosis: a tertiary care experience in a high–tuberculosis–burden area. *J Bras Pneumol*. 2021;47(2):e20200581.
8. Brazil. Ministry of Health. Health surveillance secretariat. department of chronic conditions diseases and sexually transmitted infections. Brazil free of tuberculosis: National plan to end tuberculosis as a public health problem: strategies for 2021–2025. Brasília, DF: Ministry of Health, Brazil. Ministry of Health. Tuberculosis 2021.
9. De Barros R, Aquino R, Souza LEPF. Evolution of the structure and results of primary health care in Brazil between 2008 and 2019. *Cien Saude Colet*. 2022;27:4289–4301.
10. Bertuol, Marilaine. Knowledge of family and community physicians regarding timely screening and initial management of chronic cardiovascular and kidney disease. Master's Dissertation, Post–Graduation in Family Health, Federal University of Health Sciences of Porto Alegre. Porto Alegre, 2021.
11. Santos DA da S, Marques ALA, Goulart LS, et al. Factors associated with treatment abandonment of pulmonary tuberculosis. *Cogitare Enfermagem*. 2021;26:e72794.
12. Hino P, Yamamoto TT, Magnabosco GT, et al. Impact of COVID–19 on the control and reorganization of tuberculosis care. *Acta Paulista de Enfermagem*. 2021;34:eAPE002115.
13. World Health Organization. *Global Tuberculosis Report 2021***.** Genebra: WHO; 2021.
14. Cabral ER de M, Bonfada D, Melo MC de, et al. Contributions and challenges of primary health care in the face of the COVID–19 pandemic. *Interamerican Journal of Medicine and Health*. 2020;3:1–12.
15. Giovanella L. Primary care or primary health care?. *Cadernos de Saúde Pública*. 2018;34(8):e00029818.
16. Melo EA, Mendonça MHM de, Oliveira JR de, et al. Changes in the National Primary Care Policy: between setbacks and challenges. *Saúde em Debate*. 2018;42:38–51.
17. Morosini MVGC, Fonseca AF, Lima LD de. National primary care policy 2017: setbacks and risks for the Unified Health System. *Saúde em Debate*. 2018;42(116):11–24.
18. Campos A de C, Lemus MC de S, Rodrigues N de MA, et al. Prevalence of tuberculosis treatment dropout by sex and age group in the Brazilian regions between 2013 and 2023. *Brazilian Journal of Health Review*. 2024;7(9):e75397–e75397.
19. Alves LF, da Cruz IL, Pio JVF, et al. Epidemiological aspects of tuberculosis in the Central–West region of Brazil: an ecological study. *Brazilian Journal of Health Review*. 2022:4085–4097.
20. Dhamnetiya D, Patel P, Prkash R, et al. Trends in incidence and mortality of tuberculosis in India over past three decades: a joinpoint and age–period–cohort analysis. *BMC Pulmonary Medicine*. 2021;21:1–14.
21. Oliveira MSR, Sousa LC, Baldoino LS, et al. Epidemiological profile of tuberculosis cases in the state of Maranhão from 2012 to 2016. *Infection Prevention and Health Journal.* 2020.
22. Tavares CM, Cunha AMS da, Gomes NMC, et al. Trend and epidemiological characterization of tuberculosis in Alagoas, 2007–2016. *Cadernos Saúde Coletiva*. 2020;28(1):107–115.
23. Ferreira TF, Santos AM Dos, Oliveira BLCA de, et al. Trend of tuberculosis in indigenous people in Brazil in the period 2011–2017. *Ciência & Saúde Coletiva*. 2020;25(10):3745–3752.
24. Nunes L. *Vaccination coverage in Brazil 2020*. Rio de Janeiro: Institute for Health Policy Studies; 2021.