



Temporal trend of tuberculosis in children under 15 years of age in the state of Paraná

Tendência temporal da tuberculose em menores de 15 anos no estado do Paraná
Tendencia temporal de la tuberculosis en menores de 15 años en el estado de Paraná

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ABSTRACT

Background and Objectives: Childhood tuberculosis is a neglected disease at a global level, and it remains invisible in the scientific literature. This study aims to analyze the temporal trend of tuberculosis in individuals under 15 years of age in the state of Paraná, Brazil. **Methods:** An ecological time series study conducted across the 399 municipalities of Paraná state. The population consisted of all reported cases of childhood tuberculosis (children under 15 years of age) registered in the Notifiable Diseases Information System from January 1, 2013, to December 31, 2022. The variables analyzed included age, sex, race/ethnicity, area of residence, type of case entry, clinical form, laboratory confirmation, sputum bacilloscopy, and case outcome. Descriptive statistical analysis was performed, including absolute and relative frequency calculations, along with time series analysis using the Prais-Winsten generalized linear regression method. **Results:** A total of 592 cases of childhood tuberculosis were reported. Among these, 194 (32.8%) were aged 10 to 14 years, 144 (24.3%) were under one year of age, 142 (24.0%) were aged one to four years, and 112 (18.9%) were aged five to nine years. The Prais-Winsten analysis indicated that the temporal trend remained stationary for all variables analyzed. **Conclusion:** The trend of childhood tuberculosis in Paraná is stationary, highlighting the need to strengthen TB control strategies within health services to improve case detection, diagnosis, and treatment.

Keywords: Child Health. Adolescent Health. Tuberculosis. Public Health. Time-Series Studies.

RESUMO

Justificativa e Objetivos: A tuberculose infantil é uma doença negligenciada em nível mundial que apresenta invisibilidade em relação a trabalhos científicos na área. Este estudo visa analisar a tendência temporal da tuberculose em menores de 15 anos no estado do Paraná. **Métodos:** Estudo ecológico de séries temporais, desenvolvido nos 399 municípios do Paraná. A população foi composta por todos os casos notificados de tuberculose infantil (idade menor que 15 anos) no Sistema de Informação de Agravos de Notificação, no período de 01 de janeiro de 2013 a 31 de dezembro de 2022. As variáveis incluídas foram a idade, sexo, raça/cor, zona de residência, tipo de entrada, forma clínica, confirmação laboratorial, baciloscopia de escarro e situação de encerramento. Utilizou-se a análise estatística descritiva e cálculo da frequência absoluta e relativa com aplicação de séries temporais e método de regressão linear generalizada de Prais-Winsten. **Resultados:** Foram notificados 592 casos de tuberculose infantil, destes, 194 (32,8%) casos tinham de dez a 14 anos, 144 (24,3%) tinham idade inferior a um ano, 142 (24,0%) de um a quatro anos e 112 (18,9%) de cinco a nove anos. Ao analisar a regressão de Prais-Winsten, identificou-se que a tendência temporal se apresentou estacionária para todas as variáveis de análise. **Conclusão:** A tendência da tuberculose infantil encontra-se estacionária no Paraná, evidenciando a importância da ampliação das estratégias de combate a TB nos serviços de saúde para detecção, diagnóstico e tratamento.

Descritores: Saúde da criança. Saúde do Adolescente. Tuberculose. Saúde pública. Estudos de séries temporais.

RESUMEN

Justificación y Objetivos: La tuberculosis infantil es una enfermedad desatendida a nivel mundial, que presenta invisibilidad en cuanto a la producción científica en el área. Este estudio tiene como objetivo analizar la tendencia temporal de la tuberculosis en menores de 15 años en el estado de Paraná, Brasil. **Métodos:** Estudio ecológico de series temporales, desarrollado en los 399 municipios del estado de Paraná. La población estuvo compuesta por todos los casos notificados de tuberculosis infantil (niños menores de 15 años) en el Sistema de Información de Agravamientos de Notificación, en el período del 1 de enero de 2013 al 31 de diciembre de 2022. Las variables incluidas fueron: edad, sexo, raza/color, zona de residencia, tipo de entrada, forma clínica, confirmación por laboratorio, baciloscopia de esputo y situación de cierre del caso. Se utilizó análisis estadístico descriptivo, con cálculo de frecuencias absolutas y relativas, y análisis de series temporales mediante el método de regresión lineal generalizada de Prais-Winsten. **Resultados:** Se notificaron 592 casos de tuberculosis infantil; de estos, 194 (32,8%) correspondían al grupo de 10 a 14 años, 144 (24,3%) eran menores de un año, 142 (24,0%) tenían entre uno y cuatro años, y 112 (18,9%) entre cinco y nueve años. Según el análisis de Prais-Winsten, se identificó que la tendencia temporal fue estacionaria para todas las variables analizadas. **Conclusión:** La tendencia de la tuberculosis infantil en el estado de Paraná se mantiene estacionaria, lo que resalta la importancia de ampliar las estrategias de combate a la tuberculosis infantil en los servicios de salud, con miras a mejorar la detección, diagnóstico y tratamiento oportuno de los casos.

Palabras Clave: Salud Infantil. Salud del Adolescente. Tuberculosis. Salud pública. Estudios de Series Temporales.

INTRODUCTION

Tuberculosis (TB) is an ancient disease and represents a serious public health problem at present, affecting different populations, including children.¹ In 2022, childhood tuberculosis reached 1.3 million children under 15 years of age, accounting for about 12% of all cases worldwide.² In 2023, 80,012 new cases of TB were notified in Brazil, from which 3.6% (3,409 cases) occurred in children under 15 years old. From those, 36.6% (1,248) were under five years old, 23.1% (789) from five to 10 years of age, and 40.2% (1,372) from 11 to 15 years old. In the state of Paraná, during the same period, 2,246 new cases of TB were notified, from which 77 (3.4%) occurred in children under the age of 15.³

Childhood TB in Brazil is a neglected disease. Despite of the treatment success being high (88%), it is observed a low detection rate in this age group, with an estimated 65% of cases undiagnosed, contributing to the maintenance of the disease cycle and the increase in the morbimortality.^{4,5} Therefore, it is important to improve the access to the health services, intensify the screening for the early detection of new cases and the immediate start of the treatment.

The effective treatment of childhood TB is paramount to halt the disease progression, to prevent unfavorable outcomes, and refrain the population from becoming reservoirs for the transmission of the disease. Besides that, the timely diagnosis of TB is a challenge for the health services since the symptoms are unspecific in the early stages of the disease in children. It is estimated that up to 50% of the cases can be asymptomatic in children.⁶⁻⁷

Childhood TB presents clinical specificities according to the age group. In children from five to 10 years old (school age), the predominant form is the bacillary or paucibacillary, while in children under the age of five, it is considered a sentinel event, reflecting the dissemination potential of the disease due to the contact with a bacillary adult patient.⁷⁻⁹ Thus, it is very important to carry out a rigorous assessment and to adopt effective strategies for the detection and the prevention of new cases.⁴

Furthermore, it is necessary that the healthcare professionals, especially nurses, are aware of the risk factors increasing the probability of infection or

progression from latent infection, or active disease in childhood TB. These factors are classified in three categories: 1) being born, or significant time spent in an endemic TB environment; 2) known exposure, or suspected TB, or high risk of exposure to TB; and 3) immunosuppression.⁶ The understanding and monitoring of these risk factors are essential for the development of interventions directed to the control of childhood TB, mainly in vulnerable groups.

Aiming to establish strategies for the containment and blocking the transmission of TB in the world, the World Health Organization (WHO) implemented the End TB strategy with the objective of developing measures to combat the disease, proposing an epidemiological elimination until the year 2035, with a reduction of 95% of the disease burden.⁸ Thus, the End TB strategy alerts for the risk of infection in children, especially those living in the 30 countries with higher burden of TB; Brazil is among them.

In a national level, the National Plan for the End of TB as a public health problem in Brazil was established in 2017. Among the strategies implemented with regard to the prevention and promotion of childhood TB it is worth mentioning vaccination, precise diagnosis and treatment, treatment compliance, contact tracing, and transmission control measures.⁹

In this context, the development of the present study is of great relevance for the scientific community in the sense of assuring the thematic visibility, considering the circumstances of the disease in children. Moreover, it incorporates the temporal trend, which contributes to the understanding of childhood tuberculosis' behavior in a territory. Therefore, our objective is to analyze the temporal trend of TB in individuals under the age of 15 in the state of Paraná, according to the classification previously established by the TB Epidemiological Report 2023 (*Boletim Epidemiológico da TB 2023*).³

METHODS

This is an ecological study of temporal series.¹⁰ This study was carried out in the 399 municipalities from Paraná state, which is divided in four health macro-regions, named East (with 93 municipalities), West (94 municipalities), North (97 municipalities), and Northwest (115 municipalities) (Figure 1).

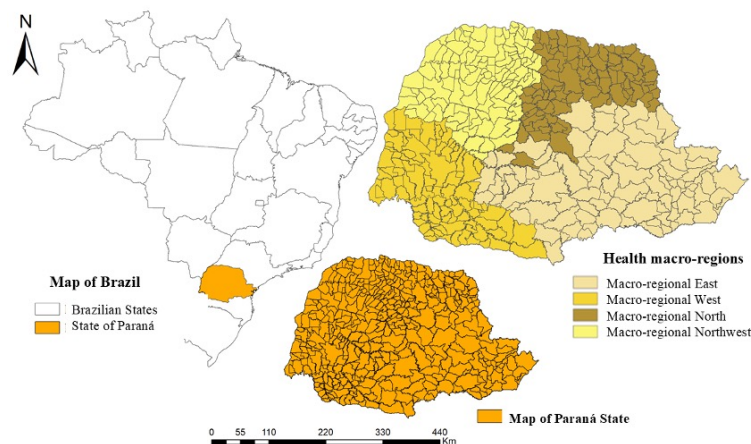


Figure 1. Map of the scenario in national, state and by health macro-region level. Bandeirantes – Paraná, 2023.

The territorial area of the state of Paraná is estimated to be 199,298,981 km², with a population of 11,444,380 people, from which 2,195,297 were under 14 years old, being 1,074,698 (55.8%) females, and 1,120,599 (44.2%) males, according to data from the Brazilian Institute of Geography and Statistics, 2022 (IBGE). The Human Development Index (HDI) for the year 2021 was 0.769, with an infant mortality rate of 9.46, and for those under five years old, 10.95.¹⁰

The study population included all confirmed childhood TB cases in the Notifiable Diseases Information System (*Sistema de Informação de Agravos de Notificação* - SINAN) from the Brazilian Ministry of Health, from 1 January 2013 to 31 December 2022.

Inclusion criteria used were patients under 15 years of age (up to 14 years, 11 months, and 29 days) at the time of diagnosis, both genders, and being a resident of the state of Paraná during the period of study. The cases with no information about the municipality of residency and those with change in diagnosis were excluded from the study. The child population was considered to include participants who corresponded to the age classifications pre-established by notification systems in Brazil, that is, children and adolescents aged from zero up to 14 years, 11 months, and 29 days, according to the terminology described in the TB Epidemiological Report 2023.³

Age group was considered the dependent variable, categorized as follows: under one year; one to four years; five to nine years; and 10 to 14 years. For data analysis, sociodemographic variables (sex, race/color, and area of residence) and clinical profile (type of entry, clinical form, laboratory confirmation, sputum bacilloscopy, and treatment outcome/closure status) were used. Laboratory confirmation was established by the combination of information available at the fields related to the case confirmation criteria “bacilloscopy” collected from the DATASUS/SINAN website.

The statistical analyses were divided into two stages. In the first, exploratory data analysis was conducted, including descriptive statistics and calculation of

absolute and relative frequencies using *Statistical Package for the Social Sciences*[®] software. (SPSS) version 20.0.

In the second stage, time series analysis was applied, consisting of a set of continuous observations sequentially over time.¹² This method aims to classify the temporal trend of the event during the study period as increasing, decreasing, or stationary. The time series statistics were calculated using STATA version 14, applying the Prais-Winsten generalized linear regression method. This procedure corrects for first-order temporal autocorrelation in organized time series analyses. The annual variation in the measure and its 95% confidence intervals (CI 95%) were also calculated.¹²

The temporal trend analysis utilized the Prais-Winsten generalized linear regression model, considering as independent variables (X – sociodemographic and clinical) the years evaluated (2013 - 2022) and as dependent variables (Y – the cases of childhood TB according to the age group - under one year; one to four years; five to nine years; and 10 to 14 years). To reduce the heterogeneity of residual variances in the temporal regression analysis, a logarithmic transformation (log₁₀) of the Y values was applied.¹³

Since this is a study based on public data (DATASUS/SINAN), available at <http://tabnet.datasus.gov.br/cgi/tabcgi.exe?sinanet/cnv/tubercpr.def>, there was no need for approval from the Research Ethics Committee with Human Beings, according to CNS Resolution No. 510 of 2016, which addresses research production and knowledge dissemination that are available without restriction to access by researchers and the general public.

RESULTS

During the period of study, 25,834 cases of TB were notified in the state of Paraná, from which 592 were childhood TB. As for the age group, 194 (32.8%) were 10 to 14 years old, 144 (24.3%) were under the age of one, 142 (24%) from one to four years of age, and 112

(18.9%) from five to nine years of age. Upon analyzing the sociodemographic characterization, there was a predominance of the male sex (66.7%), white race/color (64.6%) for those under 1 year of age, and urban

residence (37.6%) for the age group between 10 and 14 years, 11 months, and 29 days (Table 1).

Table 1. Sociodemographic characterization of childhood TB, stratified by age group, Paraná state, from 2013 to 2022.

Variables	<1 year	1 to 4 years	5 to 9 years	10 to 14 years	Total
	N(%)	N(%)	N(%)	N(%)	N(%)
Sex					
Male	96 (66.7)	87 (61.3)	58 (51.8)	91 (46.9)	332 (56.1)
Female	48 (33.3)	55 (38.7)	54 (48.2)	103 (53.1)	260 (43.9)
Race/Color					
White	93 (64.6)	86 (60.6)	65 (58.0)	123 (63.4)	367 (62.0)
Mixed/Brown	28 (19.4)	39 (27.5)	39 (34.8)	56 (28.9)	162 (27.4)
Black	9 (6.3)	8 (5.6)	3 (2.7)	5 (2.6)	25 (4.2)
Asian/Yellow	2 (1.4)	-	-	2 (1.0)	4 (0.7)
Indigenous	1 (0.7)	2 (1.4)	4 (3.6)	2 (1.0)	9 (1.5)
Blank/No information	11 (7.6)	7 (4.9)	1 (0.9)	6 (3.1)	25 (4.2)
Area of Residence					
Urban	54 (37.5)	44 (31.0)	37 (33.0)	73 (37.6)	208 (35.1)
Rural	4 (2.8)	3 (2.1)	3 (2.7)	4 (2.1)	14 (2.4)
Peri-urban	-	2 (1.4)	-	2 (1.0)	4 (0.7)
Blank/No information	86 (59.7)	93 (63.5)	72 (64.3)	115 (59.3)	366 (61.8)

Among the analysed TB cases in individuals under 15 years of age, the majority of patients were classified as new cases (91.2%), with a higher proportion in the age group from 10 to 14 years old (92.8%). As for the clinical form, notified pulmonary (69.3%), with a higher proportion in children from one to four years of age (74.6%). Laboratory confirmation was obtained in 69.9% of cases. Confirmation was more frequent among children aged 10 to 14 years (38.1%) and those under one year of age (47.2%). For the variable “sputum

bacilloscopy”, the test was not performed in 51% of cases. Positivity was 25.3% for the age group 10 to 14 years and 27.8% for those under one year of age. As for the treatment outcome status, cure was the most frequent outcome (68.6%), reaching 81.4% in children from 10 to 14 years and 79.5% in children from five to nine years of age, followed by treatment interruption (4.1%) (Table 2).

Table 2. Clinical profile of childhood TB stratified by age group, Paraná state, from 2013 to 2022.

Variables	<1 year	1 to 4 years	5 to 9 years	10 to 14 years	Total
	N(%)	N(%)	N(%)	N(%)	N(%)
Type of Entry					
New case	128 (88.9)	130 (91.5)	102 (91.1)	180 (92.8)	540 (91.2)
Relapse	5 (3.5)	1 (0.7)	-	2 (1.0)	8 (1.4)
Re-entry after abandonment	4 (2.8)	6 (4.2)	5 (4.5)	2 (1.0)	17 (4.1)
Transfer	7 (4.9)	5 (3.5)	4 (3.6)	8 (4.1)	3 (0.5)
Clinical form					
Pulmonary	93 (64.6)	106 (74.6)	78 (69.6)	133 (68.6)	410 (69.3)
Extrapulmonary	30 (20.8)	29 (20.4)	31 (27.7)	53 (27.3)	143 (24.2)
Pulmonary + Extrapulmonary	21 (14.6)	6 (4.2)	3 (2.7)	8 (4.1)	38 (6.4)
Blank/No information	-	1 (0.7)	-	-	1 (0.2)
Laboratory confirmation					
With laboratory confirmation	68 (47.2)	19 (13.4)	17 (15.2)	74 (38.1)	178 (30.1)
Without laboratory confirmation	76 (52.8)	123 (86.6)	95 (84.8)	120 (61.9)	414 (69.9)
Sputum bacilloscopy					
Positive	40 (27.8)	8 (5.6)	9 (8.0)	49 (25.3)	106 (17.4)
Negative	30 (20.8)	31 (21.8)	34 (30.4)	45 (23.2)	140 (23.6)
Not done	60 (41.7)	89 (62.7)	59 (52.7)	94 (48.5)	302 (51.0)
Blank/No information	14 (31.8)	14 (31.8)	10 (22.7)	6 (13.6)	44 (7.4)

Variables	<1 year	1 to 4 years	5 to 9 years	10 to 14 years	Total
	N(%)	N(%)	N(%)	N(%)	N(%)
Treatment outcome status					
Cure	73 (50.7)	86 (60.6)	89 (79.5)	158 (81.4)	406 (68.6)
Treatment interruption	4 (2.8)	11 (7.7)	6 (5.4)	3 (1.5)	24 (4.1)
Death due to tuberculosis	5 (3.5)	1 (0.7)	1 (0.9)	1 (0.5)	8 (1.4)
Death from other causes	10 (6.9)	1 (0.7)	4 (3.6)	4 (2.1)	19 (3.2)
Transfer	33 (22.9)	21 (14.8)	6 (5.4)	119 (5.7)	79 (13.3)
Drug-resistant TB	2 (1.4)	-	1 (0.9)	3 (1.5)	6 (1.0)
Change of treatment regimen	2 (1.4)	2 (1.4)	1 (0.9)	-	5 (0.8)
Primary abandonment	-	3 (2.1)	1 (0.9)	-	4 (0.7)
Blank/No information	15 (10.4)	17 (12.0)	3 (2.7)	14 (7.2)	41 (6.9)

It is possible, based on *Prais-Winsten* regression, to conclude that the temporal trend was stationary for all variables under analysis (Table 3).

Table 3. Temporal trend of childhood TB stratified by age group, Paraná state, 2013 to 2022.

Variable	APC (CI 95%)	p-value	Trend
< 1 year of age	0.22(-0.08 – 0.53)	0.58	Stationary
1 to 4 years of age	0.27(-0.05 – 0.60)	0.10	Stationary
5 to 9 years of age	0.03(-0.23 – 0.31)	0.78	Stationary
10 to 14 years of age	-0.04(-0.33 – 0.25)	0.77	Stationary

Abbreviations: APC: Annual Percentage Change; CI: Confidence Interval.

Regarding the year of notification of childhood TB cases, in 2014 there was a decrease in the number of cases among individuals under one year of age (nine cases notified). In the other age groups, namely, one to four years old (17 cases) and 10 to 14 years old (23 cases), there was an increase. In 2020 it was observed an increase in the number of notifications (a total of 76 cases notified), followed by a decrease in 2016 and 2021 in all age groups (44 and 59 notifications, respectively) (Figure 2).

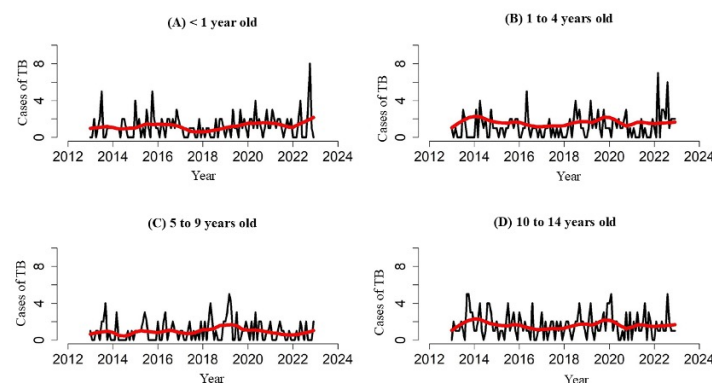


Figure 2. Temporal trend of childhood TB cases stratified by age group, Paraná state, from 2013 to 2022.

DISCUSSION

This study showed that childhood TB remained stationary in Paraná over the past ten years, when 32.77% (192) of childhood TB cases were reported in the 10 to 14 age group, and 24.32% (142 cases) occurred in children under one year old. This result is similar to findings observed in international studies, particularly among school-age children.¹⁴⁻¹⁶

Although Paraná state shows a stationary trend in childhood TB cases, there is an increase in the number of cases in the states of São Paulo, Rio de Janeiro, Pernambuco, and Amazonas, which represent 51.2% of the total cases in the national level.³ A national study that analyzed cases notified between 2010 and 2021 showed that the highest rates were in the North and Central-West regions of the country.¹⁷ In the state of Sergipe, the trend of childhood TB between 2001 and 2017 was stationary, as in the present study.¹⁷

By showing a stationary trend within the territory, it becomes evident that health services and the strategies adopted are insufficient, meaning they are maintaining a stagnation in the pathology's status. Therefore, there is a need to intensify health interventions and innovate and/or review the strategies being implemented by managers within health services.

Another factor that may be related to this stationary profile is the underreporting of childhood TB. Research carried out in Pakistan revealed that 78% of the childhood TB cases diagnosed in the country were not notified to the National TB Control Program.¹⁸

Seeking greater control and guidance, WHO published in 2006 the Guidance for National Tuberculosis Programmes on the Management of Childhood Tuberculosis in Children, the first guidelines in the world to approach childhood TB.¹⁹

Among the recommendations it is highlighted: the use of the molecular test Xpert MTB/RIF as the initial

diagnostic test; in children and adolescents aged 3 to 16 years with non severe TB - no suspicion or evidence of multidrug resistance- the medication treatment was shortened to a 4 month regimen (2 months of isoniazid (H), rifampicin (R), pyrazinamide (Z) e ethambutol (E), followed by 2 months of isoniazid and rifampicin (2HRZE/2HR)); the inclusion of family-centered care models to promote a supportive and protective environment; prevention strategies with strengthened contact investigation and TB screening, emphasizing prevention in vulnerable populations, including those living with HIV.¹⁹

The Ministry of Health also outlines key commitments, including training professionals to use the SINAN system, encouraging active case finding of individuals with respiratory symptoms, and promoting the evaluation of contacts of individuals with laboratory-confirmed TB for signs and symptoms of the disease, particularly in primary health care services, which serve as the gateway to the SUS (the Brazilian Unified Health System).⁹

The government of the state of Paraná aligns itself with the recommendations and strategies adopted by the Ministry of Health and, in 2022, launched the State Plan to End Tuberculosis as a Public Health Problem in Paraná, 2022-2030, which establishes the state's main commitments to combating TB and childhood TB.²⁰ It is worth noting that, among the recommendations of the State Plan for the End of TB, no specific strategies are mentioned for the child population, except for the indication of drug treatment, which highlights the invisibility of the issue in government spheres.

Therefore, childhood TB is a priority health issue that deserves the attention of policymakers and healthcare professionals, as children and adolescents are in a vulnerable situation considering that most infections occur through transmission from family members or other close contacts with TB.⁵ Children under five years old represent an important demographic group that deserves attention from health services, as their primary or latent progression to active TB occurs rapidly, and severe manifestations of the disease are more common in this age group.⁴

In this regard, health services, particularly in primary health care, should prioritize case screening, diagnostic clarification, and effective management of directly observed treatment, as well as the inclusion of home visits to identify social determinants of health and assess risk classification.²¹

The implementation of home visits contributes to the screening and early identification of undiagnosed new cases, preventing their progression. A study conducted in The Gambia involving 4,042 children under the age of 15, screened through home visits, found that 1.6% had TB, with 40% of these cases being asymptomatic.²² Therefore, healthcare workers must be prepared and

trained to identify signs, symptoms, and risk factors, and to implement targeted strategies for appropriate and early screening during routine visits.

However, the detection of childhood TB in health services is a challenge, as the clinical presentation of the disease is similar to other common findings in childhood, such as pneumonia, viral and bacterial bloodstream infections, and malnutrition. Therefore, primary healthcare professionals must be trained in early diagnosis and the development of new tools, not solely based on sputum, that enable rapid and reliable identification of childhood TB.

The diagnosis and treatment of childhood TB present significant challenges, particularly in large and expansive territories such as the state of Paraná, due to resource limitations and the population's access to health services. A study conducted in Cambodia identified several key barriers to accessing childhood TB services, such as lack of knowledge and awareness about the disease, costs involved, time limitation and issues related to the cultural aspects associated to the disease, and the obstacles to accessing specialized health services.²⁴

Upon analyzing the trend of childhood TB cases, a decline is observed in 2014, a factor that may be associated with the implementation of the National Health Promotion Policy, which led to intensified training of healthcare professionals in infectious diseases in the state of Paraná.⁹

Over recent decades, literature has consistently highlighted improvements in health indicators in Brazil, particularly concerning child health. These advancements are closely linked to the implementation of public health policies at the national level, such as the establishment of the *Rede Cegonha* (Stork Network). The *Rede Cegonha* focuses on maternal and child health, offering a model of care that spans from prenatal care to the child's second year of life.²⁵

Another policy that complements the fight against childhood TB is the National Policy for Comprehensive Health Care for Adolescents (*Política Nacional de Atenção Integral à Saúde do Adolescente*) alongside the Program Protect and Health Care for Adolescents in the Primary Care (*Proteger e Cuidar da Saúde de Adolescentes na Atenção Básica*), aimed at promoting, protecting, and recovering health. However, it is emphasized that these policies also do not describe specific aspects regarding the approach to childhood TB, thus once again highlighting the invisibility of policies and strategies directed at TB in the child population.²⁶

The initiative has proven significant, reflecting not only in the quality of care but also in the reduction of infant mortality, contributing to an estimated decline of approximately 4.5%, which aligns with the findings of this study, where only 1.4% of cases progressed to death

from TB, and 3.2% to death from other infectious diseases. Furthermore, the expansion of the Family Health Strategy (*Estratégia de Saúde da Família* - ESF) through the inclusion and involvement of Community Health Agents played a crucial role in this progress, strengthening healthcare services at this level and enabling a positive impact on health indicators of the population, especially children.²⁵

Moreover, the healthcare service, through the Unified Health System (SUS) and the National Immunization Program, provides specific services that assist in the prevention of TB development, such as vaccination. The administration of the Bacillus Calmette–Guérin (BCG) vaccine prevents severe cases and progression to death from TB; it should be administered during the neonatal period.⁹ Therefore, it is necessary to implement screening within primary health care services along with increasing BCG vaccination coverage in children under five years of age, since they are more susceptible to severe forms of TB, and vaccination remains an important strategy to reduce both severe cases and mortality in this age group.³

Therefore, healthcare services at the primary health care level play a crucial role in the eradication of TB by ensuring early diagnosis and timely initiation of treatment, conducting directly observed treatment to promote adherence to the appropriate therapeutic regimen, thereby preventing unfavorable outcomes such as treatment interruption, development of drug-resistant TB, and death from TB.⁸

Despite the results being relevant and due to a limited number of studies addressing the topic in the child population, there were some limitations, such as the use of secondary data, which may have introduced bias to the research due to the possibility of underreporting of cases.

The study advances knowledge by highlighting the temporal trend of TB in children under 14 years, 11 months, and 29 days, particularly in a context where there is a lack of studies. The results indicate a stationary trend of childhood TB in Paraná state, highlighting the importance of expanding strategies to combat TB in healthcare services for timely detection, diagnosis, and appropriate treatment of cases, including the implementation of directly observed treatment (DOT), as the stationary trend suggests the persistence of the disease in the region. It is also emphasized the importance of promoting the expansion of training for healthcare professionals regarding the clinical and epidemiological approach to the disease in children under 15 years, with an emphasis on contact tracing and the use of diagnostic technologies.

Besides that, it is necessary to enhance information and surveillance systems, with improved quality of data notified, enabling continuous monitoring that is sensitive to changes in the disease's epidemiological

profile. The need for educational and intersectoral campaigns aimed at the population is also highlighted, focusing on raising awareness about the signs and symptoms of childhood TB, as well as treatment adherence, and the implementation of information technologies in monitoring, such as teleconsultation.

Finally, it is suggested to develop new studies with analytical and qualitative approaches that allow a deeper understanding of the factors associated with the persistence of childhood TB in the territory, supporting more effective public policies tailored to the local reality.

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AUTHORS' CONTRIBUTIONS

Alessandro Rolim Scholze contributed to project management, writing of the abstract, introduction, methodology, discussion, interpretation and description of results, table preparation, conclusions, revision, and statistics. **Camila da Cruz Rodrigues** contributed to the literature review, introduction, results description, table preparation, and conclusions. **Kelly Holanda Prezotto** contributed to the interpretation of results, conclusions, revision, and statistics. **Carolina Fordellone Rosa Cruz** contributed to the writing of the abstract, introduction, methodology, discussion, interpretation and description of results, conclusions, and revision. **Josilene Dália Alves** contributed to the writing of the abstract, introduction, methodology, discussion, interpretation and description of results, table preparation, conclusions, revision, and statistics. **Leonardo Bigolin Jantsch** contributed to the writing of the abstract, introduction, methodology, discussion, interpretation and description of results, table preparation, conclusions, revision, and statistics. **Rosana Rosseto de Oliveira** contributed to the writing of the abstract, introduction, methodology, discussion, interpretation and description of results, revision, and statistics. **Flavia Meneguetti Pieri** contributed to the writing of the abstract, introduction, methodology, discussion, interpretation and description of results, and revision. **Emiliana Cristina Melo** contributed to project management, writing of the abstract, introduction, methodology, discussion, interpretation and description of results, table preparation, conclusions, revision, and statistics.

All authors approved the final version to be published and are responsible for all aspects of the work, including ensuring its accuracy and integrity.

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