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ORIGINAL ARTICLE

Tuberculosis load and the sociodemographic profile of indigenous children and adolescents in a western Amazon state, Rondônia, Brazil

Carga da tuberculose e perfil sociodemográfico de crianças e adolescentes indígenas em um Estado da Amazônia ocidental, Rondônia, Brasil

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ABSTRACT

Introduction: Tuberculosis (TB) among Indigenous people is a severe public health problem in Brazil. **Objectives:** To analyze the burden of tuberculosis and the sociodemographic profile of Indigenous children and adolescents in Rondônia, Brazil, between 2008 and 2018. **Methods:** A descriptive, cross-sectional study with a quantitative approach, based on the records of the variables in the Notifiable Diseases Information System; and analyzed using descriptive statistics and the comparison between proportions using the Fisher's exact test, considering a significance level of 5%. **Results:** The TB incidence coefficient was 76.1/100 thousand cases/HAB. Thirty-eight Indigenous children (mean age 2.5 years SD=±2.9) and 39 Indigenous adolescents (mean age 17 years SD=±2.3) were identified. There was a statistically significant association between the incidence of TB with both education (p<0.001) and the place of residence (Cacoal, RO) (p=0.016). **Conclusion:** The decline in incidence can be associated with several factors, including low diagnosis, incomplete notifications, and/or inadequate filling out of the variable race/color, reinforcing the importance of integrating the Health Care Network, professional training, and investigation of contacts for the early identification of cases and, consequently, interruption of the chain of transmission for the effectiveness of actions to combat and control TB.

Keywords: Tuberculosis; Indigenous People; Health Information System.

RESUMO

Introdução: A tuberculose (TB) entre os indígenas é um grave problema de saúde pública no Brasil. **Objetivos:** Analisar a carga de tuberculose e o perfil sociodemográfico em crianças e adolescentes indígenas em Rondônia, Brasil, no período entre 2008 a 2018. **Métodos:** Estudo

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descritivo, realizado de forma transversal e abordagem quantitativa, a partir dos registros das variáveis no Sistema de Informação de Agravos de Notificação; e analisados por meio de estatística descritiva e a comparação entre as proporções por meio do teste exato de Fisher, considerando nível de significância de 5%. **Resultados:** O coeficiente de incidência de TB foi de 76,1/100mil casos/hab. Indígenas. Foram identificadas 38 crianças (média de idade 2,5 anos dp=±2,9) e 39 adolescentes (média de idade 17 anos dp=±2,3) indígenas. Houve associação estatisticamente significativa entre a incidência de TB tanto em relação a escolaridade (p<0,001) quanto ao local de residência (Cacoal/RO) (p=0,016). **Conclusão:** O declínio da incidência dos casos pode estar associado a diversos fatores, que incluem o baixo diagnóstico, a incompletude das notificações e/ou a inadequação do preenchimento na variável raça/cor, reforçando a importância da integração da Rede de Atenção em Saúde, capacitação profissional e investigação dos contatos para a identificação precoce dos casos e, consequentemente, a interrupção da cadeia de transmissão para a efetividade das ações de enfrentamento e controle da TB.

Palavras-chave: Tuberculose; Povos indígenas; Sistema de Informação de Saúde.

Introduction

The World Health Organization (WHO) indicates that 10 million people became ill with tuberculosis (TB) in 2019, 12% of whom were children and adolescents (under 15 years of age)[1]. In Brazil, in the same year, there were 73,864 new cases; of these, 1.7% occurred among children (under ten years of age)[2].

Some population groups have a higher risk of becoming ill with TB when compared to the general population, such as Indigenous people (three times more likely), due to the social vulnerability factors in which they find themselves, such as malnutrition, as well as immunological fragility, and difficulties in accessing health services[3]. The literature indicated that from 2006 to 2016, the incidence of 97.6 cases per 100,000 inhabitants among Indigenous children and adolescents in the Midwest region[4].

In Brazil, the Unified Health System (SUS) has its health subsystem (SasiSUS), in which the Special Health Districts (DSEI), linked to the Special Secretariat of Indigenous Health (SESAI), provide care through the Multidisciplinary Indigenous Health Team (EMSI) and Indigenous Health Agents (ASI), who also reside in the villages.

The flow of care occurs according to the level of complexity, and the ASI refers the I Indigenous patient to the Indigenous Health Centers (PSI) in the villages. More complex cases are referred to the base-places where the EMSI operates and, if the needs and demands are not resolved, the user will be referred to the municipality network of SUS health services[5].

The Indigenous Support Homes (CASAI) are also part of this subsystem, offering support concerning lodging, food, 24-hour nursing care, and complementary exams for I Indigenous people referred to the SUS and returning to their community of origin[5].

This study aims to understand the burden of TB in this population and the aspects of the sociodemographic profile, also considering the gaps in the literature that address the subject significantly when associated with the infant-youth age group[6].

Methods

Description of the territory

This is a descriptive, cross-sectional study with a quantitative approach, taking place in Rondônia. The state is located in the Northern Region of Brazil, bordering Amazonas, Acre, Mato Grosso, and the Republic of Bolivia. It has an area of 237,590.9km^2, distributed in 52 municipalities, with a significant rural area (70.50%) and traditional peoples, including the riverine and Indigenous peoples. It has 1,562,409 inhabitants, 13,076 of whom are Indigenous (0.87%). Of these, 3,859 reside outside Indigenous lands[7,8] which has 6,365,648.20 hectares in extension; of this area, 93.92% are regulated[9].

Health care among the Indigenous people is the responsibility of two DSEI (Porto Velho and Vilhena), which are jointly responsible for 187 villages each and 79 ethnicities[9].

The state has a health system comprised of 936 health facilities[10], of which 75 are ISPs, 10 CASAI, and 9 Polos-base (categorized as Indigenous units) distributed in the DSEI of Porto Velho and Vilhena[9]. For TB care, the state reference hospital for drug-resistant TB (DR-TB) cases and hospitalizations for complications is also available, if necessary.

Study population

The population of this study consisted of all records of Indigenous children and adolescents notified in Rondônia in the National Disease Notification System (SINAN) from 2008 to 2018. Children were considered in the age range up to 10 incomplete years and adolescents between 10 and 19 years of age[11]. As an inclusion criteria, we considered residents who underwent treatment in Rondônia; and as exclusion, cases that presented the variables "start of treatment" and "closing situation" equal or blank.

Data collection

Data collection was carried out through the survey of variables (type of entry, date of birth, gender, area of residence, municipality and neighborhood of residence, education, beneficiary of government cash transfer program, occupation, diseases related to exacerbated associated diseases, treatment initiation and closure dates, health unit of notification and treatment) in SINAN.

Data analysis

Incidence was calculated using the number of new cases, regardless of the clinical form of TB, of Indigenous children and adolescents in the numerator and the estimated Indigenous population data in Rondônia referring to the same population in the denominator.

Since there is no annual intercensal growth estimate for the Indigenous population, the calculation was performed using the geometric method according to the following formula[12]:

$$r = \left[\left(\sqrt[n]{\frac{P_t}{P_0}}\right) - 1\right] \times 100$$

Considering "n" the number of years of the period, Pt was adopted as the Indigenous population of the year 2010 and P_0 as the Indigenous population of the year 2000, since data was taken from the 2000 and 2010 census[13]. Demographic Censuses were used to calculate the growth rate "r". The growth rate for children "rc" was 4.06% and for adolescents "ra" was 4.74%.

$$r = \left[\left(\sqrt[10]{\frac{\text{Censo 2010}}{\text{Censo 2000}}}\right) - 1\right] \times 100$$

$$r_c = \left[\left(\sqrt[10]{\frac{4.046}{2.717}}\right) - 1\right] \times 100 = 4{,}06$$

$$r_a = \left[\left(\sqrt[10]{\frac{3.484}{2.191}}\right) - 1\right] \times 100 = 4{,}74$$

To calculate the estimated population (EP) from 2011 to 2018 this was adjusted by adding the growth rate to the year ($EP_{(2011\text{-}2018)}$ = (100 + r) * EP previous year) and, for the years 2008 and 2009, a decrease in the growth rate ($EP_{(2008 \text{ and } 2009)}$ = (100 - r) * EP later year).

The data obtained were analyzed using descriptive statistics and comparing proportions using the chi-square test (X^2) and Fisher's exact test in Statistics 13.4, TIBCO[14] software. Statistical significance was considered $p<0.05$, and for these cases, the pattern of interdependence was verified using residue analysis in such a way that residues above 1.96 or below -1.96 indicated a significant positive or negative association between the variables.

Ethical considerations

In compliance with Resolution No. 466/12 of the National Health Council[15], the matrix project entitled "Tuberculosis in the state of Rondônia: a health evaluation study" was approved by the Federal Research Ethics Committee of the Federal University of Rondônia Foundation, according to Statement No. 3.939.112.

Results

Between 2008 and 2018, 7,804 TB cases were notified in Rondônia; of these, 322 (4.1%) were Indigenous, of which 53 (16.4%) were children and 46 (14.3%) adolescents. We excluded 13 children and seven adolescents because they lived in other states, such as Amazonas (11 cases) and Mato Grosso (9 cases); one case for having the same treatment initiation and termination date; and another with a blank termination date, totaling 38 children (49.35%) and 39 (50.64%) adolescents for this study.

There was a decrease, without statistical significance (p=1.000) in the incidence of TB cases over the years, whose mean was 76.1/100,000 Indigenous inhabitants, being higher among children in 2009 (233.2/100,000 Indigenous inhabitants) and adolescents in 2008 (189.8/100,000 Indigenous inhabitants) (Table 1).

The mean age among children was 2.5 years (SD=±2.9), with a minimum of 15 days and a maximum of 9 years; among adolescents, it was 17 years (SD=±2.3), with a minimum of 10 years and a maximum of 19 years. There was statistical significance regarding education (p<0.001), with a positive association between children and not applicable (children who were not school-age) and adolescents with elementary school II (incomplete and complete) and incomplete high school (Table 2).

Most were new cases (87.0%), regardless of age, and male (58.5%). Children participated more often in the government cash transfer program (5.3%) than adolescents (2.6%), although they had some occupation (17.9%) and had no associated diseases and illnesses (97.4%) (Table 2).

There was a statistically significant association between illness of TB and residence in the municipality of Cacoal (p=0.016), with a positive association between children from the Indigenous village on line 10 (Table 3) and the "blank" neighborhood notification and among adolescents with the village on line 14 (Table 3).

Regardless of age group, the majority lived in rural areas (76.6%) and isolated cases of children were identified in Ariquemes, a village in Ji-Paraná, as well as in Alta Floresta D'Oeste, Chupinguaia, and Vilhena (counties of Rondônia). However, in the last three cases, the neighborhood of residence was not filled in (Table 3).

All notifications and consultations were carried out exclusively in non-Indigenous health units, mainly in secondary specialized services, regardless of whether they were children (60.5%) or adolescents (92.3%) (Figure 1).

Discussion

This study meets the need expressed in the Global Tuberculosis Report 2020 to understand TB infection among children and adolescents in vulnerable populations. It is particularly challenging due to difficult diagnosis, access, and/or inconsistent reporting data[1].

The mean TB incidence rate among Indigenous children and adolescents in Rondônia was higher (76.1/100,000 Indigenous inhabitants) than the national mean incidence rate for this population (49.1/100,000 Indigenous inhabitants)[4] and 15 times higher than the mean incidence rate among non-Indigenous children and adolescents in the state from 1997 to 2006[16]. International literature indicates that in developed countries, such as the United States and Canada, the Indigenous population has a higher burden of TB than the general population, suggesting that this proportion is related to vulnerability factors and not by location[17].

Moreover, the declining incidence may be associated with several negative factors such as low diagnosis, incomplete

Table 1. Distribution of incidence among Indigenous children and adolescents with TB in Rondônia, from 2008 to 2018.

Year	n_c	$Incidence_c$	n_a	$Incidence_a$	N	$Incidence_t$	p-value
2008	5	135.8	6	189.8	11	160.8	
2009	9	233.2	3	90.4	12	167.2	
2010	3	74.1	2	57.4	5	66.4	
2011	3	71.2	5	137.1	8	101.8	
2012	5	114.1	3	78.51	8	97.5	
2013	-	-	3	75.0	3	35.1	1.000*
2014	1	21.1	4	95.4	5	56.0	
2015	4	81.1	-	-	4	42.9	
2016	2	39.0	3	65.2	5	51.4	
2017	-	-	4	83.1	4	39.4	
2018	2	36.0	-	-	2	18.9	
Total	34	67.4	33	74.2	67	Mean=76.1	

Caption: n_c: Frequency of new cases among Indigenous children; $Incidence_c$: Incidence among Indigenous children (100 thousand hab.); n_a: frequency of new cases among Indigenous adolescents; $Incidence_a$: Incidence among Indigenous adolescents (100 thousand hab.); $Incidencea_t$: Total incidence among Indigenous children and adolescents (100 thousand hab.); *Performed Fisher's exact.
Source: SINAN (2019).

Table 2. Distribution of TB cases among Indigenous children and adolescents, according to sociodemographic variables in Rondônia, from 2008 to 2018.

Variable	Children n (%)	Adolescents n (%)	Total N (%)	*p*-value
Input type				0.752*
New case	34 (89.4)	33 (84.5)	67 (87.0)	
Relapse	2 (5.3)	4 (10.3)	6 (7.8)	0.361*
Re-entry after abandonment	-	1 (2.6)	1 (1.3)	
Transfer	2 (5.3)	1 (2.6)	3 (3.9)	
Sex				0.576
Male	21 (55.3)	24 (61.5)	45 (58.5)	
Female	17 (44.7)	15 (38.5)	32 (41.5)	
Age (years)				<0.001*
Illiterate	1 (2.6)	3 (7.7)	4 (5.2)	
Incomplete Elementary School I	6 (15.8)	4 (10.3)	10 (13.0)	
Complete Elementary I Education	2 (5.3)	3 (7.7)	5 (6.5)	
Incomplete Elementary II	-[-]	15 (38.5)[+]	16 (20.8)	
Complete Elementary II	-[-]	4 (10.3)[+]	4 (5.2)	
Incomplete high school	-	5 (12.8)[+]	5 (6.5)	
Complete high school	27	1 (2.6)	1 (1.3)	
Not applicable (not of school-age)	(71.1)[+]	-[-]	27 (35.0)	
Ignored/Blank	1 (2.6)	4 (10.3)	5 (6.5)	
Government Cash Transfer Program **				1.000*
Yes	2 (5.3)	1 (2.6)	3 (3.9)	
No	7 (18.4)	7 (17.9)	14 (18.2)	
Ignored/Unwritten	29 (76.3)	31 (79.5)	60 (77.9)	
Occupation				1.000*
Agricultural worker	-	2 (5.1)	2 (2.6)	
Painter worker	-	1 (2.6)	1 (1.3)	
Housewife	-	4 (10.2)	4 (5.2)	
Student	4 (10.5)	18 (46.2)	22 (28.6)	
Unwritten	34 (89.5)	14 (35.9)	48 (62.3)	
Diseases and associated conditions				1.000*
Mental disorders	1 (2.6)	-	1 (1.3)	
Others (lupus)	-	1 (2.6)	1 (1.3)	
Unwritten	37 (97.4)	38 (97.4)	75 (97.4)	

*Performed Fisher's exact; **Considered only after inclusion in the notification form in 2014.
Source: SINAN (2019).

notifications due to lack of knowledge of the case by the health services and/or inadequate filling out of the variable race/color, which the professional's self-assessment can do through physical characteristics without considering the aspects that permeate the self-determination of the Indigenous person, or even the declaration of parents and/or guardians of the child.

Twenty cases from border states were excluded, showing that the pact contributes to interstate articulation, aiming at the continuity of care through vertical and horizontal integration of services and professionals who work in the Health Care Network (RAS). At the same time, for infectious diseases, for example, the territorial limitation does not prevent the transmissibility of the disease, including resistant strains. Therefore, early detection and immediate initiation of treatment are essential strategies in the fight against TB.

Regarding notification, 1/4 were children with a low average age (2.5 years), a fact that helps to reflect on the difficulty in making the diagnosis since bacilliferous identification, the gold standard, is difficult in this population because they are paucibacillary and have difficulty collecting sputum samples. For the isolation of the bacillus for diagnostic elucidation in this population, Canada recommends investigation with invasive techniques, such as nasopharyngeal aspirate, alveolar bronchial lavage, and gastric lavage, unlike Brazil, whose investigation is based on

Table 3. Distribution of TB cases according to area, municipality, and neighborhood of residence among Indigenous children and adolescents in Rondônia from 2008 to 2018.

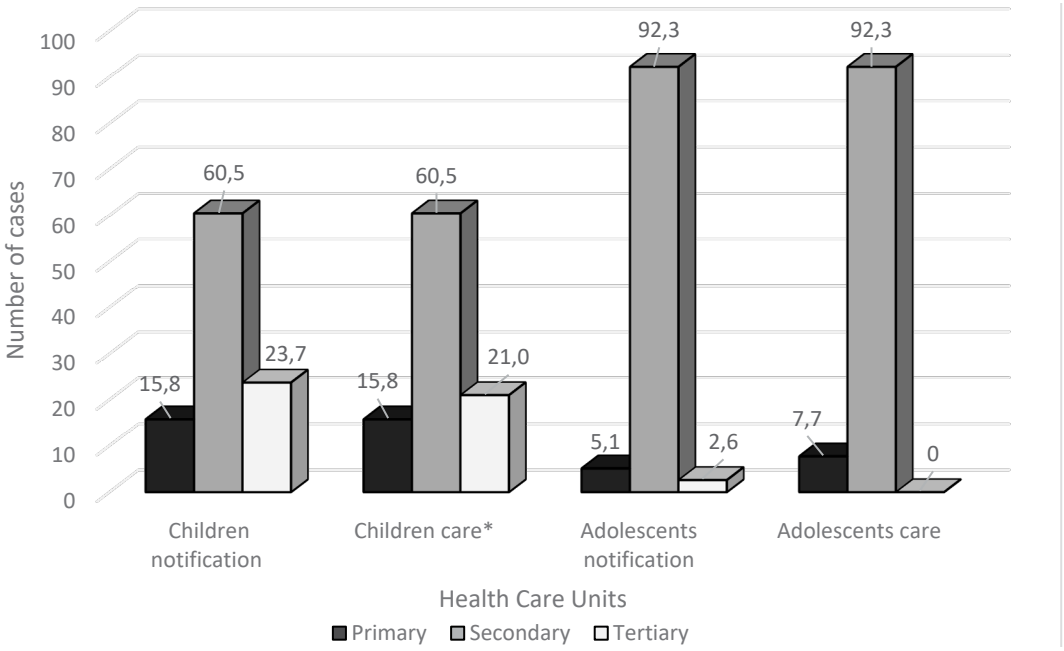
Variable	Children n (%)	Adolescents n (%)	Total N (%)	*p*-value
Residence area				0.361*
Rural	28 (73.7)	31 (79.5)	59 (76.6)	
Urban	8 (21.0)	6 (15.4)	14 (18.2)	
Peri-urban	-	2 (5.1)	2 (2.6)	
Unwritten	2 (5.3)	-	2 (2.6)	
Municipality and District of Residence				
Alto Floresta D'Oeste				-
Unwritten	1 (100)	-	1 (100)	
Ariquemes				-
Social support	1 (100)	-	1 (100)	
Cacoal				0.016*
Central Indigenous Village	1 (6.7)	-	1 (2.5)	
Indigenous village from line 9	-	2 (4.0)	2 (5.0)	
Indigenous village from line 10	2 (13.3)⁺	- ⁻	2 (5.0)	
Indigenous village from line 11	6 (40.0)	9 (36.0)	15 (37.5)	
Indigenous village from line 12	1 (6.7)	2 (8.0)	3 (7.5)	
Indigenous village from line 13	2 (13.3)⁻	13 (52.0)⁺	15 (37.5)	
Unwritten	2 (13.3)⁺	- ⁻	2 (5.0)	
Chupinguaia				-
Unwritten	1 (100)		1 (100)	
Espigão D'Oeste				1.000*
Betel - Indigenous village	1 (33.3)	-	1 (25.0)	
Capitão Cardoso - Indigenous village	1 (33.3)	-	1 (25.0)	
Pacarana - Indigenous village	-	1 (100)	1 (25.0)	
Roosevelt - Indigenous village	1 (33.3)	-	1 (25.0)	
Guajará-mirim				1.000*
10 de Abril	1 (14.3)		1 (7.7)	
Ribeirão - Indigenous village		1 (16.7)	1 (7.7)	
Ricardo Cardoso - Indigenous village		1 (16.7)	1 (7.7)	
Indigenous village **	1 (14.3)		1 (7.7)	
Unwritten	5 (71.4)	4 (66.6)	9 (69.2)	
Ji Paraná				-
Indigenous village **	1(100)	-	1 (100)	
Porto Velho				0.160*
Areal da Floresta	3 (42.9)	3 (50)	6 (46.1)	
Igarape	3 (42.9)	-	3 (23,1)	
Planalto	-	1 (16.6)	1 (7.7)	
Triângulo	1 (14.2)	-	1 (7.7)	
Vila Princesa Isabel	-	2 (33.3)	2 (15.4)	
Vilhena				-
Unwritten	3 (100)	-	3 (100)	

*Performed Fisher's exact; **Without specification of the village in SINAN.
Source: SINAN (2019).

the clinic through the use of a scoring system and only in extreme cases the use of invasive techniques[3,18].

The Brazilian Indigenous health units are managed by a subsystem of the SUS and present several administrative difficulties in meeting the prerequisites necessary for implementing the TB Control Program (TCP). Thus, the notifications and care of the Indigenous population of the state are carried out in non-Indigenous units, which causes

Figure 1. Distribution of TB cases among Indigenous children and adolescents, according to notification and health care units (non-Indigenous), Rondônia, 2008 to 2018.



*01 case was excluded from this analysis because it presented the unit of care variable blank.
Source: SINAN (2019).

monitoring difficulties since it is necessary to organize logistics with specific transportation for displacement of up to 62 km, to bring the patient from the villages to the municipalities that have the service that meets their needs and demands[19].

Because it is a specific system for the Indigenous population, hiring professionals of the same ethnicity would allow the strengthening of ties for adherence to treatment, which is essential for chronic conditions such as TB. From this perspective, investment in training Indigenous human resources specialized in TB in universities, and strategies to retain professionals, such as job, career, and salary plans; improvements of the physical conditions of the units; the reduction of the workload; the improvement in professional communication and clinical support; as well as the implementation of effective continuing education processes, are alternatives for minimizing these weaknesses[20].

Although the strategy of centralizing care in secondary and tertiary units seems assertive, since only one case in this study was finalized as a change of diagnosis, care for the Indigenous population should be prioritized at the primary level while still in the village, respecting cultural specificities, as defined by the Arouca Law[21].

The expansion of the Incentive for Specialized Care for Indigenous Peoples (IAE-PI) for PHC, so that both alternative (with medicinal herbs used by Indigenous people) and standard (with antimicrobial drugs) treatments are available, would contribute to the adherence of Indigenous people, as well as in the confrontation and control of TB, considering the vulnerability of this population in becoming ill.

Another critical point is the underutilization of Indigenous Health Agents (AIS) in health surveillance actions in the villages since they are the closest link between the Indigenous people and the health professionals. They should be the essential link in the identification and investigation aimed at interrupting the chain of transmission and control of TB. In other words, the diagnosis and treatment of latent TB infection (LTBI), and not only active TB, should be prioritized.

Concerning schooling, it was found that most children and adolescents did not attend the school year recommended for their age. The Law of Directives and Bases for National Education[22], guarantees Indigenous communities the right to bilingual and intercultural education, reaffirming their ethnic identity, valuing their knowledge, and offering non-Indigenous knowledge. However, the high diversity of ethnic groups and Indigenous languages in Rondônia is a challenge in guaranteeing this right, as well as the distance between Indigenous lands and schools.

The rural area presented the highest cases in the territory because the state's Indigenous population is predominantly rural[8]. The highest number of reported cases of TB in this study was in Cacoal, which is characterized as the second region with the highest concentration of Indigenous people in Rondônia[8]. On the other hand, in Guajará-Mirim, the first region with the highest concentration of Indigenous people, only 1/6 of cases of TB were reported, which allows reflection on underdiagnosis, especially among the vulnerable population and in frontier areas, as well as on the more significant burden of the disease in Indigenous tribes such as the Suruí and Cinta Larga, and other peoples living on the September Seventh land[23,24].

A study carried out in Porto Velho showed that the Indigenous community has a strong desire to master the non-Indigenous writing tools. However, the absence of an Indigenous Education Policy hinders the insertion of these peoples in schools[25], despite the fact that it could contribute to the understanding of the health-disease process, as well as health education actions for the promotion and prevention of diseases and illnesses.

The inclusion of the variable participation in the Brazilian government's cash transfer program in the 2014 TB notification form is in line with the strategies to end TB[26], to map the economic and social conditions that people with TB face. An economic modeling study found that TB patients in low- and middle-income countries spend more than 20% of household income on treatment, called *catastrophic cost*, which compromises their livelihoods and increases the risk of not following up treatment[27].

Although it is impossible to assess this population's socioeconomic conditions only with SINAN data: a previous study among Indigenous children and adolescents in Rondônia observed precarious conditions in the villages, with poorly ventilated and illuminated houses and many people sleeping in a single room, as well as a nutritional deficit[28]. These characteristics are drivers for the risk of getting sick with TB and other communicable respiratory diseases, in addition to the more severe evolution of the disease[26]. These aspects suggest that this population may benefit from and contribute to improving the outcomes of TB treatment[29], but the lack of knowledge and logistical conditions for receiving and accessing treatment interferes with the integration of this social right.

The low proportion of diseases and associated diseases in this public (2.6%) may explain the high rate of cure (94.9%) due to fewer complications, including adverse reactions and unfavorable outcomes[30,31], which does not exempt monitoring this population, as well as strengthening the link, monitoring, and the effectiveness of health education actions to ensure the quality of life of patients with chronic conditions such as TB.

The limitations of this study are related to the data acquired through secondary sources, which include variables with incomplete completion and the lack of a field for the insertion of ethnicity when making the self-declaration of Indigenous people, so that it is possible to understand the health-disease process uniquely, according to cultural aspects.

Conclusion

The findings found in this study pointed to the high incidence of TB among Indigenous children and adolescents in the state of Rondônia, with an association between age groups only for education and area of residence. Such aspects allow us to reflect on the population characteristics and epidemiological profile, as well as on the importance of integrating the RAS, professional training, and the early identification of cases as actions that could contribute to the control and surveillance of communicable diseases such as TB.

Author's Contribution

We describe contributions to the papers using the taxanomy (CRediT) provided below:

Gisele Aparecida Soares Cunha de Souza, Nathália Halax Orfão, Rafaele Oliveira Bonfim: *Conceptualization, Investigation, Methodology, Visualization & Writing – Review & Editing*.

Nathalia Halax Orfão: *Project Administration, Supervision & Writing – Original Draft*.

Gisele Aparecida Soares Cunha de Souza, Nathália Halax Orfão: *Validation & Software*.

Nathalia Halax Orfão: *Resources & Funding Acquisition*.

Gisele Aparecida Soares Cunha de Souza, Nathália Halax Orfão e Rafaele Oliveira Bonfim: *Data Curation & Formal Analysis*.

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