

Sociodemographic features and operating indicators of tuberculosis control between indigenous and non-indigenous people of Rondônia, Western Amazon, Brazil

Características sociodemográficas e indicadores operacionais de controle da tuberculose entre indígenas e não indígenas de Rondônia, Amazônia Ocidental, Brasil

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Abstract

With the intention of improve knowledge on the epidemiological situation of tuberculosis (TB) among vulnerable populations in Brazil, our objective was to analyze sociodemographic characteristics and operational indicators related to TB control, comparing indigenous and non-indigenous people, in Rondônia. We conducted a retrospective and descriptive epidemiological study of new TB cases reported between 1997, January 1st and 2006, December 31st. We excluded duplicate records and those for whom the results of treatment was change in diagnosis and transfer. TB cases were classified into two categories: indigenous and non-indigenous people and analysis was performed according to sex, age, origin (urban /rural), State of residence, clinical form, diagnostic tests, monitoring indicators and results of treatment. Altogether 4832 cases were reported, with 322 cases (6.7%) in indigenous people. There was a male predominance (ratios: 1.7 to 1.3 in non-indigenous and indigenous people). The majority of cases for indigenous people (82.6%) was in rural area and there was high concentration of cases (36.0%) in children < 15 years. The analysis of diagnostic tests showed a predominance of smear positive in non-indigenous peoples (56.1%) and smear negative and smear not performed in indigenous people (31.7% and 35.4% respectively, P value = 0.0001). There was difference in the monitoring in relation to smear of second month (6.1% positivity, P value = 0.0001) and exam at least one contact (69.6%, P value = 0.017) for non-indigenous peoples. On the other hand, DOTS was more associated with indigenous people cases (23.6%, P value = 0.0001). Stands out the predominance of cure in both groups, with bigger concentration in indigenous people (90.4%, P value = 0.0001) and higher rate of noncompliance in non-indigenous peoples (14.7%, P value = 0.0001). The approach showed useful for elucidate inequalities and has exceeded the usual analysis carried out surveillance on services that aim to delineate the epidemiological situation based only on rates or absolute values.

Keywords: Tuberculosis. Health surveillance. South American Indians. Epidemiology. Health services evaluation. Health Information Systems. Indigenous populations.

Resumo

Com a intenção de ampliar o conhecimento sobre a situação epidemiológica da tuberculose (TB) entre populações vulneráveis no Brasil, nosso objetivo foi analisar características sociodemográficas e indicadores operacionais referentes ao controle da TB, comparando indígenas e não indígenas em Rondônia. Realizou-se estudo epidemiológico descritivo e retrospectivo dos casos novos de TB notificados entre 01/01/1997 e 31/12/2006. Foram excluídos os registros duplicados e aqueles para os quais o desfecho foi mudança de diagnóstico e transferência. Os casos de TB foram classificados em duas categorias: indígenas e não indígenas, e foi realizada análise, segundo sexo, faixa etária, procedência (urbana/rural), UF de residência, forma clínica, exames diagnósticos, indicadores de acompanhamento e situação de encerramento. Ao todo foram identificadas 4.832 notificações, com 322 casos (6,7%) em indígenas. Houve predomínio no sexo masculino (razões: 1,7 em não indígenas e 1,3 em indígenas). A maioria das notificações em indígenas (82,6%) foi da zona rural e houve elevada concentração (36,0%) em menores de 15 anos. A análise dos exames realizados demonstrou predomínio de baciloscopias positivas em não indígenas (56,1%) e baciloscopias negativas e não realizadas entre indígenas (31,7% e 35,4%, respectivamente, P valor = 0,0001). Houve diferença no acompanhamento em relação à baciloscopia do 2º mês (6,1% de positividade, P valor = 0,0001) e no exame de pelo menos um contato (69,6%, P valor = 0,017) para não indígenas. Por outro lado, o tratamento supervisionado esteve mais associado aos casos indígenas (23,6%, P valor = 0,0001). Destaca-se o predomínio de cura em ambos os grupos, com maior concentração em indígenas (90,4%, P valor = 0,0001), e maior proporção de abandono em não indígenas (14,7%, P valor = 0,0001). A abordagem empregada mostrou-se útil para elucidar desigualdades e superou as usuais análises realizadas nos serviços de vigilância que visam delinear a situação epidemiológica da TB baseadas, apenas, em taxas ou valores absolutos.

Palavras-chave: Tuberculose. Vigilância em saúde. Índios sul-americanos. Epidemiologia. Avaliação de serviços de saúde. Sistemas de informação em saúde. Populações indígenas.

Introduction

In Brazil, tuberculosis (TB) is endemic with marked regional inequality¹. Faced with the need to control the disease and in compliance with a program policy, the Health Ministry's goal through the National Tuberculosis Control Program (NTCP) is to detect at least 70% of the expected cases, to cure 85% of the diagnosed cases and to reduce the noncompliance numbers to levels below 5%. Ideally, such actions are supposed to be implemented in 100% of Brazilian municipalities².

Data provided by the Brazilian National Reportable Diseases Surveillance System (Sistema de Informação de Agravos de Notificação – Sinan) have indicated the annual registration of more than 80 thousand cases of tuberculosis in the country (www.datasus.gov.br). The Northern and Southeastern regions have shown the highest incidence rates (http://portal.saude.gov.br/portal/arquivos/pdf/apresentacao_incidencia_05_04_11.pdf; accessed on 06/29/2011).

The State of Rondônia (RO), located in the Northern region has shown similar incidence to that reported for Brazil as far as the general population is concerned. However, when special populations such as indigenous people are highlighted the average rates of incidence of tuberculosis are much higher³, as what has been observed with respect to the Suruí ethnical group, in which 2,500 cases/100,000 inhabitants were observed, in the 1991-2002 period⁴.

A Health Ministry report indicated that in 2004, the incidence of TB in all its forms was 36.9/100,000 in the State of Rondônia, while for the smear positive form it was 18.6/100,000 inhabitants. The analysis of the treatment cohort, including just the four priority municipalities in the State, showed a 66.1% cure rate. Treatment failure was recorded in 10.0% of the reports, death in 4.7%, transfers in 16.6% and incomplete cases in 7.6%. In addition to this, co-infection with the Aids virus has been reported in 1.3% of records (http://bvsms.saude.gov.br/bvs/publicacoes/relatorio_snvs_ro_2ed.pdf,

accessed on 07/20/2011). Although priority municipalities have received more financial incentives towards developing tuberculosis control actions, the data above has shown that the operational indicators analyzed were found to be below the national targets as agreed with the NTCP.

In accordance with the decentralization guidelines of the Brazilian Unified Health System (SUS), the actions relative to NTCP should be executed within the primary health care field and are under the responsibility of municipalities^{2,5}. It should be highlighted that within the SUS, in more than 400 Brazilian municipalities, the Indigenous Health Care Subsystem (Sasi-SUS) is operating. The Sasi-SUS is organized in the form of Special Indigenous Sanitary Districts (Dsei). These are operational units whose territorial definition takes into account not only technical-operational and geographical criteria, but also attempts to respect the culture, the political relations and the indigenous ancestral population distribution, which in most of the cases fails to coincide with the States border and/or municipalities where indigenous reserves are located. Therefore, the Dsei are under the responsibility of the federal government and are currently linked to the Special Department of Indigenous Health Care (Sesai) as an integral part of the organizational structure of the Ministry of Health.

The present study aimed to assess the socio-demographic characteristics and the operational indicators related to tuberculosis control, comparing indigenous and non-indigenous in the State of Rondônia between 1997 to 2006, in order to improve the knowledge on the epidemiological situation of TB among the country's vulnerable populations.

Methods

A descriptive and retrospective epidemiological study of cases of tuberculosis reported in the State of Rondônia was carried out, through the analysis of data from the Brazilian National Reportable

Diseases Surveillance System (Sinan), obtained at the Health Department of the State of Rondônia's State Coordination for the Control of Hansen's Disease and Tuberculosis.

Rondônia occupies an area equivalent to 237,590.864 km², distributed throughout 52 municipalities and 20 demarcated and approved indigenous reserves. According to the demographic census, the population in 2010 totaled 1,562,409 individuals, and of these, 0.8% (n=12,015) was self-reported as indigenous peoples. The State has the Porto Velho and Vilhena Dsei which include part of the States of Amazonas (AM) and Mato Grosso (MT) in their territorial extension.

All the cases in which the "tipo de entrada" (input type) variable was filled out under the categories "caso novo" (new case) or "não sabe" (not known), reported in the January 1st 1997 to December 31st 2006 period, were included. Records considered as true duplicity, namely, those having two or more reports for the same patient, coming from the same reporting unit with the same reporting date, and in which the same "tipo de entrada" (input type)⁶ was informed, were excluded. Cases in which "mudança de diagnóstico" (change in diagnosis) ou "transferência" (transfer) were informed as result of treatment, were also excluded.

The individual reporting card, that is, a standard instrument used by the Health Ministry in the entire national territory⁶, should be filled out at health services where a diagnosis of TB is made. This card has a set of clinical and demographic variables, among which non-compulsory skin-color or race. The information ought to be filled out by self-reporting in compliance with the categories adopted by the Brazilian Institute of Geography and Statistics (IBGE). Namely, patients have to classify themselves under one of the following categories: white, black, yellow, brown and indigenous peoples. The correct information on this variable would make the identification of TB cases among the indigenous peoples easier in the Sinan.

However, in Rondônia for the assessed period, only 46% of the records had such

information. For this reason and bearing in mind that among the indigenous peoples population in Rondônia it is a common practice for the ethnicity to superimpose the surname (E.g. José *Uru-Eu-Wau-Wau*), following the example of other epidemiological studies of an ethnic/racial delimitation^{3,7,8}, a decision was made towards an ethnic classification procedure of the patients in two categories – indigenous and non-indigenous peoples – by consulting the name-surname identification field, as well as the fields related to house address and the reporting health unit.

The classification adopted in this study was independently carried out by one of the authors and a collaborator with previous work experience among the indigenous people in Rondônia. *Kappa* statistics was used and the concordance proved to be nearly perfect (0.97)⁹. In cases where there were disagreements, these were solved by a consensus following a complementary consultation carried out with the health professional of the Rondônia Indigenous Health Care Subsystem.

TB case analysis was carried out according to variables such as sex, age range, place of origin (urban and rural), State of residence and clinical form. The detection of cases was further analyzed by means of the following diagnostic tests: smear and culture sputum, chest x-ray, tuberculin skin tests, anti-HIV serology and histopathology exam; and result of treatment of cases, comparing indigenous and non-indigenous people.

Complementarily, for the analysis of the monitoring indicators related to the follow-up on TB cases, an empirical classification system taking into account five recommendations proposed by the III Brazilian guidelines for the control of TB¹⁰ was designed, namely: if the case reported performed smear control during the 2nd, the 4th and the 6th month of treatment; if there was recording of tests on contacts; and if the treatment was supervised (DOTS). The cases that failed to comply with or which only complied with one of the above recommendations were classified as *insufficient follow-up*.

The cases, which complied with two of the recommendations, were classified as *regular follow-up*. The cases that complied with at least three recommendations were classified as *good follow-up*. Finally, the cases, which complied with at least four recommendations, were classified as *excellent follow-up*.

Following the classification as per the adopted system, the study tried to establish the association between the follow-up and treatment results of cases comparing the indigenous and non-indigenous peoples.

Data were structured into electronic spreadsheets (Excel) and analyzed in accordance with the Statistical Package for the Social Sciences, version 9.0 (SPSS Inc., Chicago, IL, USA).

The Mann Whitney U Test was used at analysis of the age variable, and the Pearson chi-square (χ^2) for the comparison of proportions among the variables of interest (according to the indigenous people and non-indigenous people classification). The significance level adopted was 5%.

This study is part of a wider investigation known as “*Tuberculose entre os povos indígenas de Rondônia*”, which was approved by the Ethical Committee on Research of the Escola Nacional de Saúde Pública Sergio Arouca (CEP/Ensp) as per Opinion n° 14/07.

Results

Originally, the database received for analysis had 6,631 reports covering the 1997 to 2006 period. Of this total, 224 (3.4%) true duplicities, 1,032 (15.6%) cases which were not new, and 543 (8.2%) cases, which were informed to have had a change in diagnosis and transfer as a result of treatment, were excluded. Our analyses, therefore, considered a total of 4,832 cases, amongst which 322 (6.7%) were classified under the indigenous peoples category. There was a predominance of cases among males, with the following ratio: 1.7 of non-indigenous and 1.3 of indigenous peoples.

The median age in indigenous peoples cases was 20.0 years old, while in the non-indigenous cases it was 36.1 years old

(P value: 0.0001). It is to be emphasized that among the indigenous peoples there was a high concentration of cases in under 15-year olds (36.0%), whereas there was a higher concentration (41.0%) as far as non-indigenous cases were concerned in the 25 to 44 age bracket (P value=0.0001) (Table 1).

With respect to the origin of cases, most reports (82.6%) observed among the indigenous peoples were from the rural zone. An inverse situation was verified amongst the non-indigenous cases, in which there was a predominance of reports in the urban zone (83.5%). Regarding the States of residence, 12.5% of the reports among the indigenous peoples occurred in individuals living in other States, essentially the State of Amazonas and the State of Mato Grosso. Such fact was not verified amongst the non-indigenous, since the near total (99.6%) of

reports occurred in residents in the State of Rondônia (Table 1).

There was a predominance of reports of the pulmonary clinical form in both groups slightly higher among the indigenous peoples (91.6% in the pulmonary form among the indigenous people and 10.9% in the extra-pulmonary form among the non-indigenous, P value=0.076) (Table 1).

With respect to diagnostic tests carried out for detecting cases, there was a predominance of positive smears among the non-indigenous (56.1%) and negative smears and non-performed ones among the indigenous peoples (31.7% and 35.4%, P value=0.0001). There were no significant differences in chest X-ray, sputum culture and the tuberculin skin tests results among the indigenous peoples and non-indigenous. However, there was a significant

Table 1 - New TB cases, according to sex, age, origin, federal unit of residence and clinical form comparing indigenous and non-indigenous peoples, State of Rondônia, Brazil, 1997-2006.

Tabela 1 - Casos novos de TB, segundo sexo, faixa etária, procedência, unidade federada de residência e forma clínica, comparando indígenas e não indígenas, Rondônia, 1997-2006.

	Total		Indigenous				X ² (P value)
	n	%	Yes		No		
	n	%	n	%	n	%	
Sex							
Male	3,015	62.4	183	56.8	2,832	62.8	4.302
Female	1,817	37.6	139	43.2	1,678	37.2	(0.038)
Age group (years)							
0-14	344	7.1	116	36.0	228	5.1	457.365
15-24	1,001	20.7	72	22.4	929	20.6	(0.0001)
25-44	1,906	39.4	59	18.3	1,847	41.0	
45-64	1,166	24.1	47	14.6	1,119	24.8	
65 or more	415	8.6	28	8.7	387	8.6	
Place of origin							
Urban	3,823	79.1	56	17.4	3,767	83.5	795.639
Rural	1,009	20.9	266	82.6	743	16.5	(0.0001)
Federal unit of residence							
Rondônia	4,774	98.7	282	87.5	4,492	99.5	409.866
Mato Grosso	42	0.9	34	10.6	8	0.2	(0.0001)
Amazonas	13	0.3	6	1.9	7	0.2	
Others	3	0.1	0	0.0	3	0.1	
Clinical form							
Pulmonary	4,247	87.9	295	91.6	3,952	87.6	5.160
Extra-pulmonary	512	10.6	22	6.8	490	10.9	(0.076)
Pulmonary + Extra-pulmonary	73	1.5	5	1.6	68	1.5	

Fonte/Source: Brazilian National Reportable Diseases Surveillance System, Health Department of the State of Rondônia's State Coordination for the Control of Hansen's Disease and Tuberculosis

difference in the histopathology exam, as among the non-indigenous the proportion of suggestive cases of TB was higher (P value=0.026). Cases of HIV co-infection were detected only in the non-indigenous (2.4%, P value=0.0001) (Table 2).

As to the follow-up of cases, there was a difference *vis-à-vis* the 2nd month smear in which 6.1% of the non-indigenous cases yielded positive results (P value=0.0001).

Although lower positivity proportions have been recorded among the indigenous peoples, the 4th and 6th month smears failed to reveal a significant difference in the follow-up of both groups. The exam of at least one contact was more frequent among the non-indigenous (69.6%, P value=0.017). On the other hand, information on the presence of a Directly Observed Short Course Treatment (DOTS) was practically two-fold

Table 2 - New cases of TB, according to diagnostic tests (smear, X-ray, culture, tuberculin skin test, HIV, histopathology), monitoring (smear 2nd, 4th and 6th months, supervised treatment and examination of contacts) and results of treatment, comparing indigenous and non-indigenous peoples, State of Rondônia, 1997-2006.

Tabella 2 - Casos novos de TB, segundo exames diagnósticos (baciloscopia, raio-X, cultura, teste tuberculínico, anti-HIV, histopatológico), acompanhamento (baciloscopia do 2º, 4º e 6º mês, tratamento supervisionado e exame de contatos) e situação de encerramento, comparando indígenas e não indígenas, Rondônia, 1997-2006.

	Indigenous						χ^2 (P value)
	Total		Yes		No		
	n	%	n	%	n	%	
Diagnostic tests							
Smear							
Positive	2,635	54.5	106	32.9	2,529	56.1	85.509 (0.0001)
Negative	1,301	27.0	102	31.7	1,199	26.6	
Not-performed	896	18.5	114	35.4	781	17.3	
X-ray							
Suspect	3,919	81.1	269	83.5	3,650	80.9	2.726 (0.436)
Normal	131	2.7	8	2.5	123	2.7	
Other pathology	77	1.6	2	0.6	75	1.7	
Non-performed	705	14.6	43	13.4	662	14.7	
Culture							
Positive	114	2.4	7	2.2	107	2.4	1.367 (0.713)
Negative	76	1.6	4	1.2	72	1.6	
In-process	148	3.1	13	4.0	135	3.0	
Not-performed	4,494	92.9	298	92.5	4,196	93.0	
Tuberculin skin test							
0 to 4 mm	296	6.1	17	5.3	279	6.2	1.247 (0.742)
5 to 9 mm	63	1.3	5	1.6	58	1.3	
>10 mm	700	14.5	42	13.0	658	14.6	
Not-performed	3,773	78.1	258	80.1	3,515	77.9	
HIV							
Positive	109	2.3	0	0.0	109	2.4	30.980 (0.0001)
Negative	384	7.9	34	10.6	350	7.8	
In-process	487	10.1	9	2.8	478	10.6	
Not-performed	3,852	79.7	279	86.6	3,573	79.2	
Histopathology							
AFBZ positive	174	3.6	7	2.2	167	3.7	11.033 (0.026)
Suggestive of TB	163	3.4	3	0.9	160	3.5	
Not suggestive of TB	41	0.8	3	0.9	38	0.8	
In-process	98	2.0	3	0.9	95	2.1	
Not-performed	4,356	90.0	306	94.9	4,012	89.8	

Table 2 - continuation
Tabela 2 - continuação

	Indigenous						χ^2 (P value)
	Total		Yes		No		
	n	%	n	%	n	%	
Follow-up exams							
Smears (2nd month)							
Positive	274	5.7	1	0.3	273	6.1	21.157
Negative	1,329	27.5	106	32.9	1,223	27.1	(0.0001)
Not-performed	3,229	66.8	215	66.8	3,014	66.8	
Bacilloscopy (4th month)							
Positive	60	1.2	2	0.6	58	1.3	1.532
Negative	1,398	28.9	99	30.7	1,299	28.8	(0.465)
Not-performed	3,374	69.9	221	68.5	3,153	69.9	
Bacilloscopy (6th month)							
Positive	23	0.5	0	0.0	23	0.5	2.675
Negative	1,419	29.4	103	32.0	1,316	29.2	(0.262)
Not-performed	3,390	70.1	219	68.0	3,171	70.3	
DOTS							
Yes	625	12.9	76	23.6	549	12.2	47.399
No	1,458	30.2	58	18.0	1,400	31.0	(0.0001)
Not informed	2,749	56.9	188	58.4	2,561	56.8	
Contacts exam							
No	1,491	30.9	119	37.0	1,372	30.4	6.016
At least one	3,341	69.1	203	63.0	3,138	69.6	(0.017)
Treatment result situation							
Cure	3,727	77.2	291	90.4	3,436	76.3	38.662
Noncompliance	677	14.0	13	4.0	664	14.7	(0.0001)
MDR-TB	7	0.1	1	0.3	6	0.1	
Death	234	4.8	12	3.7	222	4.9	
Not informed	187	3.9	5	1.6	182	4.0	

Fonte/Source: Brazilian National Reportable Diseases Surveillance System, Health Department of the State of Rondônia's State Coordination for the Control of Hansen's Disease and Tuberculosis

the one of the indigenous peoples (23.6%, P value=0.0001) (Table 2).

With respect to treatment result status, the predominance of a favorable outcome in both groups stands out, although in a higher concentration among the indigenous peoples, among whom cure was reported in 90.4% of cases (P value=0.0001). On the other hand, was possible to verify that the proportion of noncompliance among the non-indigenous (14.7%, P value=0.0001) was nearly three times higher than the registered among the indigenous peoples. Besides, there was a greater proportion of cases without any information on the result of treatment among the non-indigenous (4.0%, P value=0.0001) (Table 2).

The assessment of the classification

system for the follow-up on the cases *vis-à-vis* the result of treatment revealed no association among the indigenous peoples. However, it is worth highlighting that all cases of death recorded in this group, were concentrated in the insufficient category (6.6%, P value=0.169) (Table 3). With respect to the non-indigenous, such assessment revealed a significant association between the follow-up indicator and the result of treatment, with highlight to the high concentration of noncompliance and death in the insufficient category (21.2% and 6.9%, respectively, P value=0.0001), as well as for the high concentration of cure in the good and excellent categories (90.6% and 95.6%, respectively, P value=0.0001) (Table 3).

Table 3 - Comparative analysis of indicator monitoring and treatment outcome of new cases of TB between indigenous and non indigenous people, State of Rondônia, 1997-2006.

Tabela 3 - Análise comparativa entre o indicador de acompanhamento e a situação de encerramento dos casos novos de TB, entre indígenas e não indígenas, Rondônia, 1997-2006.

	Treatment result situation	Follow-up							
		Insufficient		Regular		Good		Excellent	
		n	%	n	%	n	%	n	%
Indigenous*	Cure	157	86,3	37	94,9	47	95,9	50	96,2
	Noncompliance	9	4,9	2	5,1	2	4,1	0	0,0
	MDR-TB	12	6,6	0	0,0	0	0,0	0	0,0
	Death	1	0,5	0	0,0	0	0,0	0	0,0
	Not informed	3	1,6	0	0,0	0	0,0	2	3,8
	Total	182	100,0	39	100,0	49	100,0	52	100,0
Non Indigenous**	Cure	1,718	67.5	539	77.3	572	90.6	607	95.6
	Noncompliance	539	21.2	75	10.8	34	5.4	16	2.5
	MDR-TB	177	6.9	29	4.2	11	1.7	5	0.8
	Death	3	0.1	3	0.4	0	0.0	0	0.0
	Not informed	110	4.3	51	7.3	14	2.2	7	1.1
	Total	2,547	100.0	697	100.0	631	100.0	635	100.0

Fonte/Source: Brazilian National Reportable Diseases Surveillance System, Health Department of the State of Rondônia's State Coordination for the Control of Hansen's Disease and Tuberculosis

* $\chi^2(12 \text{ gl}) = 16,511$ P value = 0,169

** $\chi^2(12 \text{ gl}) = 356,332$ P value = 0,0001

Discussion

The findings of this investigation have indicated that in the State of Rondônia: most TB cases among the indigenous peoples come from the rural zone, the indigenous peoples fall ill at younger ages, and the rate of positive sputum smears is lower when compared to the non-indigenous.

Within the period of this analysis (1997 to 2006), the indigenous peoples contingent in Rondônia represented less than 1% of the whole population. However, in a clearly disproportional manner, the indigenous peoples concentrated nearly 7% of all reports, indicating a higher vulnerability to TB illness and a shortage in care by the health sector for this population of the State.

As reported in the national¹¹ and international¹² literature, in Rondônia there was a predominance of cases in males, however, the sex ratio (male/female) among

the indigenous peoples (1.3/1) was lower to what is usually described in the general population in the country, which is around 1.7/1 (www.datasus.gov.br).

It has been consistently described in the literature for quite some time that TB cases occur more frequently in young adults and in the main productive life span (25-44 years of age)^{12,13,14}. In our investigation, what drew our attention was that, among the indigenous peoples 36% of the cases occurred in individuals under 15 years old, suggesting recent infections by *Mycobacterium tuberculosis* (MTB), probably caused by the contact with a smear positive individual¹⁵.

Recent studies carried out with the Suruí ethnical group in Rondônia, however, have indicated that there may be errors in the diagnostic classification of TB cases in indigenous children^{16,17}. In the studies cited, the authors discuss that in approximately 1/3 of the cases registered in under

15 year-old individuals, treatments were initiated without the complete exploration of all diagnostic investigation possibilities. Namely, diagnoses have been mostly clinical, without performing complementary exams adequately, a fact that could explain part of the excess of reports in the under 15 year-old group.

Indigenous reserves in Rondônia are essentially located in the rural zone of the State. Our analysis has shown that the cases of tuberculosis among the indigenous peoples are mostly found in the rural zone suggesting that indigenous reserves are important foci in the dissemination of the disease in the State. Primary data collected in Rondônia and in other indigenous reserves in the country^{18,19,20,21,22} have revealed high rates of prevalence and high risk of infection by *Mycobacterium tuberculosis*, confirming the elevated transmission in these locations.

Different from what was observed among the non-indigenous where most cases were of individuals living in Rondônia, among the indigenous peoples there was high percentage of cases living in other States in the country, indicating as pointed out in the introduction that the area reached by the Indigenous Health Care Subsystem is not restricted to the territorial limits of States and municipalities. In principle, the subsystem should offer culturally-differentiated health care with the goal of reducing the health inequalities generally observed among the indigenous peoples. TB cases, which have been identified in the States of Amazonas and Mato Grosso likely originated from the indigenous ethnical groups cared by the Porto Velho and Vilhena Dsei, respectively.

It is worth pointing out that the management of these cases was probably not carried out in the municipalities of origin and/or residence, but rather elsewhere where there were Indigenous Health Homes (Casai) and a better health care structure to take care of indigenous patients both with respect to diagnoses and/or with respect to the treatment and follow-up of the TB cases. In any case, when actions are planned

to control TB in municipalities, one hardly takes into account the structuring of teams and additional expenditures for health care to people coming from other municipalities or States (in our case 12.5%). These aspects certainly impose additional challenges to the adequate control of TB among the indigenous peoples in the region.

It is likely that as a result of the small absolute number of cases distributed in each category, or by the limitation of the adopted classification system, it may not have been possible to establish a significant statistical association between the follow-up of cases and the result of treatment as far as the indigenous peoples are concerned. However, it is worth remembering that in this group, all the deaths registered were concentrated under the monitoring insufficient category. Such fact can reflect the seriousness of TB cases among the indigenous peoples or the difficulty to follow-up the cases for the successful undertaking by the local health service.

On the other hand, it was not possible to reveal a significant association between the monitoring indicator and the results of treatments for the indigenous peoples, highlighting the high rates of noncompliance and death in the insufficient category as well as cure in the good and excellent categories. It is interesting to note that the smallest percentage of noncompliance and death also was recorded in the classification of good and excellent monitoring.

The above-mentioned findings are coherent with the national and international recommendations for the adequate follow-up of the cases under treatment showing that, despite being empirical and non-validated, the hereby used classification system has operated within the logic of the National Tuberculosis Control Program, indicating that the success in the treatment of tuberculosis is directly related to the health service surveillance capacity. Namely, duly accompanied TB patients have more cases of cure, less failure and evolve less frequently towards complication and death^{23,24}.

On the other hand, when the

performance of health services is not satisfactory with regards to the follow-up of cases, treatment results are worse, and the percentages of abandoning treatment and death are higher. Thus, it is worth remembering that Nóbrega et al.²⁵ have also indicated a structural problems in the State of Paraíba Dsei (in the Brazilian Northeast region) where important frailties in the organization of the local health service and in the performance of TB control actions among the indigenous peoples of the region were identified.

It is also important to emphasize that since this is a study based on secondary reported data some limitations ought to be taken into account, such as: the possibility of under reporting of TB cases; problems related to the coverage and access to the services offered to the local population, specifically to the indigenous peoples; and the possible errors in the classification and/or diagnoses of tuberculosis cases reported in Rondônia.

Mistakes may have also been made in the classification used to allocate the TB cases under the indigenous peoples and non-indigenous categories. It is, therefore, possible that some indigenous peoples who no longer lived in indigenous reserves (“desaldeados”) during the study were included in the analysis. However, it is also possible to have indigenous peoples who live in the State rural zone but do not use ethnicity as their surname. We, therefore, believe that there has been a balance between

the probable classification mistakes, and therefore a balance as far as measures are concerned, reducing the effects of a likely spurious finding.

Despite the above indicated limitations, we understand that the approach used in this study has proved to be useful in overcoming the known problem relative to the data provided by Sinan in adequately differentiating TB reports between the indigenous and non-indigenous peoples^{26,27}. The approach has also surpassed the usual analyses performed by surveillance services, which aim to outline the epidemiological situation of TB based just on rates or absolute values in a given location.

Our investigation has, finally, unveiled notable inequalities in tuberculosis indicators between the indigenous and non-indigenous peoples raising the need for a wide debate among sanitary authorities, health professionals and civil society including, of course, the indigenous peoples with the purpose of designing and incorporating adequate strategies for the control of tuberculosis among Brazilian ethnical minorities.

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