Original Article

Evaluation of surveillance of contacts of new tuberculosis cases in the state of Mato Grosso, Brazil*

Avaliação da vigilância de contatos de casos novos de tuberculose no Estado de Mato Grosso - Brasil

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Abstract

Objective: To evaluate surveillance of contacts of new tuberculosis cases in the state of Mato Grosso from 1999 to 2004. **Methods:** This was a descriptive epidemiological study based on data from the Tuberculosis Case Registry Database. The number of new tuberculosis cases, the number of contacts (estimated, investigated, and uninvestigated), and the tuberculosis incidence rate were analyzed by age bracket. The mean rate of contacts investigated for each case of tuberculosis by age bracket was calculated per year of study. The cases of pulmonary tuberculosis with and without contacts investigated were analyzed by sputum smear microscopy results. **Results:** In 2004, there were 41.3 cases of tuberculosis per 100,000 inhabitants in the state of Mato Grosso. The south-central region presented the highest incidence rate (57 cases/100,000 inhabitants) and a 15% rate of contacts investigated. Among those younger than 15 years, 63 contacts (60.5%) were investigated, whereas among those aged 15 or older, 389 (8.9%) were investigated. In 1999, the mean rate of contacts investigated statewide was 0.02 (0.5%), and, in 2004, it reached 0.42 (10.5%). The percentage of contacts investigated was 40% higher among the contacts of contagious cases (OR = 1.4; 95% CI: 1.08-1.83). **Conclusions:** The percentage of contacts investigated is very low, principally among adults. The adoption of the standards for investigation of tuberculosis contacts proposed by the Brazilian National Ministry of Health Department of Health Surveillance has not ensured that this group at highest risk of developing active tuberculosis be given priority at health care facilities in the state of Mato Grosso.

Keywords: Contact tracing; Epidemiologic surveillance; Tuberculosis/prevention & control.

Resumo

Objetivo: Avaliar as ações de vigilância de contatos de casos novos de tuberculose em Mato Grosso no período de 1999 a 2004. **Métodos:** Estudo epidemiológico descritivo baseado em dados do Sistema de Informação de Agravos de Notificação-Tuberculose. O número de casos novos de tuberculose, o número de contatos (estimados, examinados e não examinados) e a taxa de incidência de tuberculose foram analisados segundo a faixa etária. Calculou-se, por ano de estudo, a média de contatos examinados para cada caso de tuberculose segundo a faixa etária. Os casos de tuberculose pulmonar com e sem contatos examinados foram analisados segundo o resultado da baciloscopia. **Resultados:** Em 2004, Mato Grosso apresentou 41,3 casos de tuberculose por 100 mil habitantes. A mesorregião centro-sul apresentou a maior taxa de incidência (57 casos/100 mil habitantes) e uma taxa de 15% de contatos examinados. Entre os menores de 15 anos, examinaram-se 63 contatos (60,5%), enquanto entre aqueles com 15 anos ou mais, examinaram-se 389 contatos (8,9%). Em 1999, a média de contatos examinados em Mato Grosso foi de 0,02 (0,5%), e, em 2004, ela alcançou 0,42 (10,5%). O percentual de contatos examinados foi 40,0% maior entre os contatos de casos bacilíferos (OR = 1,4; IC95%: 1,08-1,83). **Conclusões:** O percentual de contatos examinados é muito baixo, principalmente entre os adultos. A normatização do exame de contatos de tuberculose pela Secretaria de Vigilância em Saúde do Ministério da Saúde não tem sido suficiente para garantir que esse grupo de maior risco de adoecimento seja priorizado pelos serviços de saúde de Mato Grosso.

Descritores: Busca de comunicante; Vigilância epidemiológica; Tuberculose/prevenção & controle.

Introduction

The World Health Organization estimates that one third of the global population is infected with *Mycobacterium tuberculosis*. The annual number of new cases of tuberculosis (TB) is 8.7 million, and, of those, 80% are concentrated in 22 countries that present the highest TB burden, among which Brazil is ranked 15th.[1] In 2006, the Brazilian National Ministry of Health estimated that there are 129,000 new TB cases every year, although only approximately 90,000 are actually reported.

In order to control TB, it is essential to break the chain of TB transmission. Each undiagnosed individual tends to infect ten to fifteen people per year, and, of those, one or two develop the disease, maintaining the transmission of endemic TB.[2] According to the Brazilian National Ministry of Health,[3] the investigation of contacts is one of the most appropriate surveillance strategies for interrupting transmission and the subsequent development of TB, ranking lower in effectiveness only in relation to the active search for individuals presenting respiratory symptoms.

In 2003, the Brazilian National Ministry of Health created the Department of Health Surveillance, in which all surveillance and prevention activities were unified, leading to the restructuring of TB control measures and making it possible to integrate the various programs.[4] Epidemiological surveillance is defined as "a set of activities that allow the gathering of essential information to understand, at any moment, the behavior or natural history of diseases, as well as to detect or predict alterations in their conditioning factors, with the purpose of recommending, on solid bases, efficient, indicated measures that can lead to the prevention and control of certain diseases."[4] The principal objective of epidemiological surveillance of TB is to identify the possible sources of infection, which is done through epidemiological investigation among the contacts of every new TB case and, primarily, among those living or interacting with individuals with infectious TB, a group that is at a higher risk of becoming infected and developing the disease. This increase in the risk among contacts is dependent upon the infectiousness of the source, the characteristics of the contacts, and the characteristics of the environment.[5] The likely source of infection of children with TB is the adults with whom they live or interact. This situation requires compulsory home visits for individuals who fail to report to the health care facility for the investigation of contacts.

The Brazilian *Programa Nacional de Controle da Tuberculose* (PNCT, National Tuberculosis Control Program) proposes to increase the number of individuals diagnosed with active TB. The intention is to identify such individuals by performing sputum smear microscopy in those suspected of having TB, as well as in the contacts of those diagnosed with active TB, and to implement the registration of such individuals in the laboratory network of the Brazilian Unified Health Care System.[6]
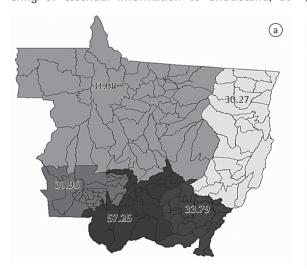

Figure 1 – Tuberculosis incidence per 100,000 inhabitants (a) and the percentage of tuberculosis-case contacts investigated (b) in the five regions of the state of Mato Grosso, 2004. Source: Tuberculosis Case Registry Database. Mato Grosso State Department of Health, 2005.

The objective of the present study was to evaluate the surveillance of contacts of new TB cases in the state of Mato Grosso from 1999 to 2004.

Methods

This was a descriptive epidemiological study based on the registry of new TB cases, reported between 1999 and 2004, among residents of the state of Mato Grosso. The data were obtained from the *Sistema de Informação de Agravos de Notificação-Tuberculose* (SINAN-TB, Tuberculosis Case Registry Database) of the Mato Grosso State Department of Health in May of 2005. The choice to analyze data collected from 1999 onward was based on the fact that such data were unavailable prior to that time.

The analysis of the incidence and percentages of investigated and uninvestigated contacts of new TB cases in the state of Mato Grosso and its respective geographic regions was performed using the programs Epi Info, version 3.2, and Tab Win (http://www.datasus.gov.br).

The incidence rates, which are based on the cases reported in the SINAN-TB, were calculated according to the Guide to Epidemiological Surveillance issued by the Brazilian National Ministry of Health.[4]

This guide does not present parameters for the minimal number of contacts to be investigated for each case diagnosed. Therefore, the average number of contacts that should have been investigated for each case reported was assumed to be 4. This value is based on the average number of residents per household in the state of Mato Grosso, as reported by the Brazilian Institute of Geography and Statistics.[7]

The estimates related to the 1999-2004 period were made by identifying the contacts investigated, estimating the number of contacts that should have been investigated, and estimating the number of contacts that were not investigated. In order to estimate the number of contacts investigated by age bracket, the variable age was divided into two categories: <15 years and ≥15 years. We performed a bivariate analysis of the cases of pulmonary TB with and without contacts investigated based on sputum smear microscopy results (positive and negative). This analysis was performed by calculating the crossover ratio and the respective 95% confidence intervals. The minimal number of 4 contacts investigated was also considered the cut-off point in this

analysis. The cases of pulmonary TB for which less than 4 contacts had been investigated were categorized as TB cases without contacts investigated.

Results

Figure 1 shows the distribution of the TB incidence rate per 100,000 inhabitants and the percentage of new TB case contacts investigated in the state of Mato Grosso in 2004. The highest incidence rate was found in the south-central region, and the lowest was found in the eastern region (57 and 30 cases per 100,000 inhabitants, respectively). However, in the south-central region, only 15% of the contacts were investigated, compared with 25% (the second highest rate) in the eastern region. Except in the southeastern region, which presented the highest percentage of contacts investigated (38.7%) together with a high incidence rate (33.8 per 100.000 inhabitants), incidence rates were found to be inversely proportional to the percentage of contacts investigated, that is, the lowest percentages of contacts investigated were found in the regions with the highest incidence rates.

Table 1 presents the population, the number of new TB cases, the number of contacts that should have been investigated in the year 2004, and the incidence rates for the two age groups studied. In 2004, there were 41.3 TB cases per 100,000 inhabitants in the state of Mato Grosso. Among those younger than 15 years, 63 contacts (60.5%) were investigated, and 41 (39.5%) were not. Among

Table 1 – Distribution of population, number of new tuberculosis cases, number of contacts (estimated, investigated, and uninvestigated), and tuberculosis incidence, by age bracket, in the state of Mato Grosso, 2004.

	Total	<15 years	≥15 years
Population	2,697,717	858,406	1,839,311
New tuberculosis cases	1113	26	1087
Contacts investigated	452	63	389
Contacts estimated	4452	104	4348
Contacts uninvestigated	4017	41	3959
Tuberculosis incidence*	41.26	3.03	59.10

Source. Tuberculosis Case Registry Database, Mato Grosso State Department of Health, 2005. *rate per 100,000 inhabitants.

those aged 15 or older, 389 contacts (8.9%) were investigated, and 3959 (91.1%) were not.

The comparison of the distribution, by age bracket and by year of study, of the mean and the percentage of contacts investigated of new TB cases registered for treatment in the state of Mato Grosso (Table 2) revealed that, in 2000 and 2004, an average of 2 contacts were investigated for each case diagnosed among those younger than 15 years of age, which corresponds to 50% and 60.5% of the contacts estimated, respectively. We found that the mean rate of contacts investigated increased slightly over the years evaluated. The mean rate of contacts investigated statewide was 0.02 (0.5%) in 1999, reaching 0.42 (10.5%) in 2004.

Table 3 presents the analysis of the cases of pulmonary TB with and without contacts investigated by sputum smear microscopy results. Among the 4051 cases in which the sputum smear microscopy results were positive, 4 or more contacts had been investigated in 170 (64.4% of the 264 cases in the *Contacts investigated* category), and fewer than 4 contacts had been investigated in 3881 (56.3% of the 6893 cases in the *Contacts not investigated* category). Of the 3106 cases in which the sputum smear microscopy results were negative, 4 or more contacts had been investigated in 94 (35.6% of the 264 cases in the *Contacts investigated* category), and fewer than 4 cases had been investigated in 3012 (43.7% of the 7157 cases in the *Contacts not investigated* category). Although the percentage of contacts investigated was low in the two groups studied, it was 40% higher for the cases in which the sputum smear microscopy results were positive than for those in which the sputum smear microscopy results were negative (OR = 1.4; 95% CI: 1.08-1.83).

Table 2 – Distribution, by year of study and by age bracket, of the contacts investigated for each new case of tuberculosis in the state of Mato Grosso, 1999-2004.

Year	Contacts investigated					
	<15 years old		≥5 years old		Total	
	Mean	%	Mean	%	Mean	%
1999	0.00	0.00	0.02	0.50	0.02	0.50
2000	2.00	50.00	0.03	0.75	0.03	0.75
2001	0.76	19.00	0.11	2.75	0.13	3.25
2002	0.53	13.20	0.37	9.25	0.38	9.50
2003	0.93	23.20	0.40	10.00	0.42	10.50
2004	2.42	60.50	0.36	9.00	0.42	10.50

Source. Tuberculosis Case Registry Database, Mato Grosso State Department of Health, 2005.

Discussion

The procedures involved in the investigation of contacts, defined as an epidemiological surveillance activity by the PNCT, are standardized in official publications issued by the Brazilian National Ministry of Health. However, such investigation has not been given priority at health care facilities in the state of Mato Grosso.

In this study, we observed that the percentage of contacts investigated for each TB case remained practically insignificant from 1999 to 2001, increasing in the three following years, but remaining under 11% (considering an expected minimum of 4 contacts per case). This significant deficiency in TB surveillance has probably impaired the control of the disease.

The investigation of contacts of pulmonary TB cases plays an important role in the identification of cases of infection and of tubercles, especially in children. Such investigation allows the detection of new sources of infection through the identification of patients in the initial stage of the disease, when there is a lower risk of complications and death.[8,9] Studies have shown that the investigation of contacts (the search for new cases among the contacts), especially those living in the same household, clearly plays a role in controlling TB.[9-12]

In the present study, the analysis of the TB incidence rate and of the percentage of contacts investigated in each geographic region of the state revealed a spatial relationship between these two indicators. Since the number of contacts investigated was inversely proportional to the rate of disease transmission (the number of new cases diagnosed), the percentage of contacts investigated partially explains the incidence rate.

In 2004, the percentage of contacts investigated was highest in the southeastern region (39%). However, this still falls far short of what is recommended and is probably insufficient to have a major impact on incidence. Therefore, it is possible that the high incidence rate in the southeastern region is due to weak surveillance, as well as to the fact that Rondonópolis, the third largest city in the state in terms of number of inhabitants, is located in the region.

The lowest percentage of contacts investigated and the highest incidence rate were found for the south-central region, where 33% of the inhabitants of the state reside. Of the 4 cities considered TB

Table 3 – Cases of pulmonary tuberculosis with and without contacts investigated, by sputum smear microscopy results, in the state of Mato Grosso, 1999-2004.

Variable	Cases of pulmonary tuberculosis						OR (95% CI) p value
	Contacts investigated		Contacts not investigated		Total		
	n	%	n	%	n	%	
Sputum smear microscopy (+)	170	64.4	3881	56.3	4051	56.6	1.40 (1.08-1.83) p = 0.009
Sputum smear microscopy (–)	94	35.6	3012	43.7	3106	43.4	
Total	264	100	6893	100	7157	100	

Source. Tuberculosis Case Registry Database, Mato Grosso State Department of Health, 2005. OR: odds ratio; and 95% CI: 95% confidence interval.

priorities for the PNCT, 3 are located in this region: Cuiabá (the state capital), Várzea Grande, and Cáceres. The higher TB incidence rate in this region reflects the fact that TB is associated with socioeconomic factors such as poverty, unequal distribution of wealth, and accelerated urbanization.[3,13-15] Such conditions are especially prevalent on the outskirts of the larger cities in each region.[13,14,16] Therefore, one of the criteria used by the PNCT for classifying cities as priorities is the size of the resident population.

According to some authors,[16] health care facilities prioritize the treatment of TB cases to the detriment of basic prevention. The low rates of investigation of contacts might be attributable to overloaded conditions at other health care facilities, which are promoted by the health care decentralization, especially after the passage of the Basic Operational Norm (01/96), which stated that health care management is ultimately the responsibility of municipal officials. Within this context, we emphasize the implementation of the Family Health Program and the marked increase in its scope within the state of Mato Grosso. Although this program gives priority to TB control, it widens the variety of attributions and responsibilities of the teams considerably, making it difficult to carry out. Despite the financial support offered by the federal government in order to strengthen basic health activities and health surveillance, problems such as high staff turnover rates, unsatisfactory supervision, and program management at the municipal level can influence the performance of the PNCT.[17-19]

According to the Guide to Epidemiological Surveillance of Tuberculosis,[3] the investigation of contacts of adult and pediatric patients with smear-positive pulmonary TB should be prioritized in order to identify the primary source of infection (index case).

In the present study, we found that the contacts were more often investigated if the sputum smear microscopy results for the pulmonary TB case were positive than if they were negative, indicating that contact investigation was prioritized in cases of smear-positive pulmonary TB. However, in absolute values, the number is almost irrelevant if compared with that of uninvestigated contacts.

A recent study[20] reported a lack of systematization regarding the monitoring of the investigation of contacts of TB patients. Sputum smear microscopy is an efficient diagnostic method used in public health care, both for its rapidity and for its low cost,[21] currently being the principal tool for the diagnosis of TB. Individuals testing positive through sputum smear microscopy are considered to have TB and to expel, through the airways, the bacilli responsible for infection and dissemination of the disease. Such patients are more likely to transmit the disease, and their contacts should be investigated since the risk of infection is 15-times greater among such contacts. Various studies have recognized the importance of contacts of cases with positive sputum smear microscopy for the dissemination of TB.[9,22]

In the present study, the percentage of contacts investigated for smear-positive individuals younger than 15 years of age might have been influenced by the smaller number of cases in this age group, which implies a lower demand for this activity. The presence of TB in children should be viewed as a sentinel event in health care, since it refers to recent infection caused by contact with an individual with infectious TB.[10]

According to some authors,[11] the investigation of contacts of smear-positive individuals aged 15 or younger is one the most simple, easily carried out, and efficient control strategies for the diagnosis of the index case. In general, children acquire the

infection from an adult with infectious pulmonary TB with whom they are in physical proximity and with whom they spend a lot of time. However, the recommendation of TB control programs, statewide and nationwide, has focused on the evaluation and treatment of symptomatic adults.[12]

Using the SINAN-TB database to analyze the investigation of contacts is limited by certain issues related to the quality of the records. Therefore, it is possible that the number of contacts investigated was greater than that reported. Another significant limitation is the way in which these data are entered into the database. Typically, not all contacts of a given case are investigated within the span of a single day, week, or month. This information is found in the case monitoring reports. It is likely that data entry clerks occasionally replace data related to the number of contacts investigated in one month with those related to the current month, rather than including the summation of such reports. In either case, the percentage of contacts investigated would be underestimated. However, using the mean number of residents in the state of Mato Grosso as a parameter will possibly result in underestimation of the number of contacts uninvestigated. In low-income families and in population clusters, where the mean population density is typically higher than 4 inhabitants per household, TB is common.

Although there was an increase in the percentage of contacts investigated over the period studied, this final percentage is still insignificant in comparison with those found in the official recommendations. We concluded that making the investigation of contacts of TB patients a priority in epidemiological surveillance has not ensured that this group of individuals, who are at significant risk of developing active TB, be given priority at health care facilities in the state of Mato Grosso.

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