

# Original Article

## Analysis of the Tuberculosis Control Program in the city of Cáceres, Brazil, prior to and after the implementation of a Family Health Program\*

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### Abstract

**Objective:** To analyze the effectiveness of the Tuberculosis Control Program, in conjunction with the recently incorporated Family Health Program, in the city of Cáceres, Brazil, between 1999 and 2004. **Methods:** This was a descriptive epidemiological study, based on the registry of tuberculosis cases diagnosed and treated in Cáceres, according to the characteristics of the cases diagnosed, whether or not the protocol for diagnosis, treatment, and monitoring of patients was followed, as well as the type of health care facility involved. **Results:** The incidence of tuberculosis was reduced from 99.4 to 49.8 (per 100,000 inhabitants) between 1999 and 2004. The patients presented characteristics similar to those of patients from other regions of Brazil, with a predominance of males during their most economically productive years. Among the patients presenting pulmonary forms and treated via the Family Health Program, there was a reduction in the number of sputum smear microscopies performed at the moment of diagnosis (OR = 0.33; 95% CI: 0.16-0.66) and prior to discharge (OR = 0.32; 95% CI: 0.18-0.59). The patients monitored via the Family Health Program presented a 16.4% lower cure rate than did those treated at the referral center, as well as being more likely to abandon treatment (OR = 2.93; 95% CI: 1.15-7.46) and to die (OR = 5.71; 95% CI: 1.85-18.1). **Conclusion:** The decentralization of the treatment services to the family health clinics did not improve the treatment or monitoring of tuberculosis cases in the city of Cáceres.

**Keywords:** Tuberculosis/epidemiology; Community Health Services; Health care reform/Brazil.

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Submitted: 20 July 2006. Accepted, after review: 4 October 2006.

## Introduction

Tuberculosis (TB), notable for its magnitude, constitutes a serious public health problem in the current world. According to an estimate by the World Health Organization (WHO), one-third of the world population is infected with TB. From 1997 to 1999, TB incidence increased by 6% per year. In 2002, approximately 80% of the new cases were concentrated in 22 countries, one of which is Brazil. Within this group, India ranks first, with 1,856,000 new cases, and Brazil ranks fifteenth, with approximately 116,000 new cases.<sup>(1)</sup> In 2003, the incidence rate of all forms of TB in Brazil was 40.76 per 100,000 inhabitants, with 72,949 new cases. In the central-west region, where 6.9% of the Brazilian population is concentrated, the incidence rate was 27.11 per 100,000 inhabitants, with 3394 diagnosed cases. In the state of Mato Grosso, in that same year, 1065 new cases were reported, which resulted in an incidence rate of 39.52 per 100,000 inhabitants.<sup>(2)</sup>

In view of the TB-related burden of morbidity and mortality, measures for disease control have been established, systematized, and intensified through the *Programa Nacional de Controle da Tuberculose* (PNCT, National Tuberculosis Control Program), which was inaugurated in 1999. In 2001, the National Mobilization Plan for the Elimination of Leprosy and Tuberculosis was launched.<sup>(3)</sup> The measures developed in these programs are aimed at increasing early detection, as well as expanding the use of the directly observed therapy, short-course (DOTS) strategy in the treatment of TB cases, as is internationally recommended. The Brazilian government recognizes the importance of decentralizing and deconcentrating TB control plans and recommends that assistance to patients be provided at all existing basic health care clinics.<sup>(3)</sup> The integration of TB control with public health care includes the Program for the Training of Community Health Agents and the *Programa de Saúde da Família* (PSF, Family Health Program) in order to ensure that the access to diagnosis and treatment effectively increases.

The objective of the present study is to analyze the effectiveness of the TB control program in the city of Cáceres, which is one of the priority cities for TB control in Brazil. The analysis refers to the characteristics of the cases diagnosed, the procedures standardized and recommended by the Ministry of

Health for diagnosis, the treatment and monitoring of patients, and the type of health care facility involved between 1999 and 2004.

The city of Cáceres, with 86,430 inhabitants (in 2004), is located in the west of the state of Mato Grosso, 210 km from the capital, Cuiabá.<sup>(4)</sup> According to the criteria established by the Ministry of Health,<sup>(5)</sup> the city of Cáceres is a priority for the treatment of TB patients through the PNCT/2004 due to the high incidence of the disease, as well as to the fact that it offers referral centers for the inpatient treatment of cases from cities in the southwest area of the state of Mato Grosso.

In 2004, the public health care facilities were structured into 8 family health teams and 1 outpatient clinic of the Bom Samaritano Hospital, which is considered a referral center for providing DOTS strategy treatment to the population that is not served by a family health care clinic, as well as for performing sputum smear microscopy of samples collected at all of the clinics in the city. The cases requiring hospitalization are referred to the São Luiz Hospital, which also functions as a regional referral center. The implementation of the PSF was started in 2000. In 2004, the coverage of the PSF reached 35% of the population of the city.

## Methods

### *Study design*

This was a descriptive epidemiological study based on the registry of TB cases diagnosed and treated in the city of Cáceres, Brazil. All cases reported between 1999 and 2004 were included in the study. This period was chosen based on the fact that records for TB cases were entered into the *Sistema de Informação de Agravos de Notificação* (SINAN, Case Registry Database) of the Mato Grosso State Department of Health beginning in 1999. Through the identification code of the health care clinics and oral guidance provided by technicians from the Cáceres Regional Health Department, it was possible to identify which records referred to cases treated at family health care clinics.

### *Variables studied*

The variables selected for data analysis were as follows: year of diagnosis; type of treatment,

according to the strategy used (DOTS or non-DOTS); clinical presentation of the disease (extrapulmonary or pulmonary); status at admission (new case, recurrence, readmission after treatment noncompliance, no information, and relocation); age bracket; gender; performance of sputum smear microscopy (at the time of diagnosis and prior to discharge), X-ray, sputum culture, and HIV testing; outcome (cure, noncompliance or death); and health care providers involved (family health team or staff at referral centers – including the outpatient clinic and the hospital for cases requiring hospitalization). Considering that only 20 TB cases (6%) were reported in the hospital inpatient clinic, these cases were added to the cases reported in the outpatient clinic in order to form 2 comparison groups for the set of the remaining variables – referral center and family health care clinic.

### Data analysis

The analysis of the relative frequency of the variables under study was performed using the Epi-Info® and the Excel® programs. The equation of linear tendency was used to calculate the incidence of TB in the period under study, as well as to linearly distribute the number of cases according to the type of health care facility involved in the diagnosis and treatment. We carried out a bivariate analysis, by type of health care facility involved, considering the following: performance (or not) of sputum smear microscopy at the time of diagnosis and prior to discharge; the use (or not) of the DOTS strategy; the performance (or not) of HIV testing; and the outcome. This analysis was performed by calculating the ORs and their respective confidence intervals at a significance level of 95%.

### Ethical aspects

This article is one of the products of the research project entitled 'Evaluation of the efficacy of the epidemiological surveillance measures among the household leprosy and tuberculosis contacts in the state of Mato Grosso,' which was approved in the edict MS/CNPq/FAPEMAT - N° 006/2004, was supported through grant n° 121/05, and was evaluated/approved by the Ethics in Research Committee of the Mato Grosso State Department of Health (process no. 161/06).

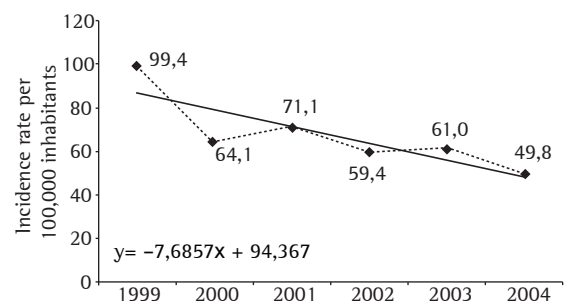
## Results

In the city of Cáceres, 333 TB cases were diagnosed and treated between 1999 and 2004. The TB incidence rate (per 100 thousand inhabitants) showed significant variation in the period under study, decreasing from 99.4 in 1999 to 49.8 in 2004, which represents a drop of 49.9% in the magnitude of the disease in that area (Figure 1). Although the decrease in the incidence rate was not stable, linear regression showing that it was sharper between 1999 and 2000, the value of the slope coefficient is equal to  $-7.6857$  when all the values of the series are used. The comparison of the decrease in incidence between 2000 and 2004 reveals a drop of 22.3%, the incidence decreasing from 64.1 to 49.8 cases per 100 thousand inhabitants.

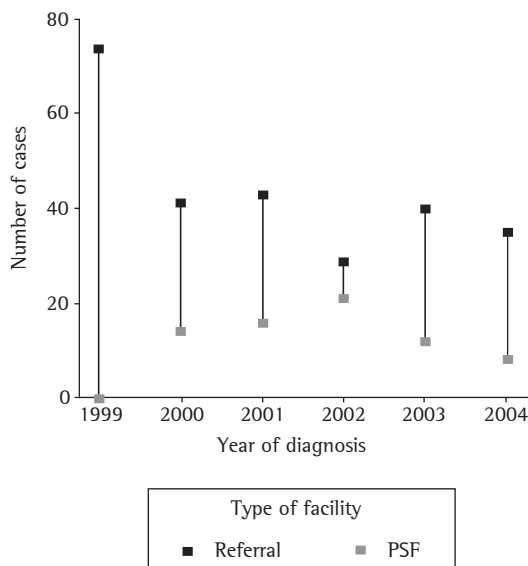
Until 1999, 100% of the treatment given to TB patients was provided by health care centers. Subsequently, the process of decentralization (transferring treatment services to the PSF clinics) began (Figure 2). As can be seen in the figure, the majority of the patients diagnosed and treated at family health care clinics were diagnosed in 2002.

Figure 2 also shows that, after 2002, the pace of decentralization of the health care assistance slowed, and more cases (81.4%) were treated at referral centers.

Table 1 shows the variables and respective categories of analysis related to the epidemiological profile, including gender, age bracket, form of disease, and approach taken by health care providers regarding the diagnosis and treatment of the TB cases. Of the patients evaluated, 69.1% were



**Figure 1** – Evolution of the tuberculosis incidence rate in the city of Cáceres between 1999 and 2004. SINAN: *Sistema de Informação de Agravos de Notificação* (Case Registry Database). Source SINAN - Tuberculosis. Mato Grosso State Department of Health, 2005.



**Figure 2** - Distribution of the number of tuberculosis cases diagnosed in the city of Cáceres between 1999 and 2004 by type of health care facility. PSF: *Programa de Saúde da Família* (Family Health Program); SINAN: *Sistema de Informação de Agravos de Notificação* (Case Registry Database). Source SINAN - Tuberculosis. Mato Grosso State Department of Health, 2005.

male, and 30.9% were female. Of those diagnosed, 59.8% were between 15 and 49 years of age. The pulmonary form predominated over the extrapulmonary form (91.3 vs. 6.3%). The cases reported to SINAN were principally new cases (79.9%), followed by cases of recurrence (8.1%) and readmission after treatment abandonment (6.9%). In the diagnostic phase, 70.6% of the patients were submitted to X-ray, and 18.9% underwent tuberculin testing. Of the 333 cases studied, 83.2% underwent sputum smear microscopy for acid-fast bacilli at the time of diagnosis. Sputum smear microscopy was performed prior to discharge in 155 cases, which accounts for 46.5% of the TB cases diagnosed and 51% of the pulmonary cases. In 294 (88.2%) of the cases studied, HIV testing was not performed. Of the 39 tests requested (15.5%), 7 (17.9%) were positive, 21 (53.8%) were negative, and 11 (28.2%) were ongoing. Of the 109 patients with negative sputum smear microscopy results, 31 were submitted to at least one test, 27 were submitted to culture, 9 were submitted to histopathology, and 5 were submitted to histopathology and sputum culture. In 78 cases, none of the procedures recommended by the

**Table 1** - Distribution of tuberculosis cases by gender, age bracket, form of disease, status at admission, performance of X-ray, and performance of tuberculin test - Cáceres, Brazil - 1999 to 2004.

Variables	Frequency	Percentage
<b>Gender</b>		
Female	103	30.9
Male	230	69.1
Subtotal	333	100
<b>Age bracket</b>		
0 to 14 years	38	11.4
15 to 49 years	199	59.8
50 years or older	96	28.8
Subtotal	333	100
<b>Form of disease</b>		
Pulmonary	304	91.3
Extrapulmonary	21	6.3
Unknown	08	2.4
Subtotal	333	100
<b>Status at admission</b>		
New case	266	79.9
Recurrence	27	8.1
Readmission after treatment noncompliance	23	6.9
No information	12	3.6
Relocation	05	1.5
Subtotal	333	100
<b>X-ray</b>		
Performed	235	70.6
Not performed	98	29.4
Subtotal	333	100
<b>PPD</b>		
Performed	63	18.9
Not performed	270	81.1
Subtotal	333	100

PPD: purified protein derivative (tuberculin test); SINAN: *Sistema de Informação de Agravos de Notificação* (Case Registry Database). Source SINAN - Tuberculosis. Mato Grosso State Department of Health, 2005.

PNCT for the diagnostic confirmation of TB were performed. Of the patients with negative sputum smear microscopy results, 14 were not submitted to X-ray.

Table 2 shows the following variables by health care facility involved (PSF or referral center): sputum smear microscopy (at the time of diagnosis and prior to discharge); type of therapeutic regimen; HIV testing; and treatment outcome. The percentage of cases in which sputum smear microscopy was performed at the time of diagnosis reached 90.3%

**Table 2** - Odds ratios of the variables sputum smear microscopy at the time of diagnosis (initial), sputum smear microscopy prior to discharge (final), directly observed therapy short-course, HIV testing, and outcomes by the type of health care facility involved, city of Cáceres, 1999 to 2004.

Variable	Type of health care facility				OR (95% CI)	p
	PSF		Referral center			
	n	%	n	%		
Initial sputum smear microscopy*						
Performed	49	75.4	223	90.3	0.33 (0.16-0.66)	0.003
Not performed	16	24.6	24	9.7		
Final sputum smear microscopy**						
Performed	19	29.2	138	55.9	0.32 (0.18-0.59)	0.000
Not performed	46	70.8	109	44.1		
DOTS						
Supervised	61	85.9	205	78.2	1.7 (0.82-3.52)	0.207
Unsupervised	10	14.1	57	21.8		
HIV testing						
Performed	14	19.7	25	9.5	2.3 (1.13-4.76)	0.019
Not performed	57	80.3	237	90.5		
Outcome**						
Cure	38	79.2	152	95.6	1.0	
Noncompliance	11	22.4	15	9.0	0.34 (0.14-0.80)	0.020
Death	10	20.8	7	4.4	0.17 (0.06-0.49)	0.010

\*Cases presenting the extrapulmonary form were excluded; \*\*Cases diagnosed in 1999 were excluded because the family health clinics still had not been implemented in the city of Cáceres in that year. PSF: *Programa de Saúde da Família* (Family Health Program); DOTS: directly observed therapy, short-course; SINAN: *Sistema de Informação de Agravos de Notificação* (Case Registry Database). Source SINAN - Tuberculosis. Mato Grosso State Department of Health, 2005.

only among the patients treated at the referral center. In the two types of health care facility, the percentage of cases in which sputum smear microscopy was performed prior to discharge was lower than that of cases in which the test was performed at the time of diagnosis, this percentage being 56% at the referral center and only 29% in the family health clinics. The patients presenting pulmonary forms and treated via the PSF were 67% less likely to be submitted to sputum smear microscopy at the time of diagnosis (OR = 0.33; 95% CI: 0.16-0.66) and 68% less likely to be submitted to sputum smear microscopy prior to discharge (OR = 0.32; 95% CI: 0.18-0.59) than were those treated at the referral center. Considering the pulmonary and extrapulmonary forms of TB, no statistically significant difference was found between the patients treated via the PSF and the patients treated at the referral center in terms of inclusion in the treatment according to the DOTS strategy (OR = 1.7; 95% CI: 0.82-3.52). In the two types of health care facility analyzed, the DOTS strategy was offered to approximately 80% of the patients. However, the analysis of the variable 'HIV testing'

reveals that less than 20% of the patients were submitted to the test, and that patients were 2.3 times more likely to undergo the test in the family health care clinics (OR = 2.3; 95% CI: 1.13-4.76). As for the outcomes of the cases diagnosed in both types of health care facilities, the patients monitored via the PSF presented a 16.4% lower cure rate than did those treated at the referral center, as well as being more likely to abandon treatment (OR = 2.93; 95% CI: 1.15-7.46) or die (OR = 5.71; 95% CI: 1.85-18.1).

## Discussion

Despite the decrease in TB incidence throughout the study period, the proximity of the city of Cáceres to the border with Bolivia and the high endemicity in the region increase the relevance of control plans in that area. The patients diagnosed in Cáceres presented epidemiological characteristics similar to those of patients being treated in other cities in Brazil,<sup>(6-9)</sup> including Cuiabá, the capital of the state of Mato Grosso,<sup>(10)</sup> with a predominance of males



in their most economically productive years and a predominance of the pulmonary form.

The weaknesses of the PSF in terms of resolvability, which result from, among other factors, high staff turnover rates, have been pointed out as one of the obstacles to maintaining the strategy of changing the treatment model.<sup>(11-13)</sup> The difficulty in maintaining a permanent staff becomes more critical in the pre- and post-electoral period. This was possibly one of the reasons for the decrease in the activities of the PSF in 2002 and 2004, given the outcomes of state and municipal elections, in which the incumbents lost power.

The protocol for TB treatment standardizes the measures for the diagnosis and monitoring of the cases, considering the effectiveness of the procedure proposed both for the diagnosis and for the cure of the cases. In Cáceres, it was expected that the implementation of family health care clinics and the existence of a referral center for TB treatment would result in increased use of disease control measures. Therefore, the offer of laboratory tests and procedures included in the treatment protocol suggests the possibility of guaranteeing the quality of the service provided in terms of diagnostic support. One group of authors evaluated the PSF interventions in the city of Mendes (in the state of Rio de Janeiro) and found that the quality of data registration and the quality of the monitoring of cases improved, with an increase in the cure rate and a decrease in the treatment noncompliance rate.<sup>(14)</sup>

Sputum smear microscopy is a priority measure for the diagnosis of pulmonary TB because it allows patients with active tuberculosis to be identified and treated, as well as allowing the chain of disease transmission to be broken.<sup>(15)</sup> Despite presenting limitations, sputum smear microscopy has a good diagnostic yield in the diagnosis of TB due to its ease of application, and due to its being a simple, reliable, and low cost laboratory procedure available in the network of public health care facilities.<sup>(16,17)</sup> If sputum smear microscopy was not given sufficient importance at the time of diagnosis, a worse situation was observed at the end of the treatment, when, prior to discharge, less than 30% of the patients treated via the PSF were submitted to the test, as recommended. These results suggest that local public health care facilities should re-evaluate their strategies for monitoring TB patients during

the treatment period as well as prior to discharge after proven cure.<sup>(18)</sup>

The prevalence of TB/HIV co-infection justifies the recommendation for the performance of HIV testing, although the patient can refuse to submit to the test. The WHO has stressed the importance of counseling patients to submit to the test voluntarily. However, infection with HIV is the primary risk factor for individuals previously infected with TB to develop the active form of the disease,<sup>(8)</sup> as well as being responsible for the higher mortality rate seen in this group.<sup>(9)</sup> It is possible that the low compliance with this procedure in Cáceres was due to the lack of training or lack of counseling of health care professionals, work overload, and even the lack of referral centers, although the city has had a Testing and Counseling Center, which is available for the performance of HIV testing and serves the region of Cáceres, since 1999.

Some studies have demonstrated the efficacy of the DOTS strategy in terms of compliance with TB treatment. In the city of Cuiabá, the rate of treatment noncompliance is lower among the TB cases under supervised treatment.<sup>(10)</sup> The same was observed in the city of Bauru (in the state of São Paulo), where patient monitoring is performed twice a week.<sup>(6)</sup> Although approximately 80% of the patients in the city of Cáceres are treated using the DOTS strategy, and despite the fact that this implies the daily presence of the patients at the health care clinics, we found that the health care teams missed the opportunity to perform the recommended laboratory tests and to evaluate the course of the disease. Supervised treatment presupposes an increase in the efficacy of the program as well as greater integration among health care professionals, health care facilities, and the community.<sup>(6,19)</sup>

In the present study, we found that treatment compliance was lower in the family health care clinics, where the cure rate reached values lower than those recommended by the WHO. Therefore, the use of the DOTS strategy did not guarantee treatment compliance, which is fundamental in reducing antimicrobial resistance and curing patients. The risk of developing antimicrobial resistance to one or more drugs (acquired resistance) increases with uncontrolled or self-administered treatments.<sup>(20)</sup> Some countries, including Brazil, presented a decrease in antimicrobial resistance after the introduction of national disease control programs.<sup>(21)</sup> The

implementation of the family health care teams in combination with the use of the DOTS strategy is an effective means of increasing treatment compliance. The supervised treatment strategy, as proposed, should therefore increase treatment compliance since it requires that the doses of anti-TB drugs ingested by patients be supervised.<sup>(10)</sup> However, the effectiveness of the TB treatment was found to be low in the city of Campinas (in the state of São Paulo), despite the availability of health services for decentralized TB treatment in the city.<sup>(9)</sup>

The death rate was found to be higher among the patients treated via the PSF. In the present study, it was not possible to identify the cause of death of the TB patients in Cáceres. However, this limitation is also related to the records kept at the referral center. It was expected that the more severe cases (those in which death was more likely) would be under treatment at the referral center. This shows the deficiencies of the activities of the PSF in terms of diagnosis, treatment, and monitoring of cases.

Being a cross-sectional study based on the analysis of secondary data, the present study was influenced by the quality and flow of information. The data regarding the PSF were aggregated, making it impracticable to detect the differences among the clinics in terms of procedures and treatments performed. The SINAN database for TB does not allow the analysis of how cases were detected, making it impracticable to determine the percentage of cases diagnosed through active searches. However, considering that basic guidelines, such as the performance of laboratory tests available in the network of public health care facilities, were not followed, it seems rather unlikely that the health care services would have carried out active search measures or would have performed tests in the community. Curiously, in the group of PSF clinics in the state of Mato Grosso, physicians and nurses rated the degree of implementation of TB control strategies, highlighting the active search for cases and absentees, the investigation of contacts, and the educational measures, as good (with percentages ranging from 70.6 to 88.4%).<sup>(13)</sup>

The strategy of organization of basic health care is based on the decentralization and deconcentration of decisions and measures/health care services, thereby promoting an increase in decision-making power and in resource allocation to the cities and health care facilities. Some authors<sup>(22)</sup> showed that,

in general, decentralization alone was not sufficient to achieve the objectives of equity of access, increased efficiency, improved quality, and sustainable funding. In the present study, the funding of the Tuberculosis Control Program was not analyzed. Therefore, since the plans of this program were based on the treatment of patients by multidisciplinary teams at the network of public health care facilities and were dependent on simple tests, these two conditions being satisfied in Cáceres, funding does not seem to have been a hindrance to the quality of the services offered to the population. The basic health care programs were implemented in all of the PSF clinics in Cáceres. Since 1999, the Mato Grosso School of Public Health, in collaboration with the Cáceres Regional Health Department, have constantly offered a group of courses that comprise the continuing education program aimed at the PSF professionals throughout the state. Cáceres, as the current headquarters of the regional health care network, has been designated a priority area in this continuing education program, which includes the content regarding the TB program.<sup>(13)</sup> The treatment protocol is provided during the training sessions. However, it can also be easily found online. Although the objective of the present study was not to investigate the reasons for not following the recommended protocol, it seems likely that the weaknesses are in the monitoring and supervision of the program, since the city defrays the performance of tests, and the state has a continuing education program that includes Cáceres.

The expansion and structuring of the network of public health care facilities possibly reduced the flow of patients to the referral units in Cáceres. The increase in the number of family health care clinics probably facilitated the access of patients to assistance close to their place of residence, considering the areas covered by the PSF. However, the decentralization of the treatment services did not result in improvement of the treatment or monitoring of TB cases in the city of Cáceres.

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