

## Prevalence of active and latent TB among inmates in a prison hospital in Bahia, Brazil\*

Prevalência de TB ativa e TB latente em internos de um hospital penal na Bahia

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### Abstract

**Objective:** To determine the prevalence of latent and active TB among detainees in a prison hospital in Bahia, Brazil. **Methods:** A cross-sectional study with prospective data collection was carried out comprising 237 inmates in the Bahia State Prison Hospital between July 2003 and April 2004. A standardized questionnaire was applied and completed by medical students. The detainees were systematically submitted to the following tests: tuberculin skin test, chest X-ray (anteroposterior), sputum smear microscopy and culture for mycobacteria. The events of interest were active TB and latent TB. **Results:** The mean age of the participants was 36.6 years, and 89.9% were male. Smoking and alcohol consumption were reported by 70.0% and 43.9% of the inmates, respectively. A history of treatment for TB was reported by 11.3% of the inmates. Of the inmates evaluated, 36.3% reported cough and 31.4% reported expectoration. Other less common symptoms were asthenia (in 26.2%), weight loss (in 23.1%), loss of appetite (in 17.7%), fever (in 11.3%) and hemoptysis (in 6.7%). Of the 86 inmates tested, none presented positive HIV serology. The prevalence of latent TB was 61.5% (96 of the 156 inmates submitted to tuberculin skin tests), whereas that of active TB was 2.5% (6 of the 237 inmates evaluated). The presence of cough was a determinant of active TB (prevalence ratio = 8.8; 95% CI: 1.04-73.9;  $p = 0.025$ ). **Conclusions:** Active and latent TB are highly prevalent among inmates hospitalized in the Bahia State Prison Hospital. Our findings justify the need to implement public policies specifically directed towards the control of TB in this population.

**Keywords:** Tuberculosis; Prisons; Hospitals; Prevalence.

### Resumo

**Objetivo:** Estimar as prevalências de TB latente e TB ativa entre custodiados de um hospital penal na Bahia. **Métodos:** Foram avaliados através de estudo de corte transversal com coleta prospectiva de dados 237 internos no Hospital Penal da Bahia entre julho de 2003 e abril de 2004. Um questionário padronizado foi preenchido por estudantes de medicina. Os indivíduos foram sistematicamente submetidos aos seguintes exames: teste tuberculínico, radiografia de tórax em incidência póstero-anterior, baciloscopia e cultura para micobactérias. Os eventos de interesse foram TB ativa e TB latente. **Resultados:** A média de idade foi de 36,6 anos, sendo 89,9% homens. Tabagismo e alcoolismo foram relatados por 70,0% e 43,9% dos internos, respectivamente. História de tratamento para TB foi relatada por 11,3% dos indivíduos. Dos internos avaliados, 36,3% relataram tosse e 31,4%, expectoração. Outros sintomas menos frequentemente referidos foram astenia (26,2%), perda de peso (23,1%), inapetência (17,7%), febre (11,3%) e hemoptise (6,7%). Nenhum dos 86 internos testados apresentou sorologia anti-HIV positiva. Entre os 156 submetidos ao teste tuberculínico, a prevalência de TB latente foi de 61,5% (146 casos). Do total, 6 casos de TB ativa foram detectados (prevalência de 2,5%). A presença de tosse foi um determinante de TB ativa (razão de prevalência = 8,8; IC95%: 1,04-73,9;  $p = 0,025$ ). **Conclusões:** A população de internos do Hospital Penal da Bahia tem altas prevalências de TB latente e ativa. Estes achados justificam a necessidade de implantação de políticas públicas especificamente direcionadas para o controle da TB nesta população

**Descritores:** Tuberculose; Prisões; Hospitais; Prevalência.

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## Introduction

In populations subject to confinement, such as those in nursing homes, psychiatric hospitals and prisons, TB constitutes a major public health problem.<sup>(1-6)</sup> However, some studies have emphasized the neglect of strategies of TB control in the prison system and in psychiatric hospitals.<sup>(6,7)</sup>

In the republics that constituted the former Soviet Union, TB was reported to be 200 times more prevalent among prison inmates than in the general population.<sup>(2,8)</sup> In the United States, there are reports that the prevalence of TB is 3 to 11 times higher in the prison population than in the general population.<sup>(9)</sup> In Brazil, a study involving four prisons in the city of Campinas (located in the state of São Paulo) estimated incidence rates ranging from 559/100,000 population (1999) to 1,397/100,000 population (1994).<sup>(4)</sup> In another, more recent study, involving prisons in the western sector of the city of São Paulo, the prevalence of active TB was found to be 2,065/100,000 population.<sup>(5)</sup>

In the literature, TB transmission within the prison system has been well documented. Transmission occurs among prisoners<sup>(10-13)</sup> and among professionals working in the prison system.<sup>(14)</sup> Longer prison stays are significantly associated with an increased risk for latent and active TB.<sup>(15,16)</sup> A study conducted in prisons in the city of New York showed that one year of incarceration doubled the probability of developing active TB among inmates who were not infected before entering the prison system.<sup>(15)</sup> In Russia, prisoners who remained incarcerated for two years or longer had a prevalence of active TB greater than did those who remained in prison for less than one year.<sup>(2)</sup>

The objective of the present study was to determine the prevalence of latent and active TB among inmates in a prison hospital (*Hospital de Custódia e Tratamento* – HCT, Custody and Treatment Hospital) in Bahia, a state located in the northeast of Brazil.

## Methods

This was a cross-sectional study with prospective data collection comprising 237 inmates treated at the HCT between July 2003 and April 2004.

The total number of inmates hospitalized at the HCT, although variable, was estimated to

be approximately 350 during the data collection period of the present study. The HCT is a facility of the Bahia State Department of Justice, Citizenship and Human Rights that has the function of accommodating, as inpatients and by court order for an expert opinion, custody and treatment, individuals who are denounced, prosecuted and sentenced, as well as having suspected or confirmed mental illness, impaired mental development or intellectual disabilities. Such individuals are to be held in closed detection and under maximum security. The booster effect was not evaluated in cases presenting a negative PPD test result (induration < 10 mm).

A clinical scoring system with a maximum score of seven points was used (Table 1). This scoring system is suggested by the World Health Organization (WHO) as an initial screening strategy for detecting TB cases in prisons.<sup>(17)</sup> It considers that the group presenting the highest clinical probability of active TB is that composed of individuals whose score is equal to or greater than five points. However, since the clinical variable “chest pain” (one of the components of the scoring system mentioned above, with a score equal to one) was not available in the database, an adaptation of the WHO scoring system was used, considering a maximum score of six points and a cut-off point of four points.

The statistical analysis, which was performed using the Statistical Package for the Social Sciences, version 9.0 (SPSS Inc., Chicago, IL, USA), was basically descriptive. Categorical and quantitative variables were expressed as proportions and means  $\pm$  SD, respectively. The chi-square test (or Fisher’s exact test, when indicated) and the Student’s t-test were used to compare proportions and means, respectively.

**Table 1** – Clinical score for TB in prisons.

Symptom	Score
Cough for more than 2 weeks	2
Expectoration	2
Chest pain	1
Weight loss (within the preceding 3 months)	1
Loss of appetite (recent)	1
Maximum score	7

Source: World Health Organization. Tuberculosis control in prisons: a manual for programme managers. Geneva: WHO; 2000.

## Results

The characteristics of the study population are shown in Table 2. Of the 237 inmates evaluated, 213 (89.9%) were male. The mean age  $\pm$  SD was  $36.6 \pm 11.7$  years (range, 18-66 years). Smoking was reported by 165 (69.9%) inmates, and alcohol consumption was reported by 104 (44.1%). In one case, the psychiatric status of the patient made it impossible to obtain reliable information on these variables. A total of 230 (11.3%) inmates reported having a history of treatment for TB (7 inmates were not able to provide this information). Body mass index (BMI) was measured in 235 of the total number of 237 inmates, and, of those, 24 (10.2%) had a BMI lower than 20 kg/m<sup>2</sup>. The mean  $\pm$  SD BMI in the general population was  $24.4 \pm 4.2$  kg/m<sup>2</sup>.

Table 3 shows the frequency of the general and respiratory symptoms that were part of the initial clinical screening of patients likely to have active TB. The most common symptom was cough (in 36.3%; 86/237), followed by expectoration (in 31.4%; 74/236). Other less common symptoms were asthenia (in 26.2%; 62/237), weight loss (in 23.7%; 55/232), loss of appetite (in 17.7%; 12/237), fever (in 11%; 26/237) and hemoptysis (in 6.8%; 16/236). Fever and hemoptysis occurred in 2 and 1 of the patients with active TB, respectively.

Of the 237 inmates, 156 (65.8%) were submitted to the tuberculin skin test (TST). The prevalence of latent TB observed in the study population was 61.8% (Table 4). Some operational factors, related to the administrative disorganization of the prison hospital, such as transfers to another facility of the prison system before the TST reading and the fact that some inmates (many of whom presenting psychi-

**Table 2** - General characteristics of the study population.

Characteristic	
Age <sup>a</sup> , years	36.6 $\pm$ 11.7 (18-66)
Male gender <sup>b</sup>	213/237 (89.9)
Smoking <sup>b</sup>	165/236 (69.9)
Alcohol consumption <sup>b</sup>	104/236 (44.1)
History of treatment for TB <sup>b</sup>	26/230 (11.3)
BMI <sup>b</sup> , kg/m <sup>2</sup>	
≤ 20	24/235 (10.2)
> 20	211/235 (89.8)

BMI: body mass index. <sup>a</sup>Mean  $\pm$  SD (range) and <sup>b</sup>n/N (%).

**Table 3** - Frequency of general and respiratory symptoms among inmates hospitalized at the Custody and Treatment Hospital, Bahia, Brazil.

Symptom	n/N	%
Cough	86/237	36.3
Expectoration	74/236	31.4
Asthenia	62/237	26.2
Weight loss	55/232	23.7
Loss of appetite	42/237	17.7
Fever	26/237	11.0
Hemoptysis	16/236	6.8

atric disorders) refuse to be inoculated with PPD, made it impossible to perform the TST in 81 study participants.

The prevalence of active TB was 2.5% (6 cases of active TB among the 237 inmates evaluated; Table 4). Of the cases diagnosed, 2 presented a positive smear microscopy, 2 presented radiological alterations consistent with TB and positive culture for *Mycobacterium tuberculosis*. The remaining 2 cases were diagnosed based on a clinical and radiological profile consistent with TB and a favorable response to the treatment with antituberculous drugs.

Only 87 (36.7%) of the 237 inmates evaluated were submitted to HIV serology. The same operational difficulties reported above regarding PPD inoculation for the TST were found in the collection of blood samples for HIV serology. All of the inmates tested presented negative HIV serology.

Two clinical symptoms were identified as predictors of active TB in the present study: cough and expectoration. The comparison of the prevalence of active TB in the groups with and without cough revealed a prevalence ratio (PR) of 8.8 (95% CI: 1.04-73.92; p = 0.025). Regarding expectoration, the PR of the two groups was 10.9 (95% CI: 1.30-92.0; p = 0.012). There were no statistically significant associations between the other clinical symptoms evaluated and active TB (Table 5): fever (PR = 4.1; 95% CI: 0.78-21.08; p = 0.132); weight

**Table 4** - Prevalence of latent and active TB among inmates hospitalized at the Custody and Treatment Hospital, Salvador, Brazil.

Diagnosis	n/N	Prevalence (%)
Latent TB	96/156 <sup>a</sup>	61.5
Active TB	6/237	2.5

<sup>a</sup>Due to organizational problems, only 156 of the 237 inmates were submitted to the tuberculin skin test.

**Table 5** – Prevalence ratio of active TB among inmates hospitalized at the Custody and Treatment Hospital, Salvador, Brazil, by clinical symptoms and clinical score for TB.

Variable	Yes		No		PR (95% CI)	p
	n/N	%	n/N	%		
Cough					8.8 (1.04-73.9)	0.025
Present	5/86	5.8	81/86	94.2		
Absent	1/151	0.7	150/151	99.3		
Expectoration					10.9 (1.30-92.5)	0.012
Present	5/74	31.4	69/74	90.5		
Absent	1/162	0.6	161/162	99.4		
Fever					4.1 (0.78-21.08)	0.132
Yes	2/26	7.7	24/26	92.3		
No	4/211	1.9	207/211	98.1		
Weight loss					1.6 (0.30-8.55)	0.629
Yes	2/55	3.6	53/55	96.4		
No	4/177	2.3	173/177	97.7		
Loss of appetite					2.3 (0.44-12.26)	0.288
Yes	2/42	4.8	40/42	95.2		
No	4/195	2.1	191/195	97.9		
Hemoptysis					2.7 (0.34-22.15)	0.347
Yes	1/16	6.3	15/16	93.8		
No	5/220	2.3	215/220	97.7		
Clinical score <sup>a</sup>					12.4 (1.48-104.41)	0.008
≥ 4	5/68	7.4	63/68	92.6		
< 4	1/169	0.6	168/169	99.4		

PR: prevalence ratio. <sup>a</sup>Clinical score for the detection of TB in prisons (adapted from the World Health Organization. Tuberculosis control in prisons: a manual for programme managers. Geneva: WHO; 2000).

loss (PR = 1.6; 95% CI: 0.30-8.55; p = 0.629); loss of appetite (PR = 2.3; 95% CI: 0.44-12.26; p = 0.288); and hemoptysis (PR = 2.7; 95% CI: 0.34-22.15; p = 0.347). Regarding the clinical scoring system suggested by the WHO for the detection of TB in prisons,<sup>(17)</sup> we used a maximum score of six, since the variable “chest pain” was not available in our database. Therefore, a cut-off point equal to or greater than four was used to define the probability of symptoms detecting the cases. The comparison of the two groups of inmates revealed a statistically significant association between scores equal to or greater than four and active TB (PR = 12.4; 95% CI: 1.48-104.41; p = 0.008). These data are shown in Table 5.

The mean BMI in the group of patients with active TB was lower than that found in the group of patients without active TB. However, this difference did not reach statistical significance (21.5 kg/m<sup>2</sup> vs. 24.5 kg/m<sup>2</sup>; p = 0.089). The variable BMI, which was categorized into two groups considering the cut-off point of

20 kg/m<sup>2</sup> and is suggested by the WHO guidebook for tuberculosis control in prisons<sup>(17)</sup> as a relevant variable for the screening detection of probable cases of active TB, was not found to be associated with active TB in the present study (p = 1.00). All 6 cases of active TB had a BMI greater than 20 kg/m<sup>2</sup>, and, therefore, it was not possible to estimate the PR of the two groups. Even considering a BMI cut-off point < 18.5 kg/m<sup>2</sup> (as defining loss of appetite), there was no statistically significant difference between the two groups (p = 1.00).

## Discussion

The findings of the present study revealed a high prevalence of active TB (2.5%) and latent TB (61.8%) among detainees in a prison hospital in Bahia. Despite the inherent methodological limitations of comparing populations of extremely different sizes, we observed that the prevalence of active TB found in the present study, if projected for the population (2,500 cases/100,000 popula-

tion) and compared with the overall prevalence reported in Bahia in the same period (approximately 60/100,000 population), is 42 times higher than that found in the general population of the state of Bahia. Regarding the data available on the prevalence of TB infection in Brazil, we found that the prevalence of latent TB among inmates of the prison hospital was 2.47 times higher than that estimated for the Brazilian population.

The findings of the present study corroborate the results observed by several other authors regarding the estimated prevalence of active TB in prison facilities being higher than that found in the community. In the United States, the prevalence rates reported are 3 to 11 times higher than that observed in the general population.<sup>(9)</sup> The highest prevalence rates in prison system facilities were observed in the republics that constituted the former Soviet Union, with prevalence rates approximately 200 times higher than that reported for the general population.<sup>(2)</sup> One group of authors analyzed consolidated data on TB—involving cases reported in prison facilities—provided by 22 European countries in 2002 and observed that the mean incidence rate of new cases of TB was 232 cases per 100,000 inmates (range, 0-17,808/100,000 population).<sup>(18)</sup> Studies conducted in other countries, such as Taiwan and Malawi, have also shown high rates of TB among prisoners.<sup>(19,20)</sup>

In Brazil, the magnitude of the epidemiology of TB in the prison system is poorly understood. However, some studies involving prisons in the states of São Paulo and Rio de Janeiro revealed findings similar to those of the present study.<sup>(4,5,21-23)</sup> In a study involving four prison facilities in the city of Campinas, located in the state of São Paulo, the incidence rate of active TB was shown to range from 559/100,000 inmates (1999) to 1,397/100,000 inmates (1994).<sup>(4)</sup> Another study, involving the prison system in the western sector of the city of São Paulo, showed a prevalence of active TB of 2.06%, which is quite similar to that found in our study (2.5%).<sup>(5)</sup> Two studies involving prison facilities in Rio de Janeiro reported a prevalence of active TB of 4.6%.<sup>(22,23)</sup>

Basically, there are three reasons for the higher prevalence rates of TB universally observed in prisons. First, prisoners are at a higher risk of being infected with TB than is the general population. They are predominantly young male adults who come from less privileged social classes and have a low educational level.<sup>(1,2,9)</sup> Second,

prisoners have a higher rate of risk factors or a lifestyle that predisposes them to developing active TB, once infected. For example, prisoners have a higher prevalence of HIV infection and use of injection drugs than that reported for the general population,<sup>(24)</sup> factors that contribute to increasing the probability of TB/HIV co-infection and to the progression from latent to active TB. Finally, the conditions of the prison environment, such as overpopulation, inadequate ventilation, poor hygienic and nutritional conditions, as well as limited access to health care facilities, can facilitate the dissemination of TB.<sup>(1)</sup>

In the present study, two symptoms were identified as being associated with the presence of active TB: cough (PR = 8.8) and expectoration (PR = 10.9). These findings, similar to those reported in previous studies,<sup>(2,17)</sup> underscore the need for a simplified and easy-to-execute strategy for the early evaluation of these symptoms in individuals who are incarcerated in the Brazilian prison system. Another, more complete approach to the clinical scoring system suggested by the WHO<sup>(17)</sup> was also evaluated in the present study, and a strong association was found between scores  $\geq 4$  and the presence of active TB (PR = 12.4). However, from an operational point of view, it is possible that the assessment of a greater number of variables that determine the score of the scoring system mentioned above can encounter practical difficulties in the routine evaluation of detainees in prison facilities with a poor administrative structure and a large population.

Despite its methodological limitations, the present study underscores the importance of increasing knowledge of the magnitude of TB in prison system populations in Brazil, especially in Bahia, in view of the lack of local data on this issue. Such data can support future public health policies aimed at interventions to implement optimal programs of early detection of cases and the systematized adoption of strategies of directly observed therapy, adapted to the local conditions of the Bahia prison system, thereby contributing to reducing transmissibility.

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