Prevalence of patients with respiratory symptoms through active case finding and diagnosis of pulmonary tuberculosis among prisoners and related predictors in a jail in the city of Carapicuíba, Brazil

Prevalência de sintomáticos respiratórios através da busca ativa, diagnóstico de tuberculose pulmonar entre pessoas privadas de liberdade e fatores associados em uma cadeia pública no município de Carapicuíba, Brasil

Amadeu A. Vieira[I,II,III]
Sandra A. Ribeiro[III]
Ana M. de Siqueira[I]
Vera M. N. Galesi[IV]
Laedi A. R. dos Santos[IV]
Jonathan E. Golub[V]

[I] Tuberculosis Control Program (PCT) of the Health and Preventive Medicine Department of the municipality of Carapicuíba, Brazil

[II] Instituto de Saúde of Universidade Bandeirante (UNIBAN), São Paulo, Brazil.

[III] Preventive Medicine Department of Escola Paulista de Medicina (EPM) of Universidade Federal de São Paulo, São Paulo, Brazil

[IV] Tuberculosis Division of the Centro de Vigilância Epidemiológica "Alexandre Vranjac" (CVE-CCD) of the São Paulo State Health Deparment, São Paulo, Brazil

[V] Johns Hopkins School of Medicine and Johns Hopkins Bloomberg School of Public Health, Baltimore, USA

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Correspondence to: Amadeu Antonio Vieira. Programa de Controle da Tuberculose (PCT), Secretaria de Saúde e Medicina Preventiva do município de Carapicuíba. Alameda dos Lírios, 150, Vila Sul Americana, Carapicuíba, SP, Brasil - CEP 06394-010. E-mail: nantico@uol.com.br

Resumo

Introdução: Estabelecimentos prisionais são um campo favorável para a transmissão de tuberculose (TB), devido a presença de vários fatores de risco clássicos, tanto para a infecção como para a doença: aglomeração, falta de ventilação e de iluminação, como também o fato de os detentos receberem uma nutrição deficitária e os locais possuírem condições de higiene precárias; uma grande proporção dos detentos apresentam história pregressa de alcoolismo e uso de drogas ilícitas nas dependências desses estabelecimentos. **Objetivos:** Determinar a prevalência de sintomáticos respiratórios (RSI) e casos de tuberculose pulmonar (TBP) através da busca ativa em população privada de liberdade na cadeia pública do município de Carapicuíba e estudar os prováveis fatores associados. **Método:** O desenho de estudo foi do tipo corte transversal, realizou-se a busca ativa de RSI e os dados sociodemográficos foram coletados em questionários específicos a partir dos processos judiciais dos participantes. Os RSI foram submetidos ao exame de baciloscopia e cultura para micobactérias do escarro. **Resultados:** Dos 397 detentos estudados, 154 relataram tosse por mais de três semanas, considerados RSI. Os fatores associados à presença de sintomas respiratórios foram estar preso há mais de seis meses e ter sido julgado. Foram diagnosticados 7 casos de tuberculose pulmonar, 1.763 casos por 100.000 detentos. **Conclusões**: A prevalência de RSI e casos de TBP foram 39 e 35 vezes superior ao encontrado na população em geral respectivamente.

Palavras-chave: Prevalência. Tuberculose. Tuberculose pulmonar. Sintomático respiratório. Busca ativa. População privada de liberdade.

Abstract

Background: Prisons offer a fertile setting for the transmission of tuberculosis due to the presence of many classic risk factors for both infection and disease: overcrowding, poor ventilation, and little sunlight. Prisoners are often malnourished and have poor hygiene and are more likely to have a background of alcohol and drug abuse. **Objectives:** To determine the prevalence of prisoners with respiratory symptoms and pulmonary tuberculosis (PTB) through active case finding in a prisoner population of the county jail of Carapicuíba, and to study possible related variables. **Methods:** This was a cross-sectional study, and respiratory symptomatic individuals (RSI) were detected through active case finding. Socio-demographic data were collected from inmates' judicial history using a specific questionnaire. The RSI provided sputum specimens for detection of acid fast bacilli and culture for mycobacterium identification. **Results:** Among the 397 prisoners studied, 154 reported respiratory symptoms for more than three weeks, and were considered RSI; the variables associated with RSI were: having already been tried and incarcerated for more than six months and seven were diagnosed as PTB (1,763 cases/ 100,000 inhabitants). **Conclusions:** The prevalence of RSI and PTB cases were respectively 39 and 35 times greater than the general population.

Keywords: Prevalence. Tuberculosis. Pulmonary tuberculosis. Respiratory symptomatic. Active case finding. Prisoners.

Introduction

Prisons offer a fertile setting for the transmission of tuberculosis (TB) because of the presence of many risk factors for both infection and disease. Prisons are generally overcrowded and poorly ventilated. Prisoners are exposed to little sunlight, often malnourished, and have a background of alcohol and drug abuse. Even in penitentiaries and other correctional facilities with health services, health workers are often poorly trained at diagnosing and treating TB. This lack of knowledge often leads to undiagnosed disease or delays in appropriate treatment, both of which increase the exposure and risk of transmission to other prisoners and prison staff[1-4].

Brazil currently ranks 22nd worldwide in the annual burden of new TB cases with an annual incidence rate of 48 per 100,000 in 2007 according to the World Health Organization[5]. There are currently 422,590 inmates in the Brazilian prison system of which 36% are in the State of São Paulo although the state only has 13% of the country's penitentiary buildings. The prison population has increased over 80% in the past 10 years and each month, approximately 3,000 more prisoners enter than leave the system, creating an excess of 173,075 prisoners over the maximum capacity of the Brazilian penitentiary system. This number does not include those being held in the Centers of Provisional Detention (CDP), and those temporarily detained in police stations and local jails waiting for trial and sentencing prior to transfer to the penitentiary system or to be released[3,5-7].

A research done on the correctional system of the city of Campinas[8] found a TB incidence between 1,497 and 559 per 100,000 inhabitants (1993-2000). Abrahão found an incidence of 787 cases per 100,000 prisoners (positive smear sputum) and 2,065 cases per 100,000 with positive culture in police stations of the West Zone of São Paulo[9]. In the city of Botucatu, the authors showed a TB incidence of 1,149 cases per 100,000 prisoners, 20 times greater than the general population[10].

Estimating the burden of respiratory symptomatic individuals (RSI) and pulmonary TB in the prison system is important to determine fund allocation in this high-risk setting. The main objective of this study was to determine the prevalence of RSI and possible predictors associated with them, and the rate of pulmonary TB through active case finding (ACF) in a prisoner population at the Municipal jail in the city of Carapicuíba, Brazil.

Study Population and Methods

Prisoners in Brazilian jails are admitted daily and for security reasons are frequently transferred to jails of other cities and different correctional facilities of the penitentiary system. The prisoner population of this study represents a wide range of offences, backgrounds, races, professions, penal situations, and places of birth. The jail of the study has 10 cells, each holding an average of 8 people, but often more than 30 prisoners are housed together at any one time.

A cross-sectional study among male prisoners was conducted in two steps at the local jail of the city of Carapicuíba, an urban center with a population of approximately 400,000 in close proximity to the capital of the state of Sao Paulo. We did not have ideal conditions or resources to survey the entire prison population, thus a representative sample was surveyed. The sample size was based on a similar prison population in the city of São Paulo which reported a prevalence of respiratory symptoms in 33% of its population[9]. We calculated that 353 patients would be required to estimate a prevalence with a precision of 7%. We increased the sample size by 10% to account for potential missing variables or contamination of sputum specimens (Figure 01). Between March and December 2006, 1,047 men were arrested, of which a sample of 397 prisoners (38%) was included in the study.

As the first step, prisoners reporting cough for over 3 weeks during their sunbath submitted a sputum specimen and were interviewed by nurses from the local public health care unit, using a structured questionnaire. Specimens were processed at the municipal laboratory. No one refused to collect the sputum specimen or to sign the written consent form. For purposes of this study a diagnosis of pulmonary TB was defined as at least one positive sputum smear or a positive culture for *Mycobacterium tuberculosis*. In the second phase, prisoners' questionnaires with their socio-demographic information and the judicial history had to fill out from the data of Municipal Court after its consent. Patients diagnosed with active TB received standard Brazilian therapy[11].

The prevalence of RSI and pulmonary TB were calculated and associations with potential predictor variables were assessed with the chi-square test or Fisher's exact test when appropriate, and multivariate logistic regression was used to assess the independent effects of each covariate. Data were entered into an Epi Info 2000 (v.3.5.0, CDC) database and analyzed using SPSS (v.11.0, SPSS Inc, Chicago, IL, USA).

Results

Between March and December 2006, 1,047 men were imprisoned in the study setting. Of the total, 397 prisoners (38%) were included in this study. Their median age was 27 years (range: 18-67 years old); median length of incarceration was 33 days (range: 1-1105 days); and, 32% were awaiting placement in the penitentiary system, while 68% were waiting trial (Table 1). Prisoners included in the survey were paired with non-surveyed subjects for age, race, marital status, education, employment, length of incarceration, and current prison status. Surveyed prisoners were slightly more likely to be from the City of Carapicuíba compared to those not surveyed.

Among the 397 prisoners, 154 (39%) reported respiratory symptoms for over 3 weeks. All 154 RSI provided one sputum specimen and 9 with an initial negative specimen for acid fast bacilli (AFB) and no resolution of their respiratory symptoms

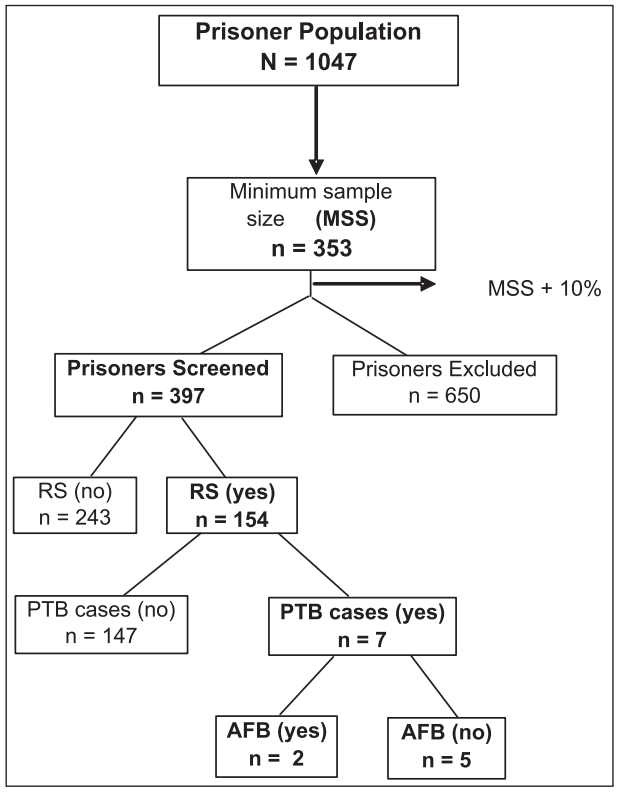

Figure 1 - Flow chart of population studied, local jail of the city of Carapicuíba.
Figura 1 - *Fluxograma da população estudada, cadeia pública do município de Carapicuíba.*

following broad-spectrum antibiotic therapy provided a second specimen prior to culture results. Among the 154 RSI, 7 (4.5%) were diagnosed with pulmonary TB, two (1.3%) were positive for AFB and all had cultures that grew *Mycobacterium tuberculosis*. All cultures were susceptible to first line TB drugs. The prevalence of pulmonary TB was 1,763 per 100,000 inhabitants; positive AFB was 504/100,000 and the prevalence of negative AFB/positive culture was 1,259/100,000. No patients reported a prior TB diagnosis.

RSI were more likely to have been incarcerated for more than 6 months (OR = 3.47; 95% CI: 2.26 - 5.34) and to be waiting placement in the prison system (OR = 2.03; 95% CI: 1.32 - 3.12) as presented in Table 2. Multivariate logistic regression confirmed that these two predictors increased the risk of respiratory symptoms among prisoners (Table 3).

Among the 7 prisoners with pulmonary TB, the median age was 27 years (range: 20–37 years) and the median length of incarceration was 131 days (range: 58–274 days). Six of seven (86%) had not yet been trialed or sentenced, 5 (71%) were single, 5 (71%) had more than seven years of schooling, and 5 (71%) were employed at time of incarceration, 4 (57%) had prior incarcerations, 3 (43%) were white, and 3 (43%) were born in Carapicuíba. Four of seven (57%) pulmonary TB cases started TB therapy in the local jail and 3 completed therapy, though none in the Carapicuíba prison.

Discussion

We detected tuberculosis in 7 (2%) previously undiagnosed prisoners through intensive active case finding in a jail in the city of Carapicuíba. Among the 39% of prisoners

Table 1 - Comparison between the characteristics of the included and not included prisoners, city of Carapicuíba, São Paulo, Brazil.
Tabela 1 *– Comparação das características gerais dos detentos incluídos e excluídos no estudo, cidade de Carapicuíba, São Paulo, Brasil.*

Characteristics	Sample		Excluded		p value
	n	(%)	n	(%)	
Age (yr)					
18 - 28	262	(66.0)	391	(60.1)	
29 - 38	89	(22.4)	168	(25.8)	
39 - 48	33	(8.3)	59	(9.2)	
49 - 68	13	(3.3)	32	(4.9)	
Total	397	(100.0)	650	(100.0)	0.25
Race					
White	173	(43.6)	275	(42.3)	
Mulatto	181	(45.6)	302	(46.5)	
Black	43	(10.8)	73	(11.2)	
Total	397	(100.0)	650	(100.0)	0.92
Marital status [(1)]					
Single	210	(53.6)	336	(51.8)	
Married	42	(10.7)	80	(12.3)	
Others	135	(34.4)	216	(33.4)	
widowed	5	(1.3)	16	(2.5)	
Total	392	(100.0)	648	(100.0)	0.47
Educational level (yr) [(2)]					
0 - 6	107	(27.9)	147	(23.5)	
> 7	277	(72.1)	479	(76.5)	
Total	384	(100.0)	626	(100.0)	0.14
Employed					
Yes	312	(78.6)	524	(80.6)	
No	85	(21.4)	126	(19.4)	
Total	397	(100.0)	650	(100.0)	0.51
Place of birth					
Carapicuíba	65	(16.4)	75	(11.5)	
São Paulo State	200	(50.4)	358	(55.1)	
Other State	132	(33.2)	217	(33.4)	
Total	397	(100.0)	650	(100.0)	0.07
Prisoner status					
First-time Offender	168	(42.3)	249	(38.3)	
Recidivist	229	(57.7)	401	(61.7)	
Total	397	(100.0)	650	(100.0)	0.22
Length of incarceration					
Six months	191	(48.1)	286	(44.0)	
> Six months	206	(51.9)	364	(56.0)	
Total	397	(100.0)	650	(100.0)	0.22
Judicial status					
Not yet-tried	127	(32.00)	192	(29.5)	
Tried	270	(68.0)	458	(70.5)	
Total	397	(100.0)	650	(100.0)	0.44

(1) missing (05 sample and 02 excluded) (2) missing (13 sample and 24 excluded)
(1) sem informação (05 amostra e 02 excluídos) (2) sem informação (13 amostra e 24 excluídos)

Table 2 - Factors associated with having respiratory symptoms in a jail of the city of Carapicuíba, São Paulo, Brazil.
Tabela 2 *– Fatores associados com os sintomáticos respiratórios da cadeia da cidade de Carapicuíba, São Paulo, Brasil.*

Characteristics	n	RSI Cases (%)	OR (95% CI)	P value
Age (yr)				
18 – 28	262	103 (39.3)	REF	
29 – 38	89	31 (34.8)	0.89 (0.50 – 1.36)	0.53
39 – 48	33	14 (42.4)	1.08 (0.55 – 2.37)	0.85
48 – 68	13	6 (46.1)	1.17 (0.43 – 4.05)	0.77
Total	397			
Race				
White	173	63 (36.4)	REF	
Mulatto	181	73 (40.3)	1.11 (0.77 – 1.81)	0.42
Black	43	18 (41.9)	1.15 (0.64 – 2.48)	0.60
Total	397			
Marital Status [(1)]				
Single	210	78 (37.1)	REF	
Married	42	13 (31.0)	0.83 (0.37 – 1.55)	0.49
Other situation	135	60 (44.4)	1.20 (0.87 – 2.10)	0.22
Widowed	5	2 (40.0)	1.08 (0.18 – 6.90)	1.0
Total	392			
Educational level (yr) [(2)]				
< 7	107	44 (41.1)	REF	
> 7	277	101 (36.5)	0.89 (0.52 – 1.30)	0.41
Total	384			
Employed				
Yes	312	116 (37.2)	REF	
No	85	38 (44.7)	1.29 (0.84 – 2.22)	**0.26**
Total	397			
Place of Birth				
Carapicuíba	65	26 (40.0)	REF	
São Paulo State	200	81 (40.5)	1.01 (0.58 – 1.81)	0.94
Other State	132	47 (35.6)	0.89 (0.45 – 1.53)	0.66
Total	397			
Prisoners Situation				
First-time offender	168	56 (33.3)	REF	
Recidivist	229	98 (42.8)	1.49 (0.99 – 2.26)	**0.07**
Total	397			
Lenght of Incarceration				
< six months	191	46 (24.2)	REF	
> six months	206	108 (52.4)	3.47 (2.26 – 5.34)	**<0.001**
Total	397			
Judicial status				
Not yet tried	270	90 (33.3)	REF	
Tried	127	64 (50.4)	2.03 (1.32 – 3.12)	**0.002**
Total	397			

RSI = respiratory symptomatic; CI = confidence interval. OR odds ratio.
RSI = sintomático respiratório; CI = intervalo de confiança. OR razão de chances.

Table 3 - Multivariate logistic regression analysis of factors associated with being respiratory symptomatic among prisoners in a jail of the city of Carapicuíba, São Paulo, Brazil.
Tabela 3 *– Análise multivariada por regressão logística com os fatores associados aos sintomáticos respiratórios entre os detentos de uma cadeia pública do município de Carapicuíba, São Paulo, Brasil.*

Characteristics	Regression Coefficient (β)	RSI Adjusted OR	CI	P value
Lenght of Incarceration				
< six months	1.20	1.00		
> six months		3.33	2.88 - 377	**<0.001**
Judicial Status				
Tried	0.53	1.71	1.23 - 2.19	**0.001**
Non-tried		1.00		
Prisoner Situation	42	1.00		
First-time offenders		1.51	1.00 - 1.95	0.07
Recidivists				
Employed	30	1.00		
yes		1.35	0.82 - 1.87	0.26
No				

RSI = respiratory symptomatic; CI = confidence interval; OR = odds ratio.
RSI = sintomático respiratório; CI = intervalo de confiança; OR = razão de chances.

who had respiratory symptoms, 4.5% had pulmonary TB. Similar rates of pulmonary TB and RSI were reported in a survey of 9 county jails in the western sector of the city of São Paulo in 2001[9].

Current guidelines in Brazil, state that people with cough ≥3 weeks should be screened for TB and the NTCP estimates that 1% of the population will be RSI[12-13]. Our results emphasize the tremendous burden of RSI in prisons and the increased risk of undetected TB. These findings are similar to other studies[8-10].

Our study showed that individuals imprisoned for at least 6 months and already tried had a greater risk of being symptomatic and these prisoners had often stayed in close contact with other prisoners for long periods of time. Imprisonment increases risk of TB transmission, which, if undetected, may lead to increased transmission in the prison system and into the community upon release. There is a public health need for appropriate TB control measures in correctional facilities; the same assumption of previous studies[8-10,15-20].

The rate of pulmonary TB in our study was 35 and 21 times higher than that of the city of Carapicuíba, respectively for positive AFB and positive culture. Higher TB rates are common among prisoners compared to their surrounding communities[3-4,9,16,18,20-22] primarily due to the ideal circumstances for exposure in the prison setting. Abrahão found an incidence of 787 cases per 100,000 prisoners (positive smear sputum) and 2,065 cases per 100,000 for positive culture pulmonary TB in the police stations of the West Zone of Sao Paulo, which was respectively 30 and 203 times higher than the general population. Higher TB rates were common among prisoners compared to their surrounding communities in studies conducted world wide[3-4,9,16,18,20-22]. Overcrowding, poor ventilation, inadequate respiratory infection control, poor health care systems, and lack of hygienic conditions create an environment favorable for TB transmission. Poor nutrition and abuse of alcohol and illicit drugs place many prisoners at risk for infection and disease. Furthermore, the lack of funding, poor po-

litical commitment and public indifference towards the prison system help maintain these conditions[19-21,22].

Police stations, jails and prisons are confined structured settings, but populations are quite dynamic due to high admission and release rates, frequent changes in prisoners' security status and constant pressure to assure cells and bed space. This is the case of our study and other ones[3,16-18]. Police stations are designed to house pre-trial prisoners; jails and detention centers house prisoners sentenced for short periods and, state and federal prisons house prisoners sentenced for longer periods. However, these theoretical designs are not complied with in the Brazilian prison system. Instead, there is constant movement of prisoners among police stations, jails and prisons, with police stations often housing them for long periods of time because of overcrowding in other sectors. These conditions are favorable to the development of respiratory diseases and facilitate TB transmission[6,8].

The considerable movement of prisoners combined with high recurrence rates in all systems result in a dynamic exchange of the incarcerated population throughout the criminal justice system and community. Thus the current conditions in the prison system will continue the chain of TB transmission not only within the correctional system (prisoners, prisoner contacts and correctional employees) but also to community members upon release[18,23,25]. During our investigation, three cases diagnosed with pulmonary TB were transferred to other correctional settings before culture results were available and to our knowledge, they had not started TB therapy.

We assume it is feasible to screen prisoners for TB symptoms at the time of their admission, thus enhancing TB detection and reducing transmission in the local system. Developed countries have programs that screen patients for TB symptoms and provide baseline and annual tuberculin skin tests (TST) to all incoming prisoners[21,24]. However these programs are not routine in the Brazilian prison system. Even in prison systems with health care centers, employees are poorly paid, poorly trained, and unmotivated, therefore unlikely to implement screening.

All prisoners should have a systematic interview to determine the presence of symptoms of active diseases[12,18,23] and prison staff could be trained to conduct screening in these settings. Smear microscopy with the Ziehl-Neelsen technique is the method recommended for the routine diagnosis of pulmonary TB in Brazil due to its simplicity, rapidity, low cost, and effectiveness in detecting infectious cases. We increased yield in this study by including mycobacterium culture which diagnosed 5 of the patients who were negative for AFB.

However, the delay in diagnosis for these patients averaged 3 months, and 60% of them had already been transferred to other police stations or correctional setting before culture results were available. Rapid identification methods are needed to accelerate TB diagnosis and drug susceptibility results in the prison system[7,12,17,24-28].

All prisoners suspected of infectious TB should be segregated from other prisoners and isolation should continue until TB is ruled out or clinical improvement is clear. Our setting, like most of the Brazilian correctional system, lacks adequate laboratory and diagnostic equipment, as well as proper isolation rooms, potentially placing staff, prisoners, correctional contacts, and the community at further risk for transmission[4,12,16,19]. Effective TB control in the correctional system is necessary for the reduction of TB rates throughout society[3,18,20-21].

The current study has several potential limitations. First, this survey studied only male prisoners from a local jail, thus making our results difficult to generalize to all pulmonary TB cases in the Brazilian correctional system. However, males make up 96% of the 403,556 prisoners in the Brazilian correctional system[6-7]. Second, X-Ray, TST and HIV serostatus were unknown because they were not feasible in jail conditions. Finally we were not able to survey the entire jail population, though our sample was quite representative of the non-surveyed population

A commitment towards building new detention centers and repairing and expanding old correctional facilities has resulted in a Brazilian correctional system of 515 penitentiaries, 452 prisons, 96 county jails and 31 hospitals[6-7]. Control of TB in those facilities needs to be an essential component of the system. Symptom screening immediately upon entry is a feasible strategy for police stations, jails and prisons. Prisoners scheduled to be transferred to another correctional setting should also be screened for TB symptoms prior to transfer. In addition, correctional employees should be trained on signs and symptoms of TB and be encouraged to facilitate prompt evaluation of prisoners suspected of having the disease. Finally, a political commitment is needed and these efforts should be implemented and sustained to have a lasting impact on TB control[6-7,28-30].

Conclusion

The findings of this study suggested that transmission and active pulmonary TB were greater in the jail of the city of Carapicuíba than in the general population. It also suggested a clear relationship of length of incarceration, judicial situation (tried), and the proportion of RSI among prisoners of the municipal jail.

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