

Latent tuberculosis among professionals with and without direct contact with inmates of two penitentiaries in the State of São Paulo, Brazil, 2008

Infecção tuberculosa latente em profissionais contatos e não contatos de detentos de duas penitenciárias do Estado de São Paulo, Brasil, 2008

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Abstract

Introduction: For groups of persons who remain confined, mainly in prisons, tuberculosis has always been a serious health problem, due to its transmission respiratory, putting in risk the professionals that work in a prison, especially the communicants of inmates. **Objective:** To know the infection prevalence for the *Mycobacterium tuberculosis* among the employees communicating and no communicating of inmates of two prisons of the State of São Paulo. **Methods:** This study consisted of the application of an individual questionnaire; application and reading of the tuberculin skin testing (TST); sputum smear examination and culture; identification and drug sensitivity testing; in the period of March the June of 2008. **Results:** 277 (48.3%) employees of the 574 existent were examined. They were applied and read 248 (89.5%) TST (PPD-RT23 – 2TU/0.1 mL); of them, 194 were in employees that worked directly with the inmates, that is, were communicants and 54 were no communicants. Among the communicants, 62.4% presented induration larger than 10 mm and among the non communicants, 38.9% presented this measure of TST. There was not positive in the sputum smear examination or in the culture, that is, tuberculosis illness case was not identified enters the professionals, at the moment of the research. **Conclusion:** This study suggests that the communicant employees have a larger risk of if they infect for the *M. tuberculosis* and consequently of being sick of tuberculosis.

Keywords: tuberculosis; workers; prisons; latent tuberculosis; tuberculin test; bacteriology.

Resumo

Introdução: Para grupos de pessoas que permanecem confinadas, principalmente em presídios, a tuberculose sempre foi um grave problema de saúde, devido a sua transmissão respiratória, colocando em risco os profissionais que trabalham no sistema prisional, especialmente os contatos de detentos. **Objetivo:** Conhecer a prevalência de infecção pelo *Mycobacterium tuberculosis* entre os profissionais contatos e não contatos de detentos de duas penitenciárias do Estado de São Paulo. **Métodos:** Este estudo consistiu na aplicação de um questionário individual; aplicação e leitura da prova tuberculínica; baciloscopia e cultura dos escarros, com posterior identificação e teste de sensibilidade às drogas antituberculose das cepas isoladas, no período de março a junho de 2008. **Resultados:** Foram examinados 277 (48,3%) profissionais dos 574 existentes. Foram aplicados e lidos 248 (89,5%) testes tuberculínicos (PPD-RT23 - 2TU/0,1 mL), sendo que 194 foram em profissionais que trabalhavam diretamente com os detentos, ou seja, eram contatos e 54, em não contatos. Entre os contatos, 62,4% apresentaram endureção maior que 10 mm e entre os não contatos, 38,9% foram reatores ao teste tuberculínico. Não houve exame de escarro positivo na baciloscopia e na cultura, ou seja, não foi identificado nenhum caso de tuberculose doença entre os profissionais, no momento da pesquisa. **Conclusão:** Este estudo sugere que os profissionais que têm contato direto com os detentos, têm um risco maior de se infectar pelo *M. tuberculosis* e adoecer por tuberculose.

Palavras-chave: tuberculose; trabalhadores; prisões; tuberculose latente; teste tuberculínico; bacteriologia.

Introduction

Tuberculosis (TB) has always been a serious health problem for people confined in psychiatric hospitals, hostels, asylums, and especially penitentiaries, because their living environmental conditions favor not only the disease's transmission but also the tendency to fall ill^{1,2}.

The importance of tuberculosis in closed communities has been known, according to Abrahão³, since 1944, when studies undertaken in various parts of the world pointed to a much higher prevalence and incidence of tuberculosis among prison populations than among the population in general.

At the present time, in accordance with the data of the Brazilian Ministry of Justice⁴, the population of the penitentiary system of the State of São Paulo oscillates at about 153,000, distributed among 147 prison units. The number of tuberculosis cases in this population, according to the Epidemiological Surveillance System of the São Paulo State Health Secretariat, was 1,302 in 2008. If it were possible to calculate the indicator incidence rate of tuberculosis, with the estimated population, it would come out at about 850 cases per 100,000 prisoners. Abrahão³ and Abrahão, Nogueira e Malucelli⁵, in 2001, after an active search among the prisoners of jails in the west end of the city of São Paulo, found an incidence of tuberculosis of 2,065 cases per 100,000 prisoners; a value 79 times higher than that for the population of the city of São Paulo, at that time.

The varying degree of criminal potentiality presented by the prison population, together with the complex relationships existing between the prisoners and the professional personnel responsible for the security of the institutions, and with the administration of the units, makes the work of the health professionals with the prisoners difficult, hindering preventive and curative actions related to the complaints which affect this population. In consequence, the contagious cases of TB are only rarely diagnosed and, when they are, it normally only takes place when the disease is already at an advanced stage².

This last above-mentioned fact² increases the risk of the transmission of tuberculosis to other prisoners, to their weekly visitors and to the professional personnel who work within the prison system and who come into direct contact with the inmates^{2,3,5,6,7,8}.

Epidemiological studies have demonstrated that, beyond those who are employed in the prisons, the professional groups at high risk of contracting tuberculosis are: hospital employees who work on wards with TB patients; nurses in hospitals; nurses who attend HIV-positive or drug-abuse patients; pathologists and workers in laboratories; therapists and physiotherapists of patients with respiratory problems; medical anesthetists, surgeons and psychiatrists; hospital cleaning staff and employees of funeral home⁶.

The objective of this study was to estimate the prevalence of latent tuberculosis among prison staff with and without direct contact with the prisoners of two penitentiaries in the State of São Paulo.

Methodology

This study is part of a research project financed by FAPESP (Process n° 07/54495-0), undertaken during the period from March to December 2008 and entitled "Tuberculosis in the Prison System – a Study undertaken in two Penitentiaries in the City of Guarulhos – SP", and which, in this study, will be denominated Penitentiary A and Penitentiary B.

The following procedures were adopted for the collection of data:

1) After the approval of the research project by the Ethics Committees of the Public Health School of the University of São Paulo and of the São Paulo State Health Secretariat and the agreement of the São Paulo State Secretariat of Penitentiary Administration, there followed the organization and training of the work team, consisting of doctors, nurses, pharmaceutical chemists, nursing technicians and assistants, all belonging to the staff of the Public Health School and of

the Tuberculosis Division of the São Paulo State Health Secretariat.

2) Then a preliminary meeting with the directors and staff of the two prison units was held to clarify the proceedings to be adopted and the importance of tuberculosis within the prison system.

3) Each member of the staff of the two penitentiaries who agreed to participate in the study and who signed a "Declaration of Informed Consent" was interviewed, individually and confidentially, by a member of the project team who used a specific questionnaire and noted the following information: name of prisoner, parents' names, age, marital status, ethnic group, origin (birth-place and nationality), schooling, position or function within the penitentiary, history of tuberculosis, previous contact with tuberculosis patients, presence of coughing, expectoration, the smoking habit, and any other lung disease.

4) After the interview the Tuberculin Skin Test (TST) using 0.1ml of Purified Protein Derivative [PPD RT23 – 2 tuberculin units (TU)] was applied, in accordance with the norms of the Brazilian Ministry of Health¹, by nurses trained by the São Paulo State Health Secretariat, and the reading was undertaken 72 hours after the application, by the same professionals.

The TST was the technique used to verify the percentage of the penitentiary staff infected by the tubercle bacillus. Even though there exist more modern methods for the detection of latent tuberculosis, such as the Interferon Gamma Release Assays (IGRA)⁹ – a test based on the secretion of the interferon gamma (IFN- γ) by circulating T-cells when stimulated *ex vivo* with specific antigens, they are expensive and of difficult application. The TST, discovered by Koch, is still therefore, despite its limitations, the gold standard method and is recommended by the Ministry of Health and the World Health Organization for the verification, whether individual or in whole populations, of infection by the tubercle bacillus.

The result of the PPD was registered in accordance with the norms of the Ministry of Health¹, which has established the following classification: a palpable induration area of 0 to 4 mm (non-reactor); of 5 to 9 mm (weak reactor); and of 10 mm or more (strong reactor).

As this population is of high risk^{2,6,7,8}, and to make it possible to compare the results of the reading of the TST with those of other studies, the professionals were divided into two groups: those with a palpable induration area <10 mm, considered negative, and those with an induration area ≥10 mm, as positive¹⁰. Apart from that, they were classified as having or not having contact with the prisoners.

Those professionals classified as “communicants” were those who had direct contact with the prisoners and included penitentiary security agents (ASP); health professionals (doctors, nurses, nursing assistants, dentists, psychologists and social workers; administrative officials of the health area); teachers; religious agents; the general director, and the director of security and discipline. The professionals classified as “no communicants” were those who had no direct contact with the prisoners, such as administrative officials of the financial area, of human resources and prison archives; escort and surveillance agents (AEVP), and the director’s staff.

5) Then the collection of a sample of sputum from each of the participating professionals was undertaken, for sputum smear examination, culture, identification of the strains identified and drug susceptibility testing (DST) to anti-tuberculosis drugs. The sputum samples were processed at the Mycobacteria Laboratory of the Epidemiology Department, School of Public Health of the University of São Paulo and at the Public Health Laboratory, belonging to the State Health Secretariat, in Guarulhos.

The sputum smear examination was undertaken by fluorescent staining methods (Auramine) for screening, and Ziehl-Neelsen, to issue the positive results of the smear, according to the recommendations of the Brazilian Ministry of Health¹¹.

The culture was undertaken by Ogawa-Kudoh’s decontamination method, in accordance with the technique standardized, with later sowing in the Ogawa-Kudoh culture medium¹².

The positive cultures were sent to the Mycobacteria Laboratory of the Adolfo Lutz Institute of São Paulo, for the identification of the mycobacterial strains and the drug susceptibility testing to anti-tuberculosis drugs in those identified as *M. tuberculosis*, for investigation of bacterial resistance.

Data were processed in an Epi-Info-6 database, version 6.04, analyzed and represented in tables. The statistical analysis used was undertaken by the Chi-squared test (χ^2), with a significance level of 0.05.

Results

A total of 277 (48.3%) professionals of the 574 working in the two penitentiaries were examined, 182 (65.7%) of them from Penitentiary A and 95 (34.3%) from Penitentiary B. The principal reasons for the exams not being carried out on the totality of the professional staff were: night shifts, vacations and leave of absence for reasons of ill-health. All the professional categories were represented, but it was not possible to undertake the statistical test to see whether they in fact represented the population of the penitentiaries, because the “boundary-wall guards” of the AEVP category could not participate in the survey for security reasons.

The professionals examined presented the following characteristics, by Prison Unit where they worked, given in Table 1:

Distribution by sex was statistically similar in the two Units ($\chi^2=1.61$ and $p=0.21$), there being a predominance of the male sex in both penitentiaries.

The average age of the staff of Penitentiary A was 39 years and that of Penitentiary B, 33.7 years. This was the only variable which presented a difference as between the two Prison Units, a fact which is easy to explain as Unit A is older than Unit B ($\chi^2=17.9$ and $p<0.01$).

Table 1. Characteristics of the employees of two prisons of the city of Guarulhos (SP), 2008**Tabela 1.** Características dos funcionários de duas penitenciárias da cidade de Guarulhos (SP), 2008

Characteristics of the employees	Penitentiary A		Penitentiary B		Total		χ^2	p
	n=182		n=95		n=277			
	n	%	n	%	n	%		
Sex								
Male	153	84.1	74	77.9	227	81.9	1.61	0.21
Female	29	15.9	21	22.1	50	18.1		
Age (years)								
18–29	16	8.8	20	21.0	36	13.0		
30–39	36	19.8	28	29.5	64	23.1	17.9	<0.01
40–49	81	44.5	36	37.9	117	37.9		
≥50	49	26.9	11	11.6	60	21.7		
Marital status								
Single	25	13.7	23	24.2	48	17.3		
Married	133	73.2	59	62.1	192	69.3	5.05	0.08
Separated/Divorced/ Widower	24	13.1	13	13.7	37	13.4		
Ethnic group								
White	125	68.7	64	67.3	189	68.2		
Black/Brown	56	30.8	30	31.6	86	31.1	0.25	0.88
Asian	1	0.5	1	1.1	2	0.7		
Indian	–	–	–	–	–	–		
Origin (region)								
North	–	–	–	–	–	–		
Northeast	21	11.5	13	13.7	34	12.3		
Center-west	1	0.6	1	1.0	2	0.7	0.67	0.88
Southeastern	150	82.4	77	81.1	227	81.9		
South	10	5.5	4	4.2	14	5.1		
Education								
Illiterate	–	–	–	–	–	–		
Basic	9	4.9	4	4.2	13	4.7		
Intermediate	105	57.7	60	63.2	165	59.6	0.78	0.68
Superior	68	37.4	31	32.6	99	35.7		
Previous TB								
Yes	2	1.1	–	–	2	0.7		
No	180	98.9	95	100	275	99.3		
Contact with prisoners								
Yes	146	80.2	69	72.6	215	77.6	2.07	0.15
No	36	19.8	26	27.4	62	22.4		

Follows

Table 1. (Continuation)
Tabela 1. (Continuação)

Characteristics of the employees	Penitentiary A		Penitentiary B		Total		χ^2	p
	n=182		n=95		n=277			
	n	%	n	%	n	%		
Cough								
Yes	31	17.0	20	21.1	51	18.4	0.67	0.41
No	151	83.0	75	78.9	226	81.6		
Expectoration								
Yes	29	15.9	20	21.1	49	17.7	1.12	0.29
No	153	84.1	75	78.9	228	82.3		
Smoking								
Yes	49	26.9	21	22.1	70	25.3	0.77	0.38
No	133	73.1	74	77.9	207	74.7		
Another Pulmonary Illness								
Yes	4	2.2	6	6.3	10	3.6	3.04	0.08
No	178	97.8	89	93.7	267	96.4		

No statistically significant differences were found in the variables: marital status ($\chi^2=5.05$ and $p=0.08$), ethnic group ($\chi^2=0.25$ and $p=0.88$), origin (region of Brazil) ($\chi^2=0.67$ and $p=0.88$), schooling ($\chi^2=0.78$ and $p=0.68$), contact with inmates ($\chi^2=2.07$ and $p=0.15$), presence of coughing ($\chi^2=0.67$ and $p=0.41$), presence of expectoration ($\chi^2=1.12$ and $p=0.29$), smoking habit ($\chi^2=0.77$ and $p=0.38$) and other lung disease ($\chi^2=3.04$ and $p=0.08$).

The results found in these tables allow us to study the staff of the two Penitentiaries as just one population.

Of the 277 professionals interviewed, 271 (97.8%) had their sputum collected for the exams, 177 (97.3%) of them being of Penitentiary A and 95 (100.0%) of Penitentiary B. There was no positive result from either sputum smear examination or culture, that is to say, no member of the staff was found to have tuberculosis.

The TST was applied to 248 (89.5%) of the professionals and read. The principal reasons for the TST not being applied to the other 29 staff members (10.5%) was their refusal and their non-appearance for the reading of the test.

Of the 248 professionals who underwent the TST, 194 (78.2%) worked directly with the

inmates, that is to say, were communicants and 54 (21.8%) were no communicants.

The distribution of these professionals, classified as "contacts" and "non-contacts", in accordance with the results of the TST, may be seen in Table 2.

The calculation of the Chi-squared test result and of the value of p demonstrated that there is an association between being a contact of the inmates and reactivity to PPD.

It may be seen from the table that the professional contacts have a higher percentage of reactors to PPD. Noteworthy is the high proportion of reactors among the contacts: for each of the 100 professionals who work directly with inmates, 62.4 are infected with the tubercle bacillus.

Discussion

In the penitentiaries studied, only 48.3% of the professional staff agreed to participate in the study. Their participation was not greater because of the difficulty encountered in reconciling their working hours with the times of the activity of the members of the research team, seeing that there were four daily work shifts and week-end spells of duty. Further, many of them were involved in external activities, on

leave of absence or on vacation. Some other professionals refused to participate, either because of personal problems or for security reasons as in the case of the escort and prison security agents (AEVP).

There was greater participation and interest on the part of the contact professionals, possibly by virtue of the fact that they were more numerous and because they were working directly with the prisoners, as 90.2% of them agreed to undergo all the exams.

The factor which explains the association between having contact with the inmates and reactivity to PPD is the greater exposure to the bacillus to which the contacts are subject. The professionals who work in close contact with the inmates run a higher risk of being infected by *Mycobacterium tuberculosis* and of falling ill with tuberculosis,

especially because the prevalence of the disease among persons deprived of their liberty is much higher than that to which the population in general is exposed^{5,6,8,9}.

Table 3 compares these results of the TST with those of other recent studies^{13,14,15} undertaken with other professional classes who are also exposed to a high risk of infection with the tubercle bacillus.

It may be seen from this table that the contacts of the penitentiaries, those of the Hospital São Paulo and of the various hospitals in four Brazilian cities present practically the same percentage of positive cases. This means that the professionals of the penitentiaries, who work directly with the inmates, run a risk of being infected and falling ill with tuberculosis statistically similar to that of hospital workers

Table 2. Result of the tuberculin skin test of the communicant and no communicant employees, of two prisons of the city of Guarulhos (SP). 2008

Tabela 2. Resultado do teste tuberculínico dos profissionais contatos e não contatos, de duas penitenciárias da cidade de Guarulhos (SP). 2008

TST	Communicant employees		No communicant employees		Total	
	n	%	n	%	n	%
<10 mm	73	37.6	33	61.1	106	42.7
>10 mm	121	62.4	21	38.9	142	57.3
Total	194	100.0	54	100.0	248	100.0

$\chi^2=9.52$ and $p=0.002$ – statistically significant
 $\chi^2=9,52$ e $p=0,002$ – estatisticamente significante

Table 3. Result of the tuberculin skin test of the communicant and no communicant employees, communicants or not of people with tuberculosis disease, in different studies, and in different professional categories

Tabela 3. Resultado do teste tuberculínico dos profissionais contatos e não contatos de detentos ou de doentes tuberculosos, em diferentes estudos, e em diferentes categorias profissionais

Professional categories	TST					
	<10 mm		>10mm		Total	
	n	%	n	%	n	%
Employee of Prisons (Communicant)	73	37.6	121	62.4	194	100.0
Employee of Prisons (No communicant)	33	61.1	21	38.9	54	100.0
Hospital São Paulo (Communicant) ¹³	105	41.8	146	58.2	251	100.0
Hospital São Paulo (No communicant) ¹³	82	46.6	94	53.4	176	100.0
Brazilian Hospitals (Communicant) ¹⁴	1149	35.4	2095	65.6	3244	100.0
Brazilian Hospitals (No communicant) ¹⁴	372	42.0	514	58.0	886	100.0
Medical Students - Vassouras ¹⁵	70	86.4	11	13.6	81	100.0

responsible for the care of patients with this malady.

That the staff of penitentiaries have a greater probability of being infected by and falling ill with tuberculosis has been demonstrated by Steenland et al.¹⁶ who studied the tuberculin turnover among the professional staff of penitentiaries in the State of New York, USA, after an outbreak of tuberculosis among prisoners, when it was demonstrated that 33% of the new tuberculin turnover was due to professional exposure.

Jochem et al.¹⁷ determined the prevalence of latent tuberculosis among the professional staff of a penitentiary for women in Montreal, Canada, as being of 32%. The authors found a positive association between working in a penitentiary and latent tuberculosis.

The São Paulo State Health Secretariat², the World Health Organization¹⁸ in its manual "Tuberculosis Control in Prisons" and the CDC¹⁹ in its July 2006 publication, recommend closer educational and preventive care of the professionals who work directly with prisoners.

Conclusion

This study suggests that the professional staff of Brazilian penitentiaries, especially

those who work in direct contact with the inmates, should receive training in tuberculosis so as to be able to identify, treat and cure their institutions' cases and thus reduce the risk of the internal transmission of the disease. Further, in view of the high risk of being infected and falling ill with tuberculosis which they run, they should be the target of greater care on the part of health authorities and participate in a program of occupational health with periodical exams for the detection of both the infection and the disease.

As one is here dealing with a population which has contact with another whose disease indicators are 70 times higher³ than those of the general population, these data should not be extrapolated to other professional groups.

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