

Tuberculosis infection and the length of stay of County Jails prisoners in the western sector of the city of São Paulo

A infecção tuberculosa e o tempo de prisão da população carcerária dos Distritos Policiais da zona oeste da cidade de São Paulo

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Abstract

Introduction: Tuberculosis has always been a serious health problem for groups of confined individuals, especially in prisons, due to its respiratory transmission. **Objective:** To verify the association between the length of stay in prison and the rate of tuberculosis infection in County Jail prisoners in the western sector of the city of São Paulo. **Methods:** An observational study was conducted in 2000 and 2001 by interviewing prisoners and by conducting Tuberculin Skin Test (TST). **Results and Discussion:** Of the 1,052 prisoners interviewed, 932 agreed to submit to TST (PPD-RT23 - 2TU/0.1 ml) and of these, 64.5% were reactors. For analyses, offenders were classified as first-time or recidivists, and as non- reactors and reactors to TST, according to the length of stay in prison. Among 134 first-time offenders who were imprisoned for less than 60 days, 40.3% were positive to TST and of the 53 with more than 366 days in prison, the percentage of reactors was of 62.3%. Among 146 recidivists who were imprisoned less than 60 days, 72.6% were reactors to TST and of the 25 with more than 366 days in prison, 100.0% were infected. In all periods of prison stays, recidivists registered a higher percentage of infectious tuberculosis than first-time offenders. The association between length of stay in prison and reactivity to TST was confirmed by the Epi-Info-6 Program Trendency Test ($p < 0.001$). **Conclusions:** The longer the confinement in prison, the higher the rate of tuberculosis infection. Recidivists are a risk of tuberculosis infection to first-time offenders.

Keywords: Tuberculosis infection; County Jails; Tuberculin Skin Test; Length of stay in prison

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Resumo

Introdução: A tuberculose sempre foi um grave problema de saúde para grupos de pessoas confinadas, especialmente em presídios, devido à sua transmissão respiratória. **Objetivo:** verificar a associação entre o tempo de prisão e a taxa de infecção tuberculosa na população carcerária dos Distritos Policiais da zona oeste da cidade de São Paulo. **Metodologia:** realizou-se um estudo observacional, no período de março de 2000 a maio de 2001, com a aplicação de um inquérito individual e da prova tuberculínica (PPD-RT23 – 2UT/0.1ml) nos detentos. **Resultados e Discussão:** do total de 1.052 presos entrevistados, 932 concordaram em fazer a prova tuberculínica e destes, 64,5% estavam infectados. Para as análises, os detentos foram classificados como primários e reincidentes e como não reatores e reatores à prova tuberculínica, segundo o tempo de prisão. Entre os 134 detentos primários que estavam presos há menos de 60 dias, 40,3% foram reatores ao PPD e dos 53 com mais de 366 dias de prisão a percentagem de reatores foi de 62,3%. Entre os 146 detentos reincidentes presos há menos de 60 dias, 72,6% foram reatores ao PPD e dos 25 com mais de 366 dias de prisão, 100,0% estava infectado. Em todos os períodos de permanência na prisão os detentos reincidentes tiveram maior percentagem de infecção tuberculosa do que os detentos primários. A associação entre tempo de prisão e reatividade ao PPD foi confirmada pelo Teste de Tendência ($p < 0.001$) do programa Epi-Info-6. **Conclusões:** quanto maior o tempo de prisão, maior a taxa de infecção tuberculosa. Detentos reincidentes são um risco de infecção para os detentos primários.

Descritores: Infecção tuberculosa; Distritos Policiais; Prova tuberculínica, Tempo de prisão.

1- Introduction

Tuberculosis has always been a serious health problem for groups of confined individuals, especially in prisons, due to its respiratory transmission. Therefore special attention should be paid to this population^{1, 2, 3, 4}.

The worldwide imprisoned population is estimated to be 8 to 10 million inmates, half of which are in the United States of America (1.9 million), China (1.4 million) and Russia (1 million)^{5, 6, 7}. Brazil ranks fourth among countries with the largest imprisoned populations, registering in 2006 a population of 401,236 inmates, 85.6% of which were in the penitentiary system and the remaining 15.4% in County Jails⁸. In 2007, this population increased to 422,590 inmates, 86.7% of which in the penitentiary system and 13.2% in County Jails⁹.

The United States has the world's highest rate of prisoners (686 inmates per 100,000 inhabitants), followed by the Cayman Islands (664/100,000) and Russia (638/100,000). However, over three fifths of the countries (62.5%) have rates below 150 inmates per 100,000 inhabitants⁷.

In Brazil, the number of inmates per 100,000 inhabitants has grown systematically, from 108.6 inmates per 100,000 inhabitants in 1997, to 135.7 in 2001 and to 229.7/100,000 inhabitants in 2007. Total numbers grew from 170,602 inmates in 1997, to 233,859 in 2001 and to 422,590 in 2007, at an average monthly cost in *reais* equivalent to U\$268.86 dollars per inmate^{2, 9}.

Despite joint efforts of the Federal and State Governments to build new prisons, the deficit of places in the Brazilian penitentiary system grew from 96,010 in 1997 to 173,075 in 2007; that is, inmates enter the system at a much faster rate than they leave it^{2, 9}.

The State of São Paulo has 39.7% of the imprisoned population of the country^{2, 10}. In 1997, the total number of inmates of the State was 67,786, although the prison system only offered 24,222 positions; therefore with a deficit of 43,564 places at the time². According to data made available by the National

Penitentiary Department⁹, the total number of inmates in the State grew to 153,056 in 2007 and places available to 95,585, while the deficit of places grew to 57,471.

In 1997, of the total 67,786 inmates, 35,847 were distributed through 59 Prisons, subordinated to the State Prison Administration Department. The other 31,939 inmates were in Public Jailhouses and County Jails, subordinated to the State Public Security Department². In 2007, there were 141,609 inmates distributed in 144 Prisons and 11,447 in Public Jailhouses and County Jails⁹.

Most Brazilian inmates are men in the 20 to 49 year-old bracket, with little schooling and coming from low level socio-economic groups¹¹. Most prisons are overcrowded, poorly ventilated and with low standards of hygiene and cleanliness. Nutrition is inadequate and illegal behaviors, such as use of alcohol and drugs or unprotected sexual activities (with and without consent), are not restrained. These conditions submit this population to a high risk for having or dying from tuberculosis and AIDS^{5,6,12}. HIV infection is the major known risk factor in the development of tuberculosis among adults infected by *Mycobacterium tuberculosis*¹¹.

It is important to highlight the extreme mobility of this population, which moves from one prison to another before returning to the community. The average length of stay in prison is around 30 months. There are no data regarding the turnover system in Public and County Jails, but it is supposedly high^{5,6,11}.

According to the Ministry of Health¹², several experts on the prison system have attested the collapse of the Brazilian prison system. The scenario is not only present in the subhuman conditions in which inmates live, but also the violence to which they are submitted prevents their recovery. Inmates do not re-socialize and still find ways to progress in the crime scenario, from the moment they are arrested. The relapse percentage among former prisoners of the national prison system is high, over 80% in São Paulo.

In Brazilian prisons, violent recidivists

and first-time offenders, detained for minor offenses, frequently share a same cell. This situation, allied to the unique prison conditions, to the absence of effective supervision, existence of weapons in the hands of inmates, and lack of activities, result in abuse among inmates¹⁰.

The precariousness of medical care is another very concerning aspect. Potentially lethal diseases such as tuberculosis and AIDS have reached epidemic levels in the imprisoned population of Brazil¹⁰.

According to the São Paulo State Health Department¹¹, most inmates in our country enter prisons already infected by the *Mycobacterium tuberculosis* and the conditions of confinement favor the development of the infection to disease and its transmission. By making it difficult to treat inmates appropriately, the prison system not only threatens the life of inmates but also facilitates transmission of these diseases to the population in general, through the professionals who work in the Prison Units, visitors (family and conjugal visits) and the release of inmates. As inmates are not completely isolated from the external world, an uncontrolled contamination among them represents a serious risk to public health¹⁰.

In 2007, according to a personal communication from the São Paulo State Epidemiological Surveillance Center, the informed incidence rate, in this population, reached 669.7 cases per 100,000 inmates, around 17.8 times higher than the 37.7/100,000 for the population in general.

The rationale for the present study is based on the severity of the scenario presented and in response to the recommendation of the Ministry of Health¹⁶ that special attention be given to groups with a higher risk of having tuberculosis, among which closed communities such as prisons.

2- Objective

To verify the association between the length of stay in prison and the rate of tuberculosis infection in County Jail prisoners in the western sector of the city of São Paulo.

3- Methods

3.1- Study Population

County Jail prisoners of the western sector of the city of São Paulo, of the 3rd County Jail Section – West, and subordinated to the São Paulo State Security Department, from March 2000 to May 2001¹³.

During the study period, there were 14 County Jails located in the western sector of the city of São Paulo, although only 9 had jails, that is they had inmates¹³.

3.2- Data Collection

A questionnaire was prepared to be answered individually by inmates who agreed to take part in the study and signed the Informed Consent Form, approved by the Ethics Committee of the School of Public Health of the University of São Paulo.

After interviews, participants were submitted to Tuberculin Skin Test (TST) using PPD-RT23 tuberculin, according to rules standardized by the Ministry of Health^{14,15} and applied through the intradermal route at the medium third of the inner surface of the left forearm, using a 0.1ml of Purified Protein Derivative [PPD RT23 – 2 tuberculin units (TU)], by professionals certified by the São Paulo State Secretariat of Health.

The TST was read 72 hours after application, using a millimeter divided ruler on the largest transverse diameter of the palpable induration area. Results were recorded in millimeters, according to the following classification:

- 0 to 4 mm - non reactor – individual not infected by the Tuberculosis bacillus or anergy.
- 5 to 9 mm – weak reactor – individual infected by the Tuberculosis bacillus or by other mycobacteria, or vaccinated with BCG.
- 10 mm or more - strong reactor – individual infected by the Tuberculosis bacillus, sick or not, or recently vaccinated with BCG^{14,15}.

3.3- Data Analysis

Data were processed in an Epi-Info-6 database, version 6.04¹⁶, analyzed and represented in tables and graphs.

In the analysis performed, inmates were classified as first-time offenders (first time inmates) and recidivists (had been inmates previously), according to prison status, and as non reactors and reactors to TST. Inmates with a palpable induration from 0 to 4 mm were considered “non reactors”, and those with an induration equal or over 5 mm, as “reactors”.

The Tendency Test ($p < 0.001$), which is the Epi-Info-6 Program version 6.04 Chi-Square Test for Linear Trend, was used to verify the association between length of stay in prison and reactivity to TST¹⁶.

4- Results and Discussion

From March 2000 to May 2001, there were 1,052 inmates in 9 County Jails of the western sector of the city of São Paulo and all were interviewed¹³. Of the total, 932 (88.6%) agreed to have a Tuberculin Skin Test (TST) and were classified in **Table 1** as first-time offenders or recidivists, and as reactors and non-reactors to the TST:

Table 1 shows that 601 (64.5%) inmates were TST reactors, that is, they were infected by the *M. tuberculosis*, 36 (6.0%) of which with a bleb or local application necrosis.

Among first-time offenders, 55.1% were TST reactors and among recidivists, 75.6% were infected, showing a much higher infection rate in recidivists inmates ($X^2=9.28$, statistically significant). These results are in agreement with several studies carried out in Brazil and in the world, such as that of Adib et al.¹⁷ 1999, in 21 prisons in Lebanon; Bellin et al.¹⁸ 1993, in New York city, in the US prison system; Martin et al.^{19,20} 1993, 2000, in Spanish Penitentiaries; Niero²¹ 1981, at a São Paulo Prison, Brazil; and Sánchez et al.²² 1995 in a prison in Spain.

Table 2 compares the result of TST with the length of stay of inmates in the County Jails of the western sector of the city of São Paulo.

Table 1 - Distribution of the number and percentage of first-time offenders and recidivists, according to results of Tuberculin Skin Test (TST). County Jails of the western sector of the city of São Paulo. State of São Paulo, Brazil, 2000-2001.

Tabela 1 - Distribuição do número e percentagem dos detentos primários e reincidentes, segundo o resultado da prova tuberculínica. Distritos Policiais da zona oeste da cidade de São Paulo, 2000-2001.

Tuberculin Skin Test (TST)	First-Time		Recidivists		Total	
	n°	%	n°	%	n°	%
Non reactor	227	44.9	104	24.4	331	35.5
Reactor	279	55.1	322	75.6	601	64.5
Total	506	100.0	426	100.0	932	100.0

$\chi^2 = 9.28$, statistically significant.

Table 2 - Distribution of the number and percentage of the prisoners who underwent Tuberculin Skin Test (TST), according to the length of stay in the County Jails of the western sector of the city of São Paulo. State of São Paulo, Brazil, 2000-2001.

Tabela 2 - Distribuição do número e percentagem dos detentos que fizeram a prova tuberculínica, segundo o tempo de permanência nos Distritos Policiais da zona oeste da cidade de São Paulo, 2000-2001.

Length of Stay (in days)	Tuberculin Skin Test (TST)				Total	
	Non reactor		Reactor		n°	%
	n°	%	n°	%		
<60	120	42.9	160	57.1	280	100.0
60 to 180	122	35.6	221	64.4	343	100.0
181 to 365	69	29.9	162	70.1	231	100.0
>366	20	25.6	58	74.4	78	100.0
Total	331	35.5	601	64.5	932	100.0

$\chi^2 = 7.52$, statistically significant.

Table 2 shows that as prison time increases, the percentage of inmates that react to the TST also grows ($\chi^2=7.52$, statistically significant).

In order to verify the association between time in prison and TST reactivity, graphs were built and the Tendency Test used ($p < 0.001$). Inmates were classified as first-time offenders or recidivists, and as non-reactors and reactors.

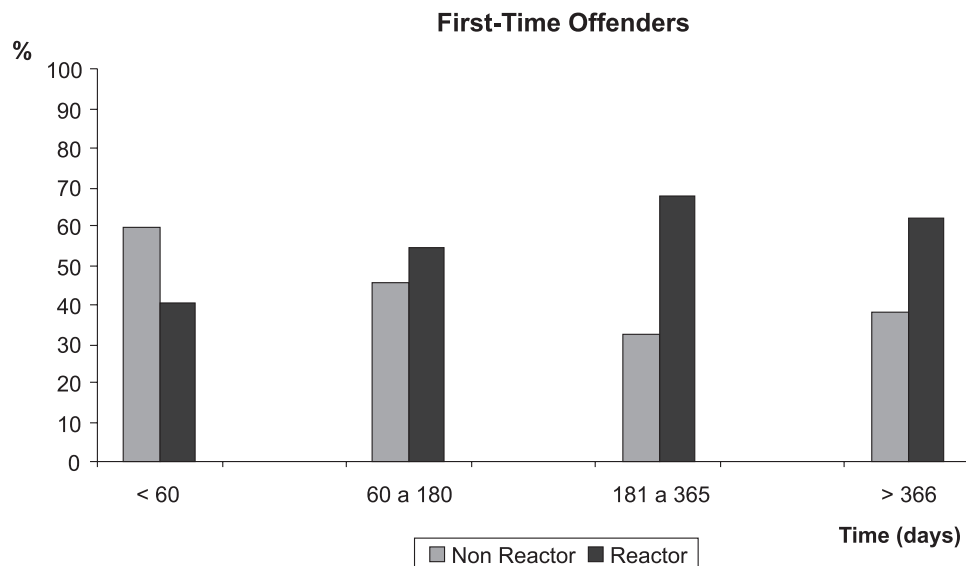
Graph 1 compares TST results with length of stay in prison of first-time offenders at County Jails in the western sector of the city of São Paulo. **Graph 2** makes the same comparison for recidivists inmates.

Graph 1, shows an association between length of stay in prison of first-time offenders at County Jails in the western sector of

the city of São Paulo and reactivity to TST, using the Tendency Test ($p=0.00066$ and $\chi^2=11.6$, statistically significant).

Of the 506 first-time offender analyzed, 134 had been inmates for less than 60 days and of these, 40.3% were TST reactors. Of the 180 first-time offenders with prison time between 60 and 180 days, the percentage of reactors increased to 64.4%, and of the 139 with prison time between 181 and 365 days, it increased to 67.6%. Of the 53 first-time offenders with over 366 days in prison, the percentage of reactors was 62.3%, with a slight fall in percentage of infected individuals. Still, the graph shows that the longer the length of stay in prison, the higher the number of TST reactor inmates.

According to Sánchez et al.²² 1995, this



Graph 1 - Percentage of first-time offenders, non reactors and reactors to Tuberculin Skin Test (TST), according to length of stay in the County Jails of the western sector of the city of São Paulo. State of São Paulo, Brazil, 2000-2001.

Gráfico 1 - Percentagem de detentos primários, não reatores e reatores à prova tuberculínica, segundo o tempo de permanência nos Distritos Policiais da zona oeste da cidade de São Paulo, 2000-2001.

relation between infection and prison time has been shown in other studies, that have observed that the longer the length of stay of inmates in prison, the greater is their exposure to the disease and the higher the risk of infection.

Graph 2, also shows the association between length of stay in prison of recidivists inmates at the County Jails of the western sector of the city of São Paulo and reactivity to the TST, using the Tendency Test ($p=0.00002$ and $X^2=18.4$, statistically significant).

Of the 426 recidivists inmates analyzed, 146 were inmates for less than 60 days and of these, 72.6% were TST reactors. Of the 163 inmates with prison time between 60 and 180 days, the percentage of reactors increased to 75.5%, and of the 92 with prison time between 181 and 365 days, the percentage was 73.9%.

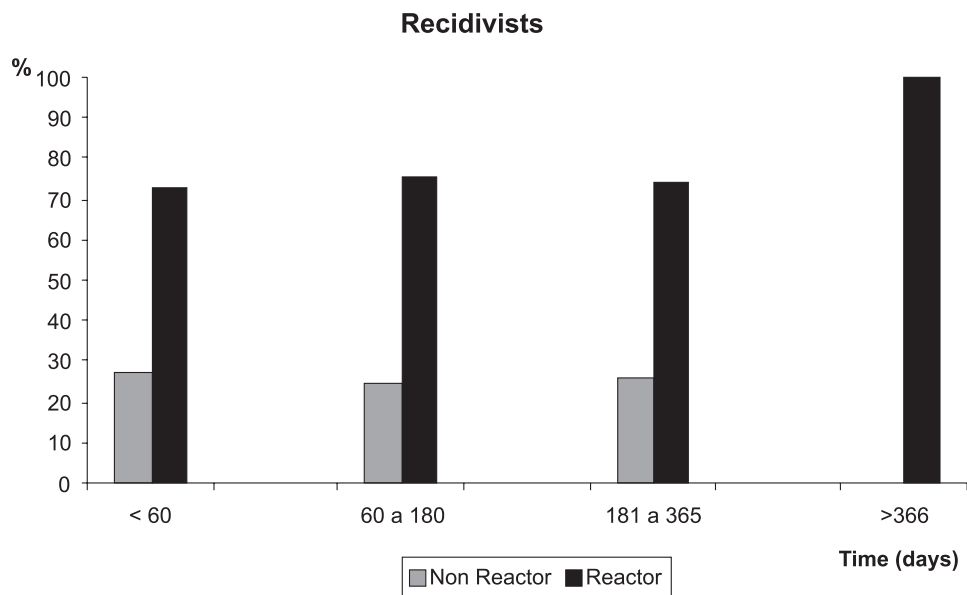
The graph shows that of the 25 recidivists inmates with over 366 days in prison 100.0% were infected, showing that recidivists inmates had the highest percentages of tuberculosis infection as of the reentry into the prison system, and that percentages

grow with length of stay in prison.

Therefore, the comparison of both graphs shows that in all periods of incarceration, recidivists registered a higher percentage of tuberculosis infection than first-time offenders; and in a period above 366 prison days, 100.0% were infected.

Similarly to the São Paulo State Secretariat of Health¹¹, which claims that most inmates in our country enter prisons already infected by *Mycobacterium tuberculosis*, the present study has verified that if only TST and length of stay in prison are considered (Table 2), without classifying inmates as first-time or recidivists, most inmates in the County Jails of the western sector of the city of São Paulo entered prison already infected, given that of the 932 inmates submitted to testing, 57.1% that were inmates for less than 60 days (without therefore, enough time to become infected in prison) were TST reactors.

However, when classified as first-time or recidivists, of those imprisoned for less than 60 days, 40.3% of first-time offenders were observed to have entered County Jails infected, and 72.6% of recidivists re-entered



Graph 2 - Percentage of recidivists, non reactors and reactors to the Tuberculin Skin Test (TST), according to the length of stay in the County Jails of the western sector of the city of São Paulo, State of São Paulo, Brazil, 2000-2001.

Gráfico 2 - Percentagem de detentos reincidentes, não reatores e reatores à prova tuberculínica, segundo o tempo de permanência nos Distritos Policiais da zona oeste da cidade de São Paulo, 2000-2001.

the prison system infected (Graphs 1 and 2), showing the need to perform the analysis according to the prison status of inmates, given that the percentage of individuals infected at the moment of prison is higher in recidivists inmates.

5- Conclusions

The high rate of tuberculosis infection (64.5%) found in the imprisoned population and the fact that the longer the length of stay in prison, the higher the reactivity to the TST are strong arguments for the implementation of Tuberculosis control measures in prisons.

Confinement and overcrowding of County Jails and of other Prison Units, along with the precarious hygiene conditions, low quality of food and stress caused by the

situation, increase the risk of becoming ill, and transform inmates in important sources of *Mycobacterium tuberculosis* infection, favoring transmission of tuberculosis. In this way, they represent a threat to public health and to the control of the endemic.

As for all lengths of stay in prison, recidivists inmates had a higher percentage of tuberculosis infection, constituting a risk of infection to first-time offenders, we recommend that they be separated at the time of entry into the prison system.

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