

## THE EPIDEMIOLOGICAL DIMENSION OF TB/HIV CO-INFECTION

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*This study aimed to analyze the epidemiological indicators of TB/HIV co-infection in São José do Rio Preto, São Paulo, Brazil from 1998 to 2006. Data of new TB cases that initiated treatment between January 1998 and December 2006 were obtained from the TB Notification System (EPI-TB) and 306 cases were reported. The incidence rate was 5.1/100,000 inhabitants in 2006. Most cases were men (72.5%) with ages ranging between 20 and 59 years (96.4 %). The majority (51%) had incomplete primary education. Pulmonary TB was the most common type (52.9%) and 46.1% of the patients received supervised treatment. In 2006, the cure rate was 33.3%, 14.3% death rate and no patient abandoned the treatment. Diagnosis occurred at the hospital in 60% of the cases. Results show the need of improved coordination between the city's Tuberculosis Control Program and the Sexually Transmitted Diseases and HIV Program.*

**DESCRIPTORS:** tuberculosis; epidemiology; HIV; comorbidity

## LA DIMENSIÓN EPIDEMIOLÓGICA DE LA COINFECCIÓN TB/VIH

*El objetivo fue analizar los indicadores epidemiológicos de la coinfección tuberculosis y virus de la inmunodeficiencia humana (TB/VIH) en el municipio de Sao José del Rio Preto, Sao Paulo, Brasil, en el período de 1.998 a 2.006. Los datos de los casos nuevos de TB, que iniciaron el tratamiento entre enero de 1.998 y diciembre de 2.006, fueron recolectados del Sistema de Notificación de la TB (EPI-TB). Fueron notificados 306 casos. El coeficiente de incidencia fue de 5,1/100.000 hab, en 2006. Hubo predominio de personas del sexo masculino (72,5%), en el intervalo de edad de 20 a 59 años (96,4%). La mayoría (51%) no poseía la enseñanza fundamental completa. La forma clínica pulmonar fue relevante (52,9%) y recibieron tratamiento supervisado 46,1% enfermos. En 2.006, la tasa de cura fue de 33,3%, de muertes 14,3%, y no hubo ningún caso de abandono. Entre los casos, 60% fueron diagnosticados en el hospital. Los datos reflejan la necesidad de tener una mayor articulación entre el Programa Municipal de Control de la Tuberculosis y el Programa Municipal de DST/SIDA.*

**DESCRIPTORES:** tuberculosis; epidemiología; VIH; co-morbilidad

## A DIMENSÃO EPIDEMIOLÓGICA DA COINFECÇÃO TB/HIV

*O objetivo foi analisar os indicadores epidemiológicos da coinfeção tuberculose e o vírus da imunodeficiência humana (TB/HIV) no município de São José do Rio Preto, São Paulo, Brasil, no período de 1998 a 2006. Os dados dos casos novos de TB, que iniciaram o tratamento entre janeiro de 1998 a dezembro de 2006, foram coletados do Sistema de Notificação da TB (EPI-TB). Foram notificados 306 casos. O coeficiente de incidência foi de 5,1/100 000 hab, em 2006. Houve predominio de pessoas do sexo masculino (72,5%), na faixa etária de 20 a 59 anos (96,4%). A maioria (51%) não possuía o ensino fundamental completo. A forma clínica pulmonar era relevante (52,9%) e receberam tratamento supervisionado 46,1% doentes. Em 2006, a taxa de cura foi de 33,3%, óbitos, 14,3%, e não houve nenhum caso de abandono. Dentre os casos, 60% foram diagnosticados no hospital. Os dados refletem a necessidade de maior articulação entre o Programa Municipal de Controle da Tuberculose e o Programa Municipal de DST/AIDS.*

**DESCRIPTORES:** tuberculose; epidemiologia; HIV; comorbidade

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## INTRODUCTION

**H**IV infection is one of the most important risk factors for acquiring tuberculosis (TB) and one disease leads to the development of the other with consequent epidemiological transformations in both. The risk of an individual without HIV to develop TB can vary from 5 to 15% over life, whereas for those infected by HIV and co-infected by *M. tuberculosis*, this risk varies from 5 to 15% in a year or 50% over life<sup>(1)</sup>.

According to the World Health Organization (WHO) there were 1.4 million new cases of tuberculosis worldwide among those infected by HIV, which led to the deaths of 456,000 people<sup>(1)</sup>.

Since 2004, new strategies have been developed with a view to include TB/HIV co-infection in policies aimed to control TB through social mobilization so as to obtain the same successful results achieved in the AIDS control program. However, such goals represent a great challenge for the control of co-infection, considering the lack of interaction between the National Tuberculosis Control Program (NTCP) and the National Sexually Transmitted Diseases (STD) and AIDS Program (NP-STD/AIDS)<sup>(2)</sup>.

Despite efforts, there are still difficulties hindering the achievement of goals to control TB, especially due to the high rates of mortality among HIV patients under TB treatment. The major difficulty is related to the fact that the TB control policy is linked to the basic health care level and to AIDS care delivery at the secondary and tertiary levels<sup>(3)</sup>.

Due to the dimension of comorbidities and the impact of TB and HIV together on public health, further research addressing the epidemiological profile of co-infected patients is needed. The development of scientific studies that evidence the sociodemographic and epidemiological contexts that affect the disease's behavior and patients' treatment can contribute to the planning of actions and strategies focused on public policies to control co-infection.

These issues drive this study, which analyzes the epidemiological indicators of TB/HIV co-infection in São José do Rio Preto, SP, Brazil between 1998 and 2006.

## METHOD

This is an epidemiological and descriptive study based on the TB Notification System (EPI-TB) of the Municipal Secretary of Health and Hygiene of

São José do Rio Preto, which updates TB cases registered in the city's disease control program which has been extant since 1998.

According to the Brazilian Institute of Geography and Statistics (IBGE), in 2006 São José do Rio Preto, North of São Paulo, Brazil had 402,770 inhabitants. The city is ranked 5<sup>th</sup> in notified cases of AIDS in the São Paulo state and presents a high rate of TB/HIV co-infection that ranged from 35-51% of the total cases of TB<sup>(4)</sup> between 1998 and 2005, which led it to be considered a priority by the National Program of Tuberculosis Control and to receive support from the State and Federal Governments for its patients' treatment<sup>(4-5)</sup>.

It has had a TB Control Program (TBCP) since the 1990s. Up to 2007, TB control actions were centralized in the TBCP and were primarily performed in the Outpatient Management Center – 60 (OMC-60) which is considered a reference for this kind of service).

This study's population included new TB cases co-infected by HIV, residents in São José do Rio Preto, SP, Brazil, who began treatment between January 1<sup>st</sup> and December 31<sup>st</sup> 2006. Duplicated cases, patients with negative or inconclusive HIV exams or HIV exams not performed were excluded as well as those that ended up being transferred or had their diagnoses changed. Patients from the prison system were also excluded.

The following variables were used in this study: incidence of TB/HIV with distribution by age range and year obtained through direct standardization of data (epidemiological indicator), gender, age range and education (sociodemographic variables), classification of disease (pulmonary, extrapulmonary and pulmonary + extrapulmonary), treatment outcome (cure, abandonment and death), option for supervised treatment and the service that discovered the case (clinic-epidemiological variables).

Data were analyzed through Epi Info Windows and the percentage of all variables was computed.

The study was approved by the Research Ethics Committee at the São José do Rio Preto Medical School (FAMERP), SP, Brazil and authorized by the city's Secretary of Health and Hygiene.

## RESULTS

A total of 1,457 new TB cases were reported in São José do Rio Preto between 1998 and 2006, of

which 306 were patients co-infected by the HIV virus. According to the study's exclusion criteria, the rate of co-infection was 21% in the period.

The standardized incident coefficient of co-infection in the city was 9.9/100,000 inhabitants in 1998, which increased to 12.6 in 2000, receding in the following years until it reached 5.1/100,000 inhabitants in 2006 as showed in Figure 1.

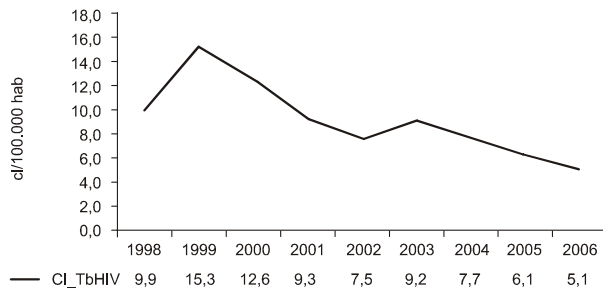


Figure 1 – Standardized TB/HIV coefficient of incidence, distributed by year in São José do Rio Preto, SP, Brazil, 1998 to 2006

In the whole period, the disease mainly affected co-infected men (Table 1); the ratio of men to women was 2.6:1.

Table 1 – Distribution of new TB cases in HIV-positive patients, according to gender, in São José do Rio Preto, SP, Brazil, 1998 to 2006

Year	Male		Female		Total n° cases
	n° cases	%	n° cases	%	
1998	23	67.6	11	32.3	34
1999	40	74.1	14	25.9	54
2000	29	64.4	16	35.6	45
2001	26	76.5	8	23.5	34
2002	22	78.6	6	21.4	28
2003	24	68.6	11	31.4	35
2004	25	83.3	5	16.7	30
2005	18	72	7	28	25
2006	15	71.4	6	28.6	21
Total	222	72.5	84	27.5	306

Ages from 20 to 59 years old stand out with 295 (96.4%) of the total of cases. The average age in all years was 36.3 years old.

In terms of education, 51% of the cases had not completed primary school, 4.9% had bachelor's

degree and 4.6% were illiterate. It is important to highlight that 29.6% (60) of the total of cases did not provide their level of education, which shows that not all data were filled out in the database.

The most frequent clinic form of TB was pulmonary (52.9%) followed by extrapulmonary with 36.6% and 10.4% of cases presented both forms (pulmonary + extrapulmonary).

Only 46.1% of patients received supervised treatment (ST) while many died at the beginning of treatment. Figure 2 presents the treatment outcomes: abandonment, death and cure.

The rate of abandonment among co-infected patients varied considerably: 26.5% in 1998 receding to 0% in 2002 and 2003, which was maintained in 2006.

The percentage of death among the co-infected was similar, except in 2001 and 2002, when there was a significant decline. It is important to highlight that the comorbidity did not necessarily determine such deaths.

The rate of cure of 41.2% started to improve from 1998 on and reached 82.1% in 2002, receding to 60% in 2005. The low rate of cure of 33.3% in 2006 can be explained by the fact that data collection ceased before many patients had finished their treatments.

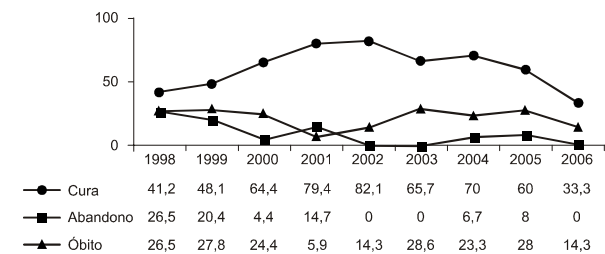


Figure 2 – TB treatment outcome in relation to the percentage of cure, treatment default and death in the total of TB/HIV co-infected in São José do Rio Preto, SP, Brazil between 1998 and 2006

The diagnoses of 156 cases (60%) were established in the hospital and 86 cases (28.2%) in public, private and teaching outpatient clinics. It is worth mentioning that the facility where diagnosis was established was not noted in 57 cases (18.2%).

## DISCUSSION

A total of 12% of the notified TB cases in Brazil in 2006 were associated with HIV infection<sup>(6)</sup>. In 2007, this rate increased to 14% in the country<sup>(1)</sup>; it was 13% in the state of São Paulo in 2005<sup>(5)</sup>. This study's results reveal that São José do Rio Preto has presented co-infection rates similar to the state of São Paulo, which is higher than the country's. The population's current behavior concerning TB is somewhat unusual because in a historical series of 24 years the city always presented a lower risk of acquiring the disease compared to national and state levels<sup>(4,7)</sup>.

Co-infection mainly affects poor countries where HIV is feeding the TB epidemic due to the population's low level of education, lack of access to free health services and condoms. This situation is not comparable with São José do Rio Preto's context since despite the fact that it is ranked one of the cities with the best quality of life in the state of São Paulo<sup>(8)</sup>, it also presents high AIDS coefficient, which also reflects TB co-infection.

Because the city has an important rail and road junction, which is considered an important route of drug trafficking, an efficient epidemiological surveillance to control AIDS, a health system that includes the active search of cases of the disease in the primary health care with a counseling program implemented in all Health Basic Units and also an outpatients clinic and a reference Specialized Center of Treatment, São José do Rio Preto became a center for the diagnosis and treatment of the disease, which are factors that can contribute to the increased rates of co-infection<sup>(4,7)</sup>.

The predominance of co-infected men confirms the results of studies carried out in Brazil<sup>(9-11)</sup>. The reason men are predominantly getting infected is not very clear but it might be related to biological factors, life style, self-care<sup>(7)</sup> and also to the fact that men search for health services later than women<sup>(12)</sup>.

The high rate of TB/HIV co-infection in men is in accordance with data related to infection only by HIV or TB, however, the co-infection relation between men and women may be altering due to the transformation of the AIDS epidemic in recent years, which has tended to affect more women. Data from São José do Rio Preto are in accordance with national data from 2006 and show that the number of women infected by HIV has increased in a ratio of 1.77:1

cases between men and women and has a tendency to become more homogeneous<sup>(13)</sup>.

The predominance of co-infected people in the economically active age range (19 to 65 years old) is also in agreement with studies carried out in several Brazilian cities<sup>(9-12)</sup>, and might also be related to the lifestyle of young adults who present reckless behavior as though they were invulnerable: a lack of condoms and a lack of appropriate guidance, which lead to greater exposure to HIV and to the *Mycobacterium tuberculosis*<sup>(13)</sup>, and as a consequence, generating considerable economic and social losses since patients are affected in the productive stages of their lives<sup>(10)</sup>.

The fact that few individuals younger than 15 years of age – the childhood period – were found to be infected in this study is explained by two factors: the efficiency of the city's STD/AIDS surveillance program on the vertical transmission of HIV and the high coverage and efficacy of the BCG vaccine. A total of 174 pregnant women infected by HIV were reported between 2000 and 2006 and of these, six children were infected (data not shown)\*. According to DATASUS (database from the Single Health System), the rate of BCG coverage was 143.32% in 2006 and the City's Multi-Annual Plan has determined that all hospitals in the city (public and private) apply the vaccine to all newborns up to 2009.

The large number of patients with a low level of education accords with the literature<sup>(9,11)</sup>, evidencing the close relation of comorbidity with factors related to social (level of education) and collective conditions (social deprivation and marginality), which points to TB and AIDS as diseases of a magnitude that exceeds biological barriers and which constitutes a severe social problem<sup>(8)</sup>. The vulnerability of these individuals is based on the fact they do not acknowledge the risk they are exposed to, which in turn leads to diminished self-care in addition to a greater difficulty accessing health services<sup>(11)</sup>.

Additionally, the predominance of co-infection in individuals with a low level of education reflects the country's educational context, which is characterized by functional illiteracy (literacy is considered to be achieved only by people who complete the 4<sup>th</sup> grade of elementary school). Only 27.8% of 15 year-olds or older individuals are in this situation, a consequence of school dropout observed in the educational system<sup>(14)</sup>.

\* Information provided by the Municipal STD/AIDS program in São José do Rio Preto, SP, Brazil, 2007.

The high rates of pulmonary TB followed by extrapulmonary TB reinforce that, despite pulmonary TB being the most common form of the disease in immunosuppressed individuals, as is the case of co-infected patients, there is alarmingly significant immunodeficiency, which could be avoided in a treatment appropriate for HIV with the establishment of an early diagnosis of TB<sup>(9)</sup>. Similar results were found in other studies<sup>(10-12)</sup>.

It was possible to observe that despite the increased rates of cure between 1998 and 2005, cure rates are still too low. In 2006, the rates of cure, abandonment and death will probably be different from those reported because there were patients who were still under treatment during data collection. The TB epidemiological development in immunosuppressed people is different from that observed in immunocompetent because there is a higher chance in the first group to develop resistance to antituberculosis drugs. In addition, infection by the *M. tuberculosis* speeds up the HIV replication process, which can hinder curing and lead to increased mortality among co-infected patients<sup>(9)</sup>.

It is important to highlight that for HIV early diagnosis and treatment contribute to the cure of co-infection. The city's STD/AIDS program has improved access to testing and counseling through the implementation of fast testing at the Testing and Counseling Center since December 2006, the areas covered by the mobile health unit have expanded to include distant neighborhoods (irregular settlements and others) and areas of prevention directed to specific populations in addition to firms and schools. The Program "*Fique Sabendo*" [Let Me Tell You] was also enlarged and all basic health units are currently trained and perform testing and counseling. Consequently, co-infection cases are being diagnosed and treated earlier.

Diminished incidence of TB has been observed in countries where antiretroviral therapy is available. Brazil is virtually the only country with a large number of co-infected individuals that has a policy to provide universal access to HIV therapy and thus with conditions to establish strategies to diminish morbimortality of TB associated with HIV. The main measure used to control the epidemic is early diagnosis and appropriate treatment for bacillary individuals and search for contacts<sup>(11)</sup>.

TB and HIV are diseases historically stigmatized and the negative impact one causes on

the other can have severe consequences such as the abandonment of treatment and high rates of mortality.

The difficulties faced by a co-infected individual adhering to the treatment are related to medication side effects and to the choice of a TB medication that can be combined with antiretroviral and not diminish its effectiveness, alcoholism, drug addiction, the patient's own beliefs, lack of bonds with health professionals and no acceptance of the ST because they often times hide the disease.

ST is a strategy, which in addition to its therapeutic focus, also allows welcoming, bonding and responsibility. It improves the ability of professionals and patients to interact with a view to ensure better quality of care delivery and adherence by patients to the treatment<sup>(15)</sup>.

DOTS was implemented in São José do Rio Preto in 1998. ST was initially performed at home by an employee hired by the AIDS program and only in co-infected patients. The ST coverage in 2001 and 2002 was 65% among co-infected patients and lower than 20% among non-infected. Those who were at a higher risk to abandon the treatment such as addicts, alcoholics, wanderers, those excluded from the community and the co-infected had priority in care delivery. After more personnel was hired, ST was offered to all those who began treatment and coverage to the non-infected reached 59% in 2002, almost the same coverage provided to the co-infected<sup>(4)</sup>.

The diagnosis of co-infection was mainly established at the secondary and tertiary levels. An epidemiological study of reported cases in a school hospital in São José do Rio Preto revealed a failure in the organization of the Primary Health Care: ineffectiveness in the discovery of TB cases at this level of care because it depended on patients' spontaneous search for care at the hospital<sup>(16)</sup>.

## FINAL CONSIDERATIONS

Although the city's quality of life is considered one of the best in the state of São Paulo and presents an efficient epidemiological surveillance in the AIDS control, the TB epidemiological behavior in individuals co-infected with HIV is worrying and reflects the need for improved coordination and cooperation between the city's TB control program and the STD/AIDS program.



Due to the impact of the superposition of the two diseases, strategies and programmatic actions are needed that focus on the TS as one of the main strategies to obtain a TB cure and on improved quality

of diagnosis at the secondary and tertiary levels, since the Primary Health Care has not effectively played its role as the main entrance of patients to the TB control services.

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