# Original Article

# Tuberculosis cases outcome in people with HIV: intervention subsidies
Desfecho dos casos de tuberculose em pessoas com HIV: subsídios para intervenção
Desenlace de los casos de tuberculosis en personas con VIH: subsidio para intervención

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## Abstract
**Objective:** To analyze the aspects associated with tuberculosis cases outcome among people living with HIV.
**Methods:** A cross-sectional study conducted between 2010 and 2014 in a large municipality located in the countryside of São Paulo State, which was considered a priority city for tuberculosis control. Secondary data collected in the TBWEB, SINAN, SISCEL and SICLOM information systems were used. Descriptive statistics and Multinomial Logistic Regression techniques were used, considering outcome (cure, default and death) as a dependent variable, and sociodemographic, clinical and clinical/therapeutic follow-up information as independent.
**Results:** A higher chance of occurrence of unfavorable TB treatment outcome in people living with HIV was observed among those with lower education degree, hospitalization history and without record of the treatment type received.
**Conclusion:** There should be integration between tuberculosis and HIV/AIDS control programs, as well as other services of health care networks and social support network for the provision of actions and services that address social, economic and health needs, aiming at the adequate follow-up of TB-HIV co-infection cases and the achievement of favorable tuberculosis outcomes in people living with HIV.

## Resumo
**Objetivo:** Analisar os aspectos associados ao desfecho dos casos de tuberculose nas pessoas que vivem com HIV.
**Métodos:** Estudo transversal, realizado entre 2010 a 2014 em um município de grande porte localizado no interior do estado de São Paulo, o qual é considerado prioritário para o controle da tuberculose. Utilizou-se dados secundários coletados nos sistemas de informação TBWEB, SINAN, SISCEL e SICLOM. Foram utilizadas técnicas de estatística descritiva e Regressão Logística Multinomial, considerando o desfecho (cura, abandono e óbito) como variável dependente e as informações sociodemográficas, clínicas e de acompanhamento clínico/terapêutico como independentes.
**Resultados:** Observou-se uma maior chance de ocorrência de desfecho desfavorável do tratamento da tuberculose entre as pessoas que viviam com HIV com menor escolaridade, com histórico de internação e sem o registro do tipo de tratamento realizado.
**Conclusão:** Reforça-se a necessidade de integração entre os programas de controle da tuberculose e de HIV/aids, bem como entre esses e os demais serviços das redes de atenção à saúde e rede de apoio social para a oferta de ações e serviços que contemplem as necessidades sociais, econômicas e de saúde, visando o adequado seguimento dos casos de coinfecção TB-HIV e a obtenção de desfechos favoráveis da tuberculose nas pessoas vivendo com HIV.

## Resumen
**Objetivo:** analizar los aspectos asociados al desenlace de los casos de tuberculosis en personas que viven con el VIH.
**Métodos:** estudio transversal, realizado entre 2010 y 2014 en un municipio de gran tamaño localizado en el interior del estado de São Paulo, considerado prioritario para el control de la tuberculosis. Se utilizaron datos secundarios recolectados en los sistemas de información TBWEB, SINAN, SISCEL y SICLOM. Se utilizaron técnicas de estadística descriptiva y regresión logística multinomial, considerando el desenlace (cura, abandono y óbito) como variable dependiente y la información sociodemográfica, clínica y de seguimiento clínico/terapéutico como independiente.
**Resultados:** se observó una mayor posibilidad de desenlace desfavorable del tratamiento de la tuberculosis entre las personas que vivían con el VIH con menos escolaridad, con antecedentes de internación y sin registro del tipo de tratamiento realizado.
**Conclusión:** se refuerza la necesidad de integración entre los programas de control de la tuberculosis y de VIH/sida, así como también entre estos y los demás servicios de las redes de atención en salud y red de apoyo social para la oferta de acciones y servicios que contemplen las necesidades sociales, económicas y de salud, a fin de proporcionar un seguimiento adecuado de los casos de coinfección TB-HIV y obtener desenlaces favorables de la tuberculosis en las personas que viven con el VIH.

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## Introduction

Worldwide, at least one-third of the nearly 35 million people living with Human Immunodeficiency Virus (PLHIV) are infected with *Mycobacterium tuberculosis*.[1] These individuals are 21 to 34 times more likely to develop active tuberculosis (TB).[2] This situation places TB as one of the main comorbidities associated with Human Immunodeficiency Virus (HIV), favoring the emergence of more severe clinical forms of the disease, a greater frequency of hospitalization, a greater number of retreatments and a higher rate of treatment default and death.[3]

It should be noted that cure rates among people with TB-HIV coinfection are usually lower than those found in people with TB. Researchers justify this fact due to the use of multiple medications, adverse effects, lack of family support and unprepared services in dealing with both diseases and their consequences in people's lives.[4] Non-compliance to treatment is considered an important obstacle in the management of both diseases, which is often influenced by organizational aspects such as the patient's lack of access to health actions and services and the fragmentation of care among different teams and institutions.[4]

Literature points to evidence on the association between TB and HIV and the increase in the probability of death of those affected and, consequently, a relative increase in mortality rates.[5-8] In TB-HIV coinfection, there is a mutual modification of the evolution of each infection and, consequently, of the resulting diseases. This is revealed as complications of the clinical picture, differentiated responses to drug therapies and uncertain or unfavorable prognoses.[8-11] The association between low CD4 lymphocytes rates increases the likelihood of developing other opportunistic diseases and atypical TB presentations, which are more frequent in advanced stages of immunodeficiency, and may make diagnosis and delay TB treatment more difficult.[12,13] In addition, individuals with advanced immunosuppression had an increase in unfavorable TB outcomes, as well as retreatment cases.[10,12] Older age, usually associated with other comorbidities, has also been associated with unfavorable TB outcomes among PLHIV, who end up dying before completing TB treatment.[5,8,10] Some studies have also shown that people with extrapulmonary TB-HIV co-infection had an increased risk of death during treatment of TB compared to PLHIV with pulmonary TB and negative smear microscopy.[5,7]

In this sense, TB-HIV becomes an important challenge for health systems, especially in developing countries, which still face difficulties for TB control.

In Brazil, the Ministry of Health has reaffirmed the priority of TB control actions within an integrated and resolute health services network. In this context, one of the major challenges to achieve better results in TB-HIV co-infection control is to ensure the sustainability of coordinated and integrated health actions, allowing new strategies to be added to those already in existence and the proposed goals to be overcome, providing comprehensive and quality care.[14] Addressing these priorities will enable the strengthening of actions aimed at the cure of TB among PLHIV, in addition to reducing the number of TB cases in the general population and in other vulnerable groups.

HIV/AIDS Specialized Care Services (SAE - *Serviços de Atenção Especializada*) are among the protagonists for TB-HIV cases follow-up. However, close interaction of the two diseases demands an articulated work developed by TB and HIV/AIDS programs, as well as those with the other points of the network of health care and support.[15]

In addition to biological and clinical factors, both HIV/AIDS and TB have a strong social, cultural and behavioral determination regarding infection, development and control of both conditions. This represents an important challenge for public policies and specific and equanimous actions implementation in the confrontation and management of the two diseases and their coexistence.

Thus, the present study is justified by the need to produce theoretical and operational knowledge

about aspects associated with TB cases outcome in PLHIV. This study contributes to the reflection, discussion and conception of intervention strategies that subsidize the adequate management of TB in this population in the context of the health care network, as well as the development of a cooperative process between health professionals and users.

In view of the above, this study sought to analyze the aspects associated with the outcome of TB cases in PLHIV.

## Methods

This is a cross-sectional, quantitative study carried out in a municipality in the countryside of São Paulo State and classified by the State TB Control Program as one of the 73 priorities for TB control.

In Brazil, in 2016 69,509 TB cases and 6,501 TB-HIV coinfection cases were reported, accounting for 9.4% of TB cases in the country.[16] In the study municipality, in the same year, 141 new TB cases were reported, with a cure rate of 85.0%, approximately 9% of TB-HIV coinfection, but with a decrease in death rate among people with TB-HIV co-infection from 35% in 2015 to 18% in 2016.[17]

During the study period, the municipality's public health network was organized into five Health Districts, where SAEs and Tuberculosis Control Program (TCP) teams were inserted. SAEs were responsible for clinical-therapeutic follow-up of HIV/AIDS cases diagnosed and followed up in the municipality. TCPs, in turn, were responsible for monitoring cases of sensitive TB. Contrary to the Brazilian recommendation to decentralize the management of TB to Primary Health Care (PHC) in the municipality, both programs provided assistance at a secondary level in a centralized way with specialized teams. A tertiary-level hospital served as a back-up to secondary-level services for assistance of more severe cases either on an outpatient basis or in partial hospitalization (day hospital) or full-time.

For research development, people living with HIV and diagnosed with TB, in other words, TB-HIV co-infection cases with a diagnosis of TB after HIV were considered as the study population. The criteria were: confirmed TB cases reported from 2010 to 2014, residents in the study municipality, aged 18 years or older. Individuals established in the prison system and cases of transfer were excluded.

The data were collected from August to October 2015 with the support of a specific form developed for the present study, based on other scientific studies on TB-HIV co-infection.[4,18,19] In this tool, independent variables were classified into three sessions: I - Sociodemographic information, II - Clinical information, and III - Data on clinical and therapeutic follow-up. They were based on the tool used by Selig et al.[4] in a study carried out in Rio de Janeiro State in order to analyze data on the deaths attributed to TB and in the tool used by Seidl et al.[8] on clinical and therapeutic follow-up. This lists clinical data and information regarding TB treatment compliance and Antiretroviral Therapy (ART) in Rio de Janeiro State and Federal District.[18,19]

As a dependent variable, TB cases outcome classified as cure, default and death was considered. Failure and drug resistance outcomes were not considered in the study because, as a result of the recent implementation of the Tuberculosis Special Treatment Information System (SITETB - *Informação de Tratamentos Especiais da Tuberculose*) in the country by the Ministry of Health during the study period, the special case and resistance information to the antituberculostatic drugs were in the consolidation process between the existing systems and the new system established, which compromised information completeness and quality.

The collection of information related to the sociodemographic, clinical profile and follow-up and cases outcome was carried out from the Tuberculosis Patient Control System of São Paulo State (TB-WEB - *Sistema de Controle de Pacientes com Tuberculose do Estado de São Paulo*), Information System for Notification

Diseases (SINAN - *Sistema de Informação de Agravos de Notificação*), Laboratory Examination Control System (SISCEL - *Sistema de Controle de Exames Laboratoriais*), Logistic Control System for Medicines (SICLOM - *Sistema de Controle Logístico de Medicamentos*), and Hygia-Web Electronic Record (implemented in the health services of the municipality).

In the TB-WEB survey, there were 224 records of TB diagnoses in PLHIV from 2010 to 2014, although in SICLOM it was not possible to obtain information about the ART of 59 of these people, which were excluded from the sample, since would not accurately represent the group regarding the number of treatments performed. Thus, there were a total of 165 PVHIV diagnosed with TB in the analyzed period, and, therefore considered as a study sample according to the inclusion and exclusion criteria of the study.

In the data analysis, to characterize the sociodemographic and clinical profile of subjects and to identify cases outcome, descriptive analysis techniques were used through the Statsoft program, version 9.0 of Statsoft. To verify the association between treatment outcome indicators of TB cases with clinical, sociodemographic and follow-up variables, a Logistic Regression analysis was carried out. Thus, a Multinomial distribution was assumed for the study's dependent variable, treatment outcome: cure, default and death. The cure variable was used as a reference category in order to model factors that increase (or decrease) the probability of occurrence of default and/or death. As independent variables, those that presented a statistically significant association for the chi-square test (p <0.20) were considered. These were inserted together in the model. Variables were individually withdrawn, one by one, respecting the criterion of highest p value, that is, the one with the lowest statistically significant association. After the variable was removed, a new adjustment was made with the remaining variables until the final model was obtained. Adjusted and not adjusted Odds Ratio (OR) were established along with the respective confidence intervals, from the chosen model. The significance level adopted in all analyzes was 5%

(alpha=0.05). For analyzes, the program R version 3.2.3 was used.

The project was approved by the Research Ethics Committee of *Universidade de São Paulo*'s *Escola de Enfermagem de Ribeirão Preto* (CAAE (*Certificado de Apresentação para Apreciação Ética* - Certificate of Presentation for Ethical Consideration): 47141015.0.0000.5393), in compliance with the recommendations of Resolution 466/12 of the Brazilian National Health Board (*Conselho Nacional de Saúde*).

## Results

Of the 165 people living with TB-HIV in the municipality of study from 2010 to 2014, the majority were male (70.3%); with a ratio of 2.37 men for each woman; age group predominance from 30 to 49 years (67.3%); with a mean age of 45 (standard deviation = 10.4) years. The minimum age found was 24 years and the maximum 88 years; white skin predominates (61,2%). It was observed that 41.2% of the interviewees had 4 to 7 years of study and 40.6% had some paid activity (employees, self-employed) (Table 1).

**Table 1.** Frequency distribution of sociodemographic variables of people living with HIV/AIDS and TB in a large municipality in the countryside of São Paulo State

| Variable | | n(%) |
|---|---|---|
| Gender | Female | 49(29.7) |
| | Male | 116(70.3) |
| Age group | 18 to 29 years | 8(4.9) |
| | 30 to 49 years | 111(67.3) |
| | 50 to 69 years | 44(26.7) |
| | 70 and over | 2(1.2) |
| Skin color | White | 101(61.2) |
| | Brown | 38(23.0) |
| | Black | 14(8.5) |
| | No information | 12(7.3) |
| Education level | From 1 to 3 years | 28(17.0) |
| | From 4 to 7 years | 68(41.2) |
| | From 8 to 14 years | 31(18.8) |
| | None | 13(7.9) |
| | No information | 25(15.2) |
| Work situation | Retired | 14(8.5) |
| | Unemployed | 33(20.0) |
| | Employed/Self-employed | 67(40.6) |
| | No information | 51(30.9) |

Regarding clinical aspects related to the existence of comorbidities and habits/addictions,

most cases did not present Diabetes Mellitus diagnosis (98.8%), people did not use drugs (87.3%), nor did they use alcohol (87.9%) and tobacco (97.0%).

Regarding cases follow-up, treatment number performed was considered, being more than one during the considered period. Thus, of the 192 treatment registries, most of the follow-up of the cases was performed in a hospital (71.4%); 85.9% were new cases and Pulmonary classification was predominant (64.6%); 51.0% did not withdraw ART regularly. Regarding the treatment type performed, there was a predominance of DOT (69.3%). Regarding treatment outcome, the majority (58.3%) obtained TB cure (Table 2).

**Table 2.** Frequency distribution of follow-up variables of TB treatment in people living with HIV/AIDS in a large municipality in the countryside of São Paulo State

| Variable | | n(%) |
|---|---|---|
| Service unit of follow-up | Reference Ambulatory | 55(28.7) |
| | Hospital | 137(71.4) |
| Case type | New | 165(85.9) |
| | Relapse | 7(3.7) |
| | Retreatment | 20(10.4) |
| Illness classification | Pulmonary | 124(64.6) |
| | Extrapulmonary | 43(22.4) |
| | Pulmonary + Extrapulmonary | 25(13.0) |
| ART withdrawal | Yes | 60(31.3) |
| | No | 98(51.0) |
| | No information | 34(17.7) |
| Treatment type | Self-administered | 10(5.2) |
| | Directly Observed | 133(69.3) |
| | No information | 49(25.5) |
| Treatment Outcome | Default | 30(15.6) |
| | Cure | 112(58.3) |
| | Death | 50(26.0) |

Concerning the data related to the sociodemographic profile, only "Education level" presented statistical significance for the Chi-Square test. Regarding individuals' clinical profile, no variables were significant for the same test. Regarding cases follow-up, "Service unit", "Treatment type" and "Hospitalization" variables presented statistical significance for Chi-square (Table 3).

In relation to logistic regression analysis, the best model that represented the set was composed of four variables: "Education level", "Service unit", "Treatment type" and "Hospitalization".

**Table 3.** Frequency distribution of socio-demographic, clinical and follow-up profile of people living with AIDS and TB according to case outcomes in a large municipality in the countryside of São Paulo State

| Sociodemographic, clinical and follow-up profile | | Cure n(%) | Default n(%) | Death n(%) | P value* |
|---|---|---|---|---|---|
| Race/Color (n=153) | White | 62(66.0) | 11(64.7) | 28(66.7) | 0.983 |
| | Brown | 23(24.5) | 5(29.4) | 10(23.8) | |
| | Black | 9(9.6) | 1(5.9) | 4(9.5) | |
| Gender (n=165) | Female | 28(26.9) | 5(29.4) | 16(36.4) | 0.517 |
| | Male | 76(73.1) | 12(70.6) | 28(63.6) | |
| Education level (n=127) | From 1 to 3 years | 13(17.3) | 6(40.0) | 9(24.3) | 0.087 |
| | From 4 to 7 years | 38(50.7) | 8(53.3) | 22(59.5) | |
| | From 8 to 14 years | 24(32.0) | 1(6.7) | 6(16.2) | |
| ART withdrawal (n=133) | Yes | 33(37.5) | 2(16.7) | 16(48.5) | 0.146 |
| | No | 55(62.5) | 10(83.3) | 17(51.5) | |
| Service unit (n=165) | Reference Ambulatory | 46(44.2) | 2(11.8) | 2(4.5) | 0.000 |
| | Hospital | 58(55.8) | 15(88.2) | 42(95.5) | |
| Case classification (n=165) | Extrapulmonary | 26(25.0) | 3(17.6) | 7(15.9) | 0.361 |
| | Pulmonary + Extrapulmonary | 12(11.5) | 1(5.9) | 9(20.5) | |
| | Pulmonary | 66(63.5) | 13(76.5) | 28(63.6) | |
| AIDS (n=165) | Yes | 95(91.3) | 16(94.1) | 43(97.7) | 0.360 |
| | No | 9(8.7) | 1(5.9) | 1(2.3) | |
| Diabetes Mellitus (n=165) | Yes | 1(1.0) | - | 1(2.3) | 0.713 |
| | No | 103(99.0) | 17(100.0) | 43(97.7) | |
| Alcoholism (n=165) | Yes | 12(11.5) | 3(17.6) | 5(11.4) | 0.762 |
| | No | 92(88.5) | 14(82.4) | 39(88.6) | |
| Use of drugs (n=165) | Yes | 10(9.6) | 4(23.5) | 7(15.9) | 0.213 |
| | No | 94(90.4) | 10(76.5) | 37(84.1) | |
| Smoking (n=165) | Yes | 2(1.9) | - | 3(6.8) | 0.211 |
| | No | 102(98.1) | 17(100.0) | 41(93.2) | |
| Treatment type (n=121) | Self- administered | 7(8.0) | 2(22.2) | - | 0.086 |
| | Directly Observed | 80(92.0) | 7(77.8) | 25(100.0) | |
| Hospitalization (n=165) | Yes | 60(57.7) | 14(82.4) | 42(95.5) | 0.000 |
| | No | 44(42.3) | 3(17.6) | 2(4.5) | |

* Chi-Square test

However, "Service unit" did not present statistical significance when placed together with the others.

For those who reported that treatment type was absent (no information), chances of dropout were 7.10 times greater than for whom treatment was directly observed, and chances of death was 3.95 times greater when information about treatment type was absent than for those who underwent DOT. For those who needed to be hospitalized, the chance to die was 12.03 times higher than for those who were not hospitalized. For individuals who had an education level between 1 and 3 years, the chance of dropping out was 13.81 times higher than for those who had 8 to 14 years of education (Tables 4 and 5).

**Table 4.** Risk factors analysis of TB cases outcome in people living with HIV/AIDS according to the relationship default/cure in a large municipality of the countryside of São Paulo State

| Risk factors | | OR | 95% CI | P value | adjOR | 95% CI | P value |
|---|---|---|---|---|---|---|---|
| Treatment Type | Self-administered | 3.58 | [2.20; 9.36] | 0.2249 | 5.82 | [0.79; 43.00] | 0.0841 |
| | Directly Observed | 1 | | | 1 | | |
| | No information | 5.21 | [0.57; 10.10] | 0.0774 | 7.10 | [2.08; 24.30] | 0.0018* |
| Hospitalization | Yes | 3.42 | [-1.05; 7.92] | 0.1335 | 2.36 | [0.53; 10.44] | 0.2562 |
| | No | 1 | | | 1 | | |
| Education level | None | 3.00 | [-5.65; 11.65] | 0.4969 | 3.95 | [0.20; 78.4] | 0.3677 |
| | 1 to 3 years | 11.08 | [-3.54; 35.70] | 0.3777 | 13.81 | [1.32; 144.8] | 0.0285* |
| | 4 to 7 years | 5.05 | [-5.76; 15.87] | 0.3599 | 6.11 | [0.66; 56.8] | 0.1115 |
| | 8 to 14 years | 1 | | | 1 | | |

OR – Odds Ratio; 95% CI – 95% Confidence Interval; adjOR – adjusted Odds Ratio; *Presence of statistical significance

**Table 5.** Risk factors analysis of TB cases outcome in people living with HIV/AIDS according to the death/cure relationship in a large municipality in the countryside of São Paulo State

| Risk factors | | OR | (95%) CI | P value | adjOR | (95%) CI | P value |
|---|---|---|---|---|---|---|---|
| Treatment type | Self-administered | 0.21 | [-0.40; 0.82] | 0.4987 | 7.10 | [0.00; 0.00] | 0.9900 |
| | Directly Observed | 1 | | | 1 | | |
| | No information | 3.51 | [0.76; 6.28] | 0.0124* | 3.95 | [1.64; 9.76] | 0.0030* |
| Hospitalization | Yes | 15.40 | [-7.25; 38.05] | 0.1827 | 12.03 | [2.58; 56.14] | 0.0015* |
| | No | 1 | | | 1 | | |
| Education level | None | 2.00 | [-0.99; 4.99] | 0.1904 | 2.14 | [0.35; 12.95] | 0.4058 |
| | 1 to 3 years | 2.77 | [-0.65; 3.19] | 0.1122 | 1.84 | [0.43; 7.80] | 0.4061 |
| | 4 to 7 years | 2.31 | [-0.09; 4.72] | 0.0588 | 1.56 | [0.44; 5.48] | 0.4852 |
| | 8 to 14 years | 1 | | | 1 | | |

OR – Odds Ratio; 95% CI - 95% Confidence Interval; adjOR – adjusted Odds Ratio; * Presence of statistical significance

## Discussion

In this study, more than half of the participants were male, a result that corroborates other studies that showed a greater involvement of TB-HIV coinfection in the male population.[20,21] Other research carried out in the same municipality also affirmed the greater vulnerability of men to TB-HIV co-infection.[14,22-24] According to some authors, the reasons for a greater involvement of TB in males can be explained by their behavioral characteristics, greater exposure to the disease, immunological and genetic factors, less search and use of health services, and greater difficulty adhering to treatment.[23] The literature has also pointed out that women are more concerned about health and seek health services more than men.[25]

The predominant age group was between 30 and 49 years, corresponding to the productive age, which is in agreement with data observed in other studies.[21,24,26] The involvement of these people of economically active age may be related to greater exposure to risk factors and may influence personal and professional life, and may have socioeconomic consequences for the individual, family and society.

TB involvement also shows the marginalization and predominance of cases in the most disadvantaged segments of society,[27] reinforcing the social character linked to the disease.[14] As for skin color, most of individuals were white, which also occurred in other investigations focusing on TB.[23]

Regarding education level, most subjects had 4 to 7 years of study, a result also found in other studies involving TB.[14,28] Education level can be used as an indirect variable of the socioeconomic situation, since it reflects a set of precarious social conditions that increase the vulnerability to infection, both by Mycobacterium tuberculosis and HIV, the less compliance to treatment and, consequently, the maintenance of TB and HIV transmission.[29,30] It is worth highlighting that the study municipality has a Human Development Index (HDI) of 0.800 (2010), which is considered high in relation to the country and São Paulo State and an *Índice Paulista de Responsabilidade Social* (freely translated as Paulista Social Responsibility Index) (2012) of 46 in the Wealth Dimension, and 52 on education level. This makes it possible to classify it in Group 2, being a municipality that, although it presents a high level of wealth, is not

able to guarantee good social indicators, resuming the reflection of the relation between TB and unequal socioeconomic conditions in society.

Regarding cases outcome, it was observed that for individuals with low education level there was a greater chance of treatment default. People with lower education level tend to present difficulties in the perception of risk and need for treatment completeness due to poor access to information and knowledge, which leads to low consumption of health services and actions.[29] Low education level of individuals plays an important role in incorporation of health, preventive and self-care actions in the person's daily life routine, considering that there is a greater difficulty in understanding the given guidelines on disease and treatment. Thus, education is one of the forms of TB coping and control, since there is a relation between low education level and the increased risk of unfavorable outcomes. It is important to emphasize that, faced with the complexity of TB-HIV co-infection, actions should not be restricted to the health sector, aiming also to address social problems in the search for satisfactory results.[14]

With regard to comorbidities presence, most of cases were not diagnosed with Diabetes Mellitus, people did not use illicit drugs, nor did they use alcohol and tobacco. This does not reflect what occurs in the overall Brazilian population, which registered a 6.2% prevalence of Diabetes Mellitus in adult population in 2014, 10.3% of illicit drug use per year, 12.3% of alcohol use (having some problem resulting from this habit) and 1.05% of tobacco use.[19]

However, the data found in the study regarding skin color, education level, habits and presence of Diabetes Mellitus may be lower than the actual value, since this information is self-reported by individuals at notification time.

In the present study, it was identified that most of cases follow-up was performed in a hospital, and it was not possible to identify if the occurrence of hospitalization occurred due to HIV or TB-related complications. It was observed that the chance of cure was greater among those who were not hospitalized, while default of treatment and death was greater in those who needed hospitalization. These results are plausible and corroborate with other studies, since hospitalized individuals more frequently have severe forms of TB and immunosuppression for HIV.[31] Studies show that the complexity of cases may be related to the need for hospitalization and higher chances of death.[14] Hospitalizations for TB reflect the delay in diagnosis of the disease, which causes physical, psychological and social consequences to individuals and families.[24]

The data showed that there was a predominance of new cases and pulmonary TB classification in the period studied, which is in agreement with the literature.[14,21,24,32]

TB-HIV co-infection requires additional therapies, which brings with it several side effects and drug interactions affecting compliance to treatments.[30] In the present study, most PLHIV did not regularly withdraw the ART at the health service by the time of TB diagnosis, which may be related to difficulties in adhering to treatment due to individual limitations, but also to health services. Issues such as the difficulty understanding and accepting the therapeutic regimen, adverse side effects and the lack of complacency of health professionals regarding the individual's physical and psychological complaints may be strongly related to non-compliance to treatment. Guidelines on diseases based on the individual and comprehensive approach configure important elements for the education and empowerment of the person in the perception of signs and symptoms, for example, as well as to improve compliance to treatment and strengthening the link between the professional and the individual.[27]

Regarding the treatment type performed, there was a predominance of DOT, however, there was a greater chance of treatment default and death among the cases whose records referring to treatment type were without information. These record failures occurred exactly in cases of self-administered treatment. Achieving better goals in relation to treatment default and death demands changes capable of overcoming new (and old) challenges that TB control faces in relation to the ways of diagnosing and treating the disease and the peculiarities in the organization of services. In the analysis of the

implementation of DOT in Brazil in its first decade, significant advances were demonstrated in the improvement of epidemiological indicators related to TB in the country, including drop in treatment dropout rate and better access to medicines.[33] A study carried out in Ethiopia highlighted that DOT expansion and the involvement of health teams in HIV prevention and control activities in PLHIV is the key to reducing mortality rates and compliance to ART and TB treatment.[34]

Regarding treatment outcome, the majority were able to cure TB, being a result corroborated by a study carried out in Thailand.[35] Regarding cases outcome and the number of treatments performed, it was observed that there was, in general, a decrease in cure and an increase in treatment default rates. This result resumes the question of non-compliance to treatment, which can be attributed to several aspects: psychosocial, economic, lack of attachment to the team, drug toxicity, side effects and/or alcoholism and drug addiction, also identified in other studies in the country.[36] Regarding compliance to treatment as a *sine qua non* aspect to obtain better results, it is important to point out that drug toxicity and drug interactions contribute substantially to non-compliance to treatment, emphasizing the need for special care in follow-up of individuals.[35] Authors also point out characteristics related to previous TB treatments and TB-HIV co-infection itself as aspects related to TB mortality.[21,37]

Although HIV and TB are infectious and communicable diseases, they can be considered chronic conditions due to the persistence in time and the need for an integrated health system capable of providing permanent and continuous care through appropriate prevention and control strategies. In this sense, the complexity required in care for both infections also requires articulation of several services of the Brazilian Unified Health System (*Sistema Único de Saúde*) in the development of an integrated work that considers a humanized embrace, as well as strengthening the links between professionals and users. In order to achieve the internationally proposed goals for TB control, the Brazilian National Tuberculosis Control Program (PNCT - *Programa*

*Nacional de Controle da Tuberculose*) began to recommend the decentralization of TB control actions to TB services, emphasizing the importance of the work of the family health teams in the implementation of TB surveillance, prevention and control actions.[28] However, other studies warn that the centralization of TB actions in reference services,[38,39] since weaknesses are found in the physical and human resources structure of PHC services,[40] which was observed in the study municipality.

It was verified in the study that some variables did not have significant statistical association with default and death. However, factors such as male gender, economically active age, active employment status, recurrence and re-treatment of TB, pulmonary clinical form of TB, presence of comorbidities, use of drugs and alcohol, and irregular ART withdrawal.[14,15,22,27,29,39] This result prompts reflections on data quality of information systems used in this study and the truthfulness of the self-reported information. In this sense, it is believed that there may be an information bias due to secondary data sources use consulted for the study development.

## Conclusion

The findings suggest a higher chance of occurrence of unfavorable TB outcome in people living with HIV with lower education level, as well as among those with hospitalization history and who had no record as to the type of TB treatment performed. There should be integration between TB and HIV/AIDS control programs, as well as other services of health care networks and social support network for the provision of actions and services that address social, economic and health needs, aiming at the adequate follow-up of TB-HIV co-infection cases and the achievement of favorable TB outcomes in people living with HIV. It is also recommended the interface between the different information systems (SINAN, SISCEL, SICLOM, TB-WEB) to complement the recorded data, as well as the importance of filling and proper use of the systems, making possible the best use of data in planning, follow-up and

assessment of care, and, consequently, in obtaining better epidemiological and care results.

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## Collaborations

Magnabosco GT developed the design and design of the research, data gathering, analyzing and interpreting the data, statistical analysis, writing and critical review of the manuscript. Arakawa T and Monroe AA developed data analysis and interpretation, writing and critical review of the manuscript. Andrade RLP developed the data analysis and interpretation, statistical analysis, writing and critical review of the manuscript. Villa TCS developed the research's creation and design, data analysis and interpretation, writing and critical review of the manuscript.

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