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Characteristics of cases of tuberculosis coinfected with HIV in Minas Gerais State in 2016

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ABSTRACT

This study aimed to characterize the cases of tuberculosis (TB) co-infected with the human immunodeficiency virus (HIV) in Minas Gerais State, Brazil, after the notification sheet modification, and to verify the association between the new variables and the treatment outcome. It is an analytical cross-sectional study with TB/HIV cases notified in the year 2016 to the Brazilian Information System for Notifiable Diseases (*Sistema de Informação de Agravos de Notificação*). Descriptive statistics, chi-square test, and multiple correspondence analysis were performed to verify the association between the outcome, ageand associated diseases. Of the 180 cases, most were male (75.6%) between 30 and 49 years old (63.3%), mixed ethnicity (black and white) (49.4%), 94.4% had the Acquired Immunodeficiency Syndrome (AIDS) and 60.6% had pulmonary TB. The molecular test was not performed at the time of diagnosis in 70.5% of the cases. Homeless people (4.4%) and prisoners (3.9%) featured prominently among the special populations. People between 40 and 49 years old without concurrent diseases were cured in 40.0% of the cases; 18.9% abandoned the treatment due to smoking, drug abuse and mental illness in the age group between 20 and 29 years old. The deaths were associated with the age group between 30 and 39 years old and the occurrence of AIDS. The results have shown that the groups considered vulnerable (drug users, smokers and people with mental illness) abandoned the treatment, the notification upon death from AIDS in adults was late and some treatments were inadequate. The epidemiological surveillance, prevention and assistance strategies towards cases of TB/HIV must be improved in order to achieve the goal of the Brazilian National Plan to end Tuberculosis as a Public Health Problem until 2035 in the state.

KEYWORDS: HIV. Acquired Immunodeficiency Syndrome. Tuberculosis. Factor analysis.

INTRODUCTION

Tuberculosis (TB) is the 9th cause of death around the world. In 2016, 1.3 million deaths from TB were estimated among HIV-negative people and 374,000 deaths were estimated among HIV-positive people. Of the total cases of TB/HIV, 85% were on antiretroviral therapy (ART), and the successful rate of treatment was 78%[1]. The specific goals to eradicate TB until 2030 include 90% reduction in deaths and 80% reduction of TB incidence per year[1]. One of the factors hindering the elimination of TB is the emergence of HIV/Aids epidemics, since HIV-positive individuals are more likely to have the disease throughout their lives[2-4].

HIV has a huge impact on perpetuation of TB, increasing the incidence and mortality rates of the disease[5]. Other conditions and diseases that also interfere with the immunological state enabling the emergence of latent TB, such as alcohol

consumption, illicit drugs, smoking and the presence of chronic diseases, like diabetes[6]. These chronic factors may interfere with the outcomes of TB/HIV coinfection (cure, deaths, and abandonment of treatment)[7]. It is recommended that every patient with TB should be tested for HIV, but, in many regions, the frequency of notified cases of TB that were positive for HIV is low[1,2,8,9].

In Brazil, at the end of 2014, there was a change in TB notification and the compulsory notification became mandatory in the HIV-positive cases. The new notification encompassed the identification of associated factors that may favor the emergence of the disease and cause complications, the identification of populations vulnerable to the infection, the result of the rapid molecular test and the use of ART. Given the introduction of a new TB notification, it was necessary to assess the association of treatment outcomes after the inclusion of these new variables. The purpose of this work is to characterize the cases of TB coinfected with HIV and to verify the combination of the new variables with the closure status of the cases.

MATERIALS AND METHODS

This was an analytical cross-sectional study with reported cases of TB coinfected with HIV in Minas Gerais State, Brazil, in 2016, registered in the Brazilian Information System for Notifiable Diseases (SINAN), provided by the State Office of Health of Minas Gerais (SES/MG – *Secretaria do Estado da Saúde de Minas Gerais*). Minas Gerais State has 853 cities with 21,119,536 inhabitants (in 2017), and is considered the second most populated state in Brazil.

Due to the period of implantation and adaptation to the new TB notification in the state, 2016 was the year chosen because it contains cases after this phase and the cases had a concluded closure status with respect to treatment, considering that TB is treated for at least 6 months.

Variables selected for this study were: cases of TB/HIV, closure status (cure, abandonment, death from TB, death from other causes), age group, sex, ethnicity, education, district, pregnant woman, type of entrance, special populations (prisoners, healthcare practitioners, immigrants, homeless people), type of disease (pulmonary, extra-pulmonary or pulmonary and extra-pulmonary), associated diseases and disorders (AIDS, alcoholism, diabetes, smoking, mental illness, illicit drug abuse), sputum smear microscopy, chest X-ray, ART use and HIV test, as well as the rapid molecular test. Blank data or data specified as a not specified category was considered unknown[10].

The inclusion criteria were new cases notified in 2016 with closure status defined as cured, abandoned, death from

TB and death from other causes. Blank outcomes (without a defined closure status) were excluded.

Data were analyzed with the Statistica software version 10 (StatSoft, USA), through descriptive statistics, and the differences between proportions of the variables and the closure status of the case were verified through the Chi-square test. The variables with significant difference (p≤0.05) were included in the Multiple Correspondence Analysis (MCA), enabling to verify the association between the "additional" variable closure status of the case with the other "active" variables in a factorial plan[11-13].

The project was approved by the Human Research Ethics Committee of the Federal University of Triangulo Mineiro (UFTM – *Universidade Federal do Triângulo Mineiro*), opinion Nº 2.099.176. The Free and Informed Consent was not used as we dealt with secondary data from a database and had no variables identifying the participants.

RESULTS

In 2016, 466 cases of TB/HIV coinfection were notified in Minas Gerais State. Of these, 180 met the inclusion criteria. Of the cases analyzed, 75.6% were male, most of them in the age groups between 30 and 39 years old (36.7%) and between 40 and 49 years old (25.6%), were mixed ethnicity (black and white) (49.4%) or white (27.5%), living in the urban area (97.0%) (Table 1). Cases of pregnant women were not registered in this year and there was a high rate of unknown education (53.9%); 40.0% of the cases were cured, 18.9% abandoned treatment and 33.9% passed away for causes other than TB.

The predominant clinical form was pulmonary (60.6%), followed by extra-pulmonary (28.9%). The predominant diagnostic method was the chest X-ray (73.6%) of the cases. The rapid molecular test and the sensitivity test had not yet been implemented in Minas Gerais State, and were not performed in 70.5% and 57.1% of the cases, respectively (Table 2).

Among the cases, 94.4% had AIDS with an associated disease, and only 57.4% were on ART, 30.7% were alcoholic, 23.5% used illicit drugs and 26.8% were smokers (Table 3). Among the special populations, homeless people (4.5%), prisoners (3.9%) and beneficiaries of government programs (3.9%) featured prominently. Cases in healthcare practitioners were not registered.

The multiple correspondence analysis considered the new cases of TB coinfected with HIV/AIDS where the outcome variable was the closure status regarding the cure, abandonment and deaths from TB and other causes. It was verified that the deaths from TB were associated with the age group between 50 and 59 years old, whereas the deaths

Table 1 - Distribution of the sociodemographic profile of TB/HIV coinfection cases, Minas Gerais State, Brazil, 2016.

Variables	Healing N (%)	Abandonment N (%)	Death TB N (%)	Death other causes N (%)	Total N (%)	p
Gender						0.35
Male	57(31.7)	22(12.2)	11 (6.1)	46 (25.6)	136 (75.6)	
Female	15 (8.3)	12 (6.7)	2 (1.1)	15 (8.3)	44 (24.4)	
Age group						0.01
0 to 9 years old	1 (0.6)	1 (0.6)	0 (0.0)	1 (0.6)	3 (1.7)	
From 10 to 19 years old	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)	
From 20 to 29 years old	11 (6.1)	6 (3.3)	0 (0.0)	11 (6.4)	28 (15.6)	
From 30 to 39 years old	21(11.0)	19(10.6)	5 (2.8)	21 (11,7)	66 (36.7)	
From 40 to 49 years old	23(12.8)	7 (3.9)	2 (1.1)	14 (7.8)	46 (25.6)	
From 50 to 59 years old	13 (7.2)	1 (0.6)	2 (1.1)	11 (6.1)	27 (15.0)	
≥ 60 years old	2 (1.1)	0 (0.0)	4 (2.2)	3 (1.7)	9 (5.0)	
Education						0.11
1st to 4th grades [a]C and I	11 (6.1)	4 (2.2)	3 (1.7)	8 (4.4)	26 (14.4)	
5th to 8th grades [a]C and I	18(10.0)	4 (2.2)	4 (2.2)	8 (4.4)	34 (18.9)	
High school [a]C and I	5 (2.8)	7 (3.9)	0 (0.0)	1 (0.6)	13 (7.2)	
Higher education [a]C and I	4 (2.2)	0 (0.0)	0 (0.0)	2 (1.1)	6 (3.3)	
Illiterate	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)	
Not applicable	1 (0.6)	1 (0.6)	0 (0.0)	1 (0.6)	3 (1.7)	
Ignored	32(17.8)	18(10.0)	6 (3.3)	41 (22.8)	97 (53.9)	
Ethnicity						0.73
Mixed (Black and White)	32(18.0)	22(12.4)	6 (3.4)	28 (15.80)	88 (49.4)	
White	22(12.4)	6 (3.4)	3 (1.7)	18 (10.1)	49 (27.5)	
Black	12 (6.7)	4 (2.3)	4 (2.3)	9 (5.0)	29 (16.3)	
Ignored	6 (2.3)	2 (1.1)	0 (0.0)	5 (2.8)	13 (6.2)	
Asian	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)	
Zone						0.65
Urban	68(39.5)	28(16.3)	11 (6.4)	60 (34.9)	167 (97.0)	
Rural	2 (1.2)	1 (0.6)	1 (0.6)	1 (0.6)	5 (2.9)	

[a]C and I = complete and incomplete. Data source: Notification of Injury Information System from the Minas Gerais State.

from other causes were mainly associated with AIDS, lack of information regarding other associated diseases and age between 30 and 39 years old. People cured were associated with absence of diseases and were in the age group between 40 and 49 years old, meanwhile, the cases of abandonment of treatment were associated with the age group between 20 and 29 years old and with illicit drug use, smoking, and mental illness, as well as diseases associated with TB/HIV coinfection. HIV infection without AIDS was associated with patients under the age of 19 years old (Figure 1).

DISCUSSION

Many factors increase the susceptibility to infection by *Mycobacterium tuberculosis,* such as impairment of the immune system by several diseases and medicines, like HIV and AIDS, type II diabetes, terminal kidney disease, alcoholism, intravenous drug abuse, certain types of cancer, chemotherapy to treat cancer, malnutrition and very young or advanced age. Some other factors include the use of tobacco, which increases the risk of contracting and dying due to TB[14,15.]

The insertion of the variable "diseases and disorders associated" to TB, included in the notification, was correlated with the treatment outcomes, being a favorable indication of its importance to assess and supervise the cases of TB/HIV. The insertion of the variable "special populations" showed low number of cases in which

Table 2 - Distribution of TB/HIV coinfection cases, according to the results of molecular tests and the sensitivity test, smear microscopy after 6 months of treatment, chest X-Ray and clinical form, Minas Gerais State, Brazil, 2016.

Variables	Cure N (%)	Abandonment N (%)	Death TB N (%)	Death other causes N (%)	Total N (%)	p
Rapid Molecular test for TB						**0.09**
Not performed	48 (27.3)	21 (12.0)	9 (5.1)	46 (26.1)	124 (70.45)	
Detectable sensitive to rifampicin	13 (7.4)	6 (3.4)	1 (0.6)	6 (3.4)	26 (14.8)	
Not detectable	8 (4.6)	6 (3.4)	0 (0.0)	6 (3.4)	20 (11.3)	
Detectable rifampicin resistant	1 (0.6)	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.6)	
Inconclusive	0 (0.0)	0 (0.0)	2 (1.1)	3 (1.7)	5 (2.8)	
Sensitivity Test[a]						**0.55**
Not performed	8 (22.9)	5 (14.3)	1 (2.9)	6 (17.2)	20 (57.1)	
In progress	1 (2.9)	0 (0.0)	0 (0.0)	0 (0.0)	1 (2.9)	
Sensitive	8 (22.9)	0 (0.0)	0 (0.0)	2 (5.7)	10 (28.6)	
Resistant to other first line drugs	0 (0.0)	1 (2.9)	0 (0.0)	0 (0.0)	1 (2.9)	
Resistant to isoniazid	1 (2.9)	1 (2.9)	0 (0.0)	1 (2.9)	3 (8.6)	
Smear microscopy after 6 months						**0.47**
Not applicable	27 (35.6)	10 (13.2)	2 (2.6)	20 (26.3)	59 (77.6)	
Not performed	5 (6.6)	1 (1.3)	1 (1.3)	3 (4.0)	10 (13.2)	
Negative	6 (7.9)	0 (0.0)	0 (0.0)	0 (0.0)	6 (7.9)	
Positive	1 (1.3)	0 (0.0)	0 (0.0)	0 (0.0)	1 (1.3)	
Chest X-Ray						**0.21**
Suspect	52 (29.2)	28 (15.7)	9 (5.0)	42 (23,6)	131 (73.6)	
Normal	11 (6.2)	4 (2.2)	0 (0.0)	10 (5.6)	25 (14.0)	
Not performed	6 (3.4)	2 (1.1)	4 (2.2)	5 (2.8)	17 (9.5)	
Other pathology	2 (1.1)	0 (0.0)	0 (0.0)	3 (1.7)	5(2.8)	
Clinical form						**0.32**
Pulmonary	37 (20.6)	24 (13.3)	10 (5.6)	38 (21.1)	109 (60.6)	
Extra-pulmonary	24 (13.3)	7 (93.9)	2 (1.1)	19 (10.6)	52 (28.9)	
Pulmonary and extra-pulmonary	11 (6.1)	3 (1.7)	1 (0.6)	4 (2.2)	19 (10.6)	

[a]Only 35 responded. Data source: Notification of Injury Information System from the Minas Gerais State.

information was provided and they were not associated with the outcome in the MCA[12,13].

An association between treatment abandonment and diseases associated with smoking, illicit drug use and mental illness was observed. The ratio of people abandoning the treatment was 18.9%, higher than the ratio verified in Alagoas State (10.42%) and Piaui State (4.8%)[2].

Tobacco smoking interferes by suppressing the activation of the immune response inherent to bacterial infections. Nicotine may inhibit the signaling of T cells and production of antibodies, in addition to a potential inhibition of apoptosis, a defense mechanism against TB infection[15,16]. Studies indicate that alcohol and drug consumption favor

abandonment of treatment, as well as poverty and low education[7]. The improper alcohol consumption also impairs the immune system, inhibiting cellular functioning and hindering the destruction of invasive microorganisms. It also interferes with the production of signaling molecules that directly help the immune response, such as cytokines, increasing the susceptibility to TB[15]. In a literature review study, Cruz *et al.*[17] reported that the illicit drug abuse favors the dissemination of TB. Crack (cocaine) induces cough, favors intimate contact in closed environments and intermittent people flow. In addition, there was spread of HIV infection among malnourished drug users as malnutrition makes the users even more vulnerable.

Table 3 - Distribution of TB/HIV coinfection cases, according to types of associated aggravations and use of antiretroviral therapy, Minas Gerais State, Brazil, 2016.

Associated aggravations	Cure N (%)	Abandonment N (%)	Death TB N (%)	Death other causes N (%)	Total N (%)	p
Aids						0.01
Yes	67 (37.2)	32 (17.8)	10 (5.6)	61 (33.9)	170 (94.4)	
No	5 (2.8)	1 (0.6)	3 (1.7)	0 (0.0)	9 (5.0)	
Ignored	0 (0.0)	1 (0.6)	0 (0.0)	0 (0.0)	1 (0.6)	
Alcohol						0.15
Yes	17 (9.5)	12 (6.7)	5 (2.8)	21 (11.7)	55 (30.7)	
No	49 (27.3)	19 (10.6)	6 (3.5)	27 (15.1)	101 (56.4)	
Ignored	6 (3.3)	3 (1.7)	2 (1.1)	12 (6.7)	23 (12.8)	
Diabetes						0.07
Yes	1 (0.6)	1 (0.6)	0 (0.0)	1 (0.6)	3 (1.7)	
No	68 (38.0)	31 (17.3)	9 (5.0)	54 (30.2)	162 (90.5)	
Ignored	3 (1.7)	2 (1.1)	4 (2.2)	5 (2.8)	14 (7.8)	
Mental illness						0.04
Yes	0 (0.0)	2 (1.1)	0 (0.0)	1 (0.6)	3 (1.7)	
No	70 (39.1)	30 (16.8)	10 (5.6)	55 (30.8)	165 (92.2)	
Ignored	2 (1.1)	2 (1.1)	3 (1.7)	5 (2.4)	12 (6.1)	
Other						0.46
Yes	3 (2.0)	1 (0.7)	2 (1.3)	5 (3.3)	11 (7.3)	
No	49 (32.7)	23 (15.3)	7 (4.7)	42 (28.0)	121 (80.7)	
Ignored	7 (4.7)	2 (1.3)	3 (2.0)	6 (4.0)	18 (12.0)	
Use of illicit drugs						0.00
Yes	9 (5.0)	18 (10.1)	1 (0.6)	14 (7.8)	42 (23.5)	
No	53 (29.6)	11 (6.1)	9 (5.0)	31 (17.3)	104 (58.1)	
Ignored	10 (5.6)	5 (2.8)	3 (1.7)	15 (8.4)	33 (18.4)	
Tobacco smoking						0.00
Yes	18 (10.1)	13 (7.3)	3 (1.7)	14 (7.8)	48 (26.8)	
No	50 (27.9)	18 (10.1)	4 (2.2)	36 (20.1)	108 (60.3)	
Ignored	4 (2.2)	3 (1.7)	6 (3.3)	10 (5.6)	23 (12.9)	
Use of antiretroviral therapy						0.03
Yes	38 (27.9)	13 (9.6)	6 (4.4)	21 (15.4)	78 (57.4)	
No	9 (6.6)	10 (7.4)	3 (2.2)	21 (15.4)	43 (31.6)	
Ignored	7 (5.1)	2 (1.5)	3 (2.2)	3 (2.2)	15 (11.0)	

Data source: Notification of Injury Information System from the Minas Gerais State.

Another literature review study indicates that the illicit drug abuse favors the low adherence to and the abandonment of treatment. The stereotypes associated with drug abuse poses an obstacle in the appropriate approach to users, and the healthcare practitioners do not have a specific ability to make this approach[18].

Other factors may also contribute to the non-adherence to treatment, such as the use of other medicines, the type of medicine, history of previous treatment of TB and previous abandonment, the lack of training of healthcare practitioners, low doctor-patient interaction, need to hospitalization, operational problems to follow the treatment, fear to be stigmatized and discriminated after the disclosure of the HIV diagnosis, side effects and drugs
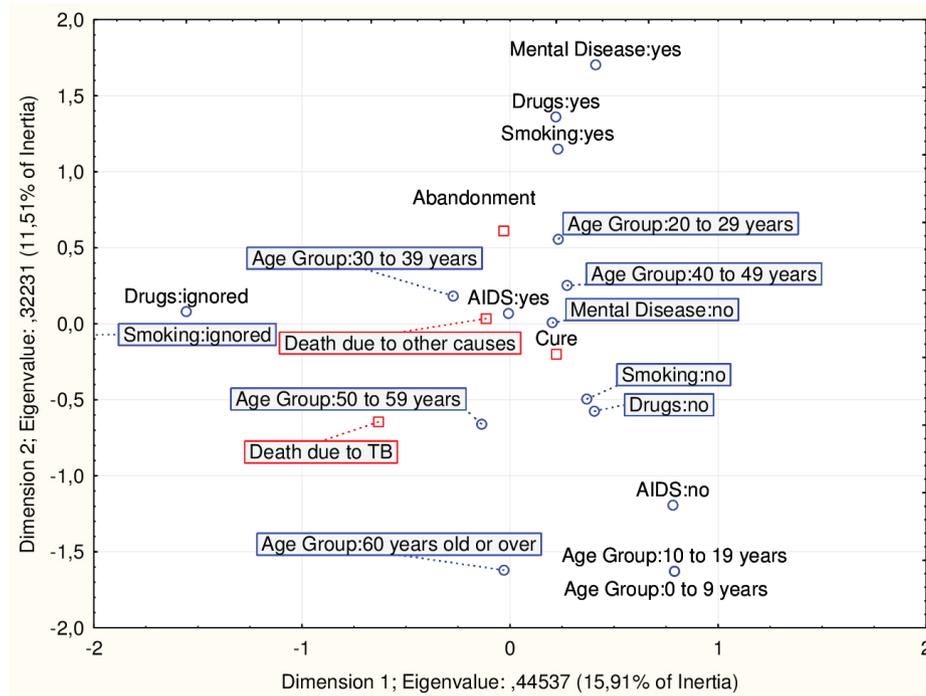
Figure 1 - Factors associated with the closure of the TB/HIV coinfection cases, Minas Gerais State, Brazil, 2016.

toxicity, the patient's disbelief in the treatment efficacy, complexity of treatment, different place to treat TB and HIV/AIDS, difficulty to give the TB diagnosis to patients with AIDS, depression and no social support[18].

It is known that the pulmonary TB is relevant to the public health due to its high infectivity and the easy diagnosis in comparison to other types of TB, helping to interrupt the chain of transmission[2,19]. Pulmonary TB was predominant (60.6%), followed by extrapulmonary TB (28.9%). A similar result of 62.7% was observed in a study carried out in the city of Contagem, Minas Gerais State[20]. In a national-based study, a similar result was also observed, between 37% and 40% for extrapulmonary TB, and 59% and 62% for pulmonary TB[21]. The results are also similar to the ones found in Ethiopia, where 51.8% of the patients had pulmonary TB and 44% had extrapulmonary TB[22].

In 2014, the Rapid Molecular Test Network (RTR-TB – *Rede de Teste Rápido Molecular*) was implemented in the public health system in order to diagnose TB and there was progress during the first years of RTR-TB use. The test is important to reduce the spread of the disease, since it detects the presence or absence of the bacillus, quickly shows the resistance to rifampicin, facilitating the work process of healthcare teams and the epidemiological surveillance, speeding up the beginning of treatment, whether TB is resistant or not to the drugs[23]. In Minas Gerais State, many individuals were not submitted to the molecular test (70.45%) and to the drug-sensitivity test (57.1%), being an indication that RTR-TB has not shown epidemiological

impacts in Minas Gerais State so far according to the results,probably due to the fact that Minas Gerais was the 15th state to perform the test and one of the states with higher rates of underused equipments[23-25].

Most cases of TB/HIV were in male adults (75.6%), with acquired immunodeficiency syndrome (AIDS) and pulmonary TB. Belo *et al.*[26] found a significant difference between sex and delay in the diagnosis of the disease, being higher in women than in men (p<0.05), which can be explained by the differences in behavior between genders, being reported that men had early and rapid access to quality health services. The high proportion of cases in males with working age between 30 and 49 years old (63.3%), being most of mixed ethnicity (black and white) (49.4%), was also observed in other researches using SINAN in different states of Brazil[2,21]. Magno *et al.*[21] verified predominance in males (>71%), in the age group between 25 and 40 years old (>53%), in mixed ethnicity (black and white) patients (>83%). A study carried out in Piaui State between 2007 and 2016 with cases of TB/HIV coinfection has also observed predominance in males (75.4%), in the age group between 20 and 49 years old (79.5%) and in mixed ethnicity (black and white) patients (73.8%)[2].

Considering that almost every patient had AIDS and that a little more than half of them used ART (57.4%), which is important for the the immune system function, the low percentage of cure (40%) and the significant number of patients abandoning treatment may be related to the low adherence to ART and to diseases and disorders associated

with TB. All cases were of TB coinfected with HIV and, therefore, they should be on medication recommended to all HIV-positive patients regardless of their CD4 count and the virus count, according to a 2013 recommendation[24], and that the treatment of the TB/HIV coinfection follows the same principles that the one in non-HIV infected individuals[27]. ART reduces the risk of TB among people living with HIV/AIDS in 67% and, if expanded, may contribute to reduce TB rates at the population level[28-30].

TB/HIV coinfection may favor resistance to drugs, attributed to the immunological state and potential abandonments prior to treatment. The proportion of TB multi-resistant to other first-class drugs was 2.9%, a rate higher than the one verified in a study by Gaspar *et at*.[31] who reported it in 0.17% in patients coinfected with TB/HIV and in a study by Silva *et al*.[32] in 0.14%, in TB cases without HIV coinfection.

The TB cure rate of 40.0% was lower than the rate verified by Oliveira *et al*.[2] in Piaui State (60.8%), by Silva *et al*.[32] in Alagoas State (57.03%), and in Brazil between 2002-2012 (50.74%)[31]. The low cure rate must be analyzed with special attention by health authorities, as cure benefits not only the patient, but the entire social scope in which the patient is inserted, breaking the chain of transmission[32], particularly in smear-positive pulmonary cases, the majority group in this study (60.6%).

It was verified that the cure was associated with individuals between 40 and 49 years old, without diseases related to TB, probably because this group is composed by people who are more careful with their health since they do not use drugs, tobacco, and they do not drink alcoholic beverages in an abusive way and are possibly favored as they do not have diabetes, mental illness and other diseases concurrent to HIV/AIDS. A study carried out by Gaspar *et al*.[31] has shown that patients with TB/HIV have 48% less chance to be cured, 50% are more likely to stop the treatment and 94% are more likely to die from TB with respect to those without coinfection.

The deaths from other causes, excepting for TB, were associated with the ages between 30 and 39 years old, having AIDS and other diseases associated with TB registered as unknown, probably because the notification was made at the time of the death, explaining why the practitioner who made the notification failed to collect the information from the patient itself or from their family members. Deaths from TB totaled 7.2% of the notifications and deaths from other causes totaled 33.9%. A study carried out in Amazonas State with cases of TB/HIV reported that deaths took place in the age group between 25 and 39 years old and were more likely to be notified, increasing the chance of TB notification by 40%[21]. In Piaui State, the death rate was lower than the one

in this study (3.5%), and the same happened in a research carried out with national data (3.63%) for patients with TB/HIV[31] coinfection, and deaths from other causes have also shown a lower rate (3.8%)[2].

Prisoners totaled 3.9% of the cases. A study carried out in Alagoas State reported that people confined in overcrowded and unhealthy environments with inadequate ventilation had a higher exposure to risk factors related to the infection by *Mycobacterium tuberculosis,* but they found a lower proportion of cases (2.84%)[32].

On the other hand, homeless people in this study were 4.4%, a fact that concerns the sanitary authorities, since they perpetuate the disease, particularly with respect to the optimization of treatment strategies in this target audience. Purely biomedical approaches have a limited effect on the cure, since they do not consider important factors predisposing to the disease[33,34]. Interventions should go beyond approaches to individual lifestyle factors, considering health inequalities that lead to exclusion, malnutrition, poor access to diagnostic services and health care, in addition to improper use of legal substances such as alcohol and tobacco, and illicit substances, like crack (cocaine). A study evaluated the experience of healthcare practitioners in the care of homeless people with TB, concluding that a complete human resource staff is not enough to provide health care for this population, as the adherence to treatment is complex. Factors such as intersectionality and availability of resources and government incentives are important, such as public transportation vouchers, basic food basket and the directly observed treatment[35].

There was no registration of cases in healthcare practitioners. Despite being a risk group for this infection due to exposure to patients during the workday and shortage of administrative, environmental control, and individual protection measures[36]. Even in the absence of cases, it is necessary to be alert to the early diagnosis in this target audience, since the study carried out in the city of Vitoria, Espirito Santo State, with primary care health practitioners found a high prevalence of latent infection by *Mycobacterium tuberculosis* in this population, ranging from 39.4% to 54.1%, with a higher proportion among the community health workers[37].

As one of the main challenges of the Brazilian National Plan for the End of Tuberculosis as a Public Health Problem, it is important to improve the diagnostic network for TB and resistant TB; expand and maintain the RTR-TB; implement surveillance of TB deaths, latent infection and resistant TB; improve information systems for monitoring and decision-making purposes; strengthen the disease control actions in the most vulnerable populations; approach the

disease in the perspective of social determinants; expand the decentralization and qualification of coping actions in basic care and improve the treatment outcome indicators[24].

The limitations of the study include the use of secondary data sources with predetermined variables, with possible lack of information and underreporting of cases. However, since TB is a disease whose treatment is offered only in the public health network, the underreporting of this disease is likely to be reduced. A recent study in Amazonas State has indicated an underreporting rate of HIV cases of 7.7%, while the national average was 6.9%[21].

People with communicable chronic diseases such as TB and HIV/AIDS are more likely to develop chronic non-communicable diseases, and if they coexist with TB/HIV, they increase the risk or the effect of the other. Generally, resource-constrained healthcare services are unprepared to deal with the dual burden of the disease, and the care and specific approaches to the disease are not the most efficient response to treat the coinfection. Traditional approaches need to be reevaluated, with greater emphasis on the multidisciplinary approach with the assistance of integrated care management[33,38-40].

CONCLUSION

The results indicate that abandonment of treatment should be reduced in vulnerable groups, late notification of TB only at death should be avoided, the proportion of treatment effectiveness should be increased, the molecular and sensitivity tests and adherence to the use of ART should be expanded. The inclusion of diseases associated with TB in the new notification form was correlated with treatment outcome, being an indicative of its relevance for the follow-up of new cases. Strategies for controlling the double burden of diseases (TB/HIV) should be reissued in the state in order to reach the goals of the Brazilian National Plan for the End of Tuberculosis as a Public Health Problem until 2035. There are points of weakness in the epidemiological surveillance in Minas Gerais State to comply with the protocol recommended for cases of TB with HIV coinfection.

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CONFLICT OF INTERESTS

There are no conflict of interests.

AUTHORS' CONTRIBUTIONS

Sybelle de Souza Castro: conception, design, analysis and interpretation of data, article writing and critical review; Lúcia Marina Scatena: analysis and interpretation of data, article writing and critical review; Alfredo Miranzi: analysis and interpretation of data, article writing; Almir Miranzi Neto: analysis and interpretation of data, article writing; Altacílio Aparecido Nunes: conception and design, article writing and critical review. All authors approved the final version of the manuscript.

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