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Epidemiological profile of adult patients with tuberculosis and AIDS in the state of Espírito Santo, Brazil: Cross-referencing tuberculosis and AIDS databases*

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Abstract

Objective—To evaluate the epidemiological profile of patients with tuberculosis (TB) only and that of patients with TB/AIDS in the state of Espírito Santo, Brazil, between 2000 and 2006.

Methods—For the patients of interest, we collected demographic and clinical data from the Epidemiological Surveillance Center (TB database), Brazilian Case Registry Database, and Brazilian National Mortality Database, as well as the Brazilian National CD4+/CD8+ T Lymphocyte Count and Viral Load Network Laboratory Test Control System and the Logistic Medication Monitoring System (HIV/AIDS databases). All of the compiled data were cross-referenced.

Results—During the study period, we identified 9,543 TB patients > 15 years of age, 437 of whom (4.6%) had AIDS. The median age did not differ between TB/AIDS and TB-only patients (35 years vs. 38 years). Of the 437 TB/AIDS patients, 298 (68.2%) were male, and 156 (35.8%) were in the 30–39 age bracket. In terms of TB treatment outcome, 79.0% were cured, 9.7% were referred to other facilities, 6.0% died, 5.2% abandoned treatment, and 0.2% developed multidrug-resistant TB. Death was 4.75 times more common in patients with TB/AIDS than in those with TB only. Pulmonary TB accounted for 82.4% of the cases. The combination of pulmonary and extrapulmonary TB was 8.2 times more common in the TB/AIDS patients than in the TB-only patients (95% CI: 6.2–10.8).

Conclusions—Our results emphasize the significance of AIDS among TB patients in Brazil, as well as the importance of evaluating secondary data in order to improve their quality and develop public health interventions.

*Study carried out at the Federal University of Espírito Santo, Vitória, Brazil.

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Keywords

Tuberculosis; Acquired immunodeficiency syndrome; Brazil

Introduction

Tuberculosis (TB) is thought to be an ancient disease that has reemerged as a significant cause of morbidity and mortality in various countries. According to the World Health Organization, Brazil ranks 14th among the 22 high-burden countries that are responsible for 80% of the total number of cases of TB worldwide.[1] In Brazil, there are an estimated 120,000 new TB cases per year.[1] In 2007, the national mean TB incidence rate was 54.7/100,000 population, which is similar to that reported for the state of Espírito Santo (56.0/100,000 population).[2]

Since the 1980s, HIV has been one of the main factors contributing to the resurgence of TB in developed and developing countries alike. [3] The virus has altered the balance between human beings and Koch's bacillus, as well as having a noticeable impact on the epidemiology, natural history, and clinical evolution of TB.[4,5] Co-infection with TB/HIV results in higher mortality rates than does HIV infection alone. [6] Resistance to antituberculosis drugs, as well as an increased risk of transmission, has also emerged as a problem due to noncompliance with the TB treatment.[3] It has been shown that HIV-infected patients are at greater risk of reactivation of latent TB infection,[7] due to a deficient immunological response,[8] and that AIDS is a strong risk factor for death in TB patients.[7] In co-infected patients, mortality is commonly related to delayed diagnosis, because some HIV-infected individuals postpone seeking health care in order to avoid receiving an AIDS diagnosis.[9] Therefore, the Brazilian National Tuberculosis Control Plan recommends that all patients diagnosed with TB be submitted to serological investigation for HIV.[3]

In 1992, the number of AIDS cases in Brazil was the second highest in the Americas, and, ultimately, HIV/AIDS contributed to the resurgence of high TB incidence rates in the 1990s.[10] The incidence of AIDS increased in the mid 1990s, with a peak of 19/100,000 population in 1998. By December of 2007, 506,499 cases of AIDS had been reported in Brazil. Approximately 80% of the AIDS patients reside in the Southeast and South of Brazil. The Southeast, where the state of Espírito Santo is located, has been the most affected region since the beginning of the epidemic. However, despite the high incidence rate, the number of AIDS cases in the region has remained stable, at approximately 17,000 cases per year.[2]

It has been estimated that, in the year 2000, 11% of all adults with TB also had HIV co-infection or AIDS.[11] The World Health Organization estimated that, in 2009, 14% of the 72% of the TB patients tested for HIV were found to be HIV-positive.[1] In mortality surveillance systems, co-infection rates have been reported to be as high as 51% in Rio de Janeiro, Brazil.[6] The greatest impact of the rise in the incidence of TB has been on individuals between 25 and 44 years of age, since this is the age group most affected by HIV.[12]

There is a lack of communication between AIDS and TB programs. Co-infected patients are often not identified until their death, highlighting a failure of the health system to detect, diagnose, and treat these related diseases. [10] The objective of this study was to compile the data from existing TB and AIDS surveillance databases in order to evaluate rates and profiles of adult patients with TB/AIDS, by gender, age, immune status, and mortality.

Methods

A descriptive study was designed in order to identify the profile of TB patients residing in the state of Espírito Santo by accessing surveillance data from the Epidemiological Surveillance Center database for the period of January of 2000 to December of 2006. This database has complete and comprehensive data regarding the target population. In addition, data on patients with HIV/AIDS, residing in the same state and during the same study period, were compiled from the following databases: Brazilian Case Registry Database, Brazilian National Mortality Database; Brazilian National CD4+/CD8+ T Lymphocyte Count and Viral Load Network Laboratory Test Control System; and Logistic Medication Monitoring System.

The compiled data were cross-referenced with the RecLink software, version 3,[13] embedded within the STATA program (Stata Corp., College Station, TX, USA), and we used the Statistical Package for the Social Sciences, version 11.5 (SPSS Inc., Chicago, IL, USA) to support the identification of the cases of TB/AIDS.

Variables from both types of databases (TB and HIV/AIDS) were combined in such a way as to avoid problems during the cross-referencing process. During the study period, there were 9,958 TB cases and 3,795 AIDS cases in the state of Espírito Santo. All of those cases were cross-referenced. We compared the data using the name of the patient, the name of the mother of the patient, and the date of birth of the patient, with a mathematical probability of 92% for names and of 90% for dates. Block variables with the gender, first name, and last name of the patient were created in order to optimize the procedure and to identify the patients who were present in both types of databases. Through this procedure, we identified 437 records. The data were checked individually to confirm the concomitant TB/AIDS status, to rule out duplicity, and to fill in missing information. Data from TB patients < 15 years old were excluded, which resulted in 9,543 cases. Cases of TB in subjects reported to have AIDS at the time of the diagnosis of TB were classified as TB/AIDS cases. Patients with TB and without AIDS according to the database were classified as patients with TB only.

Standard descriptive analyses were performed, including frequency distribution for categorical data and calculation of medians and interquartile ranges (IQRs) for continuous variables. Trends in TB/AIDS cases were analyzed regarding selected demographic and clinical characteristics. The prevalence of TB/AIDS was calculated for each risk factor of interest with the respective OR and 95% CI, estimating the strength of association. Independent risk factors for AIDS were assessed using stepwise logistic regression: variables with $p < 0.05$ in the bivariate analysis were considered statistically significant and were tested in the model, and additional variables were tested in the multivariate model based on previously identified associations (for instance, age and gender). This study was approved by the Review Board of the Federal University of Espírito Santo.

Results

A total of 9,958 TB cases were reported to the Epidemiological Surveillance Center during the study period, 9,543 of which in patients over 15 years of age, who were included in the present study. The median age of those patients was 38 years (IQR, 27–50 years). Patients with TB/AIDS accounted for 437 (4.6%; 95% CI: 2.7–6.5%). Therefore, there were 9,106 cases of TB only and 437 cases of TB/AIDS, Of those 437 cases, 26 (6.0%) were not reported in the TB database.

Demographic variables of the TB cases and of the TB/AIDS cases are shown in Table 1. The TB/AIDS comorbidity rates remained relatively stable from 2000 to 2006, with no

statistically significant differences. The median age of the patients with TB/AIDS was 35 years (IQR, 30–45 years), whereas that of those with TB only was 39 years (IQR, 27–50 years). The patients with TB/AIDS were more likely to be living in rural areas and to have a lower level of education than were those with TB only.

Table 2 shows the clinical variables of the TB cases and of the TB/AIDS cases. The patients with TB only were more commonly diagnosed with pulmonary TB, had higher cure rates, presented with evidence of TB on chest X-rays more commonly, and had stronger reactions to the tuberculin skin test. Of the patients with TB/AIDS, 240 (54.9%) presented with the pulmonary clinical form of TB, 118 (27.0%) had the extrapulmonary form, and 79 (18.1%) had both presentations, whereas 83.5% of the patients with TB only had the pulmonary form. Among the extrapulmonary clinical forms, peripheral lymph node TB was the most common presentation (19.9%), followed by meningeal TB and pleural TB (6.4% and 6.2%, respectively).

In terms of the treatment outcome in the TB/AIDS patients, 48.5% were cured of TB, 8.9% abandoned the treatment, 8.2% were referred to other facilities, 0.5% developed multidrug-resistant TB, and 28.8% died (Table 1). Table 3 shows the multivariate analysis of the factors associated with AIDS among the patients with TB in our sample.

Discussion

The prevalence of TB/AIDS in the state of Espírito Santo, Brazil, was 4.6% during the study period. In 2000, one group of authors estimated a prevalence of 3.3% (3,762 HIV-positive cases) among the TB cases reported in Brazil.[5] In 2007, the incidence of TB in the state of Espírito Santo was 56 cases/100,000 population, similar to the national average.[2] In terms of age, individuals in the 20–39 age bracket, which represents the most economically active part of the population, were most commonly infected with the TB bacillus.[14,15]

The prevalence of TB/AIDS in the population studied is similar to that reported in other studies conducted in Brazil and other regions.[16–18] It has been reported that TB/HIV co-infection is significantly associated with being in the 30–39 age bracket, with having a low level of education, with living in an urban area, and with having extrapulmonary TB. After the onset of AIDS, extrapulmonary forms of TB are known to have become more common in TB patients.[19,20]

In Brazil, the AIDS epidemic has been growing among younger individuals and in females. However, as observed in other studies,[21,22] the population presenting TB/AIDS in our study included predominately working-age males.

In the present study, a low level of education was an important factor influencing the number of TB/AIDS cases. Since the beginning of the new century, the AIDS epidemic in Brazil has reached new population groups and cities where it had not been previously reported, affecting the less privileged social segments in the country.[23] Such populations have historically been plagued with high TB rates; therefore, the introduction of the AIDS epidemic has worsened the TB problem. Using education as a proxy measure for poverty, we can suggest that TB/AIDS patients are poorer than are those with AIDS only. Impoverished areas arise out of a sociopolitical context based on differential access to political power and resources. In this context, poverty is associated with little or no political power, as well as extremely limited resources. Consequently, poverty dramatically increases the risk for HIV/AIDS and TB by providing greater exposure and vulnerability to the infections.[24] Once infected, individuals who are members of poorer populations have a diminished capacity to cope with the consequences of the disease because of impaired access to preventive, diagnostic, and curative services.[24]

As reported in other studies,[14] the negative sputum smear test results in patients with pulmonary TB can be attributed to immunodeficiency. In our study, the prevalence of negative sputum smear tests was higher among individuals with TB/AIDS than among those with TB only. This trend should indicate a need for another diagnostic method, such as culture, for all HIV-infected individuals.[25]

The treatment of co-infected patients is difficult. Patients with TB require long-term treatment with various medications. For patients with TB/AIDS, compliance with the treatment regimen is difficult due to the extra burden of needing to use concomitant medications to treat the additional infection. This increased difficulty in treatment compliance contributes to the development of multidrug-resistant TB strains.

In the present study, as in other studies, the TB/AIDS patients had a higher mortality rate and a lower cure rate. This supports the notion that TB is the leading cause of death among TB/AIDS patients.[14,16] Therefore, measures such as facilitating and encouraging early diagnosis, should be taken in order to increase the cure rates.

Efforts to prevent and control TB/HIV co-infection in impoverished populations with limited access to health care services are not likely to succeed without an integrated approach that seeks to reduce the underlying social inequities for which Brazil has been known. One challenge in addressing AIDS and TB in informal settlements is how to strategically utilize potential opportunities to create long-term improvements in urban areas with impoverished conditions so that they are better equipped to reduce their vulnerability to this co-infection, as well as to provide the full-range of health care services in order to prevent, treat, and mitigate these diseases.

It is important to use secondary data in order to assess health problems and implement cost-effective health strategies. However, the data must be analyzed and interpreted appropriately,[16] and there is an underlying assumption that data collection is relatively complete. In our study, we identified 26 cases of TB/AIDS (6.0%) that were not reported in the TB database. Underreporting patients and data can have a dramatic impact on programs and interventions that utilize such estimates.

The most important limitation of this study was the definition of TB/AIDS, which included patients diagnosed with TB prior to, concomitant with, or after the diagnosis of AIDS. Another limitation was the fact that we had access only to data related to patients diagnosed with AIDS and not to those related to HIV-positive patients. In Brazil, TB is not considered an AIDS-defining illness. Therefore, it is difficult to determine the exact moment of the HIV infection, as well as that of the onset of AIDS and of active TB, which leads to the decision to combine these groups of patients.

The greatest strength of the present study was the sample size, the range of the data, and the cross-referencing of AIDS and TB data. In addition, this study emphasizes the significance of AIDS among TB patients in Brazil, as well as the importance of evaluating secondary data in order to improve the quality of the data set and to develop public health interventions. Surveillance for TB among HIV-infected patients contributes to the development of more coordinated and collaborative approaches for controlling the TB and AIDS epidemics. We conclude that the combination of various surveillance components and data sources improves the knowledge of the AIDS and TB epidemics within groups at increased risk for both infections.

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Table 1

Demographic data of adult patients with tuberculosis only and of those with tuberculosis/AIDS in the state of Espírito Santo, Brazil, 2000–2006.

Variable	TB only (n = 9,106) n (%)	TB/HIV (n = 437) n (%)	OR (95% CI)
Age bracket, years			
15–19	571 (6.3)	2 (0.5)	Reference
20–29	2,232 (24.5)	99 (22.7)	9.0 (2.9–28.5)
30–39	2,051 (22.5)	162 (37.1)	15.0 (4.8–47.2)
40–49	1,874 (20.6)	117 (26.8)	12.1 (3.8–38.2)
≥ 50	2,378 (26.1)	57 (13.0)	0.2 (0.1–0.6)
Place of residence			
Urban	8,133 (89.3)	411 (94.1)	2.3 (1.4–3.5)
Rural	867 (9.5)	14 (3.2)	Reference
No data	106 (1.2)	12 (2.7)	-
Gender			
Male	5,977 (65.6)	300 (68.6)	1.1 (0.9–1.4)
Female	3,129 (34.4)	137 (31.4)	Reference
Level of education, years			
< 1	1,386 (15.2)	38 (8.7)	1.0 (0.51–1.91)
1–3	1,405 (15.4)	143 (32.7)	2.7 (1.48–4.91)
4–7	3,112 (34.2)	164 (37.5)	1.4 (0.77–2.53)
8–11	1,199 (13.2)	56 (12.8)	1.2 (0.65–2.33)
≥ 12	317 (3.5)	12 (2.7)	Reference
No data	1,575 (18.6)	24 (5.5)	
Reported cases/year, n			
2000	1,350 (14.8)	66 (15.1)	Reference
2001	1,365 (15.0)	74 (16.9)	1.1 (0.8–1.6)
2002	1,346 (14.8)	56 (12.8)	0.8 (0.6–1.2)
2003	1,269 (13.9)	69 (15.8)	1.1 (0.8–1.6)
2004	1,287 (14.1)	71 (16.2)	1.1 (0.8–1.6)
2005	1,274 (14.0)	64 (14.6)	1.0 (0.7–1.5)
2006	1,215 (13.3)	37 (8.5)	1.2 (0.9–1.7)

TB: tuberculosis.

Table 2

Clinical data of adult patients with tuberculosis only and of those with tuberculosis/AIDS in the state of Espírito Santo, Brazil, 2000–2006.

Variable	TB only (n = 9,106) n (%)	TB/HIV (n = 437) n (%)	OR (95% CI)
Clinical presentation of TB			
Pulmonary	7,605 (83.5)	240 (54.9)	Reference
Extrapulmonary	1,202 (13.2)	118 (27.0)	3.0 (2.4–3.8)
Both	299 (3.3)	79 (18.1)	8.2 (6.2–10.8)
Outcome			
Cure	7,054 (77.5)	212 (48.5)	Reference
Noncompliance	463 (5.1)	39 (8.9)	2.6 (1.9–3.7)
Death	535 (5.9)	126 (28.8)	7.2 (5.7–9.0)
Referral	869 (9.5)	36 (8.2)	1.4 (1.0–2.0)
Multidrug-resistant TB	21 (0.2)	2 (0.5)	2.8 (0.7–12.1)
No data	164 (1.8)	22 (5.0)	-
Chest X-ray			
Indicative of TB	7,653 (84.0)	317 (72.5)	Reference
Normal	382 (4.2)	62 (14.2)	3.8 (2.9–5.1)
Other pathologies	138 (1.5)	15 (3.4)	2.0 (1.1–3.7)
Not performed	933 (10.2)	43 (9.8)	1.1 (0.8–1.6)
Sputum smear testing			
Positive	5,894 (64.7)	163 (37.3)	Reference
Negative	1,921 (21.1)	146 (33.4)	2.5 (2.0–3.2)
Not performed	1,291 (14.2)	128 (29.3)	3.4 (2.7–4.3)
DOTS			
Yes	2,711 (29.8)	85 (19.5)	Reference
No	3,815 (41.9)	249 (57.0)	1.8 (1.4–2.3)
No data	2,580 (28.3)	103 (23.6)	-
Tuberculin skin test			
No Reaction	422 (4.6)	78 (17.8)	Reference
Weak Reaction	270 (3.0)	5 (1.1)	0.1 (0.04–0.26)
Strong Reaction	1,652 (18.1)	48 (11.0)	0.2 (0.1–0.3)
Not performed	6,755 (74.2)	306 (70.0)	0.3 (0.2–0.3)
No data	7 (0.1)	0 (0.0)	-

TB: tuberculosis; and DOTS: directly observed treatment, short-course.

Table 3

Multivariate analysis of factors associated with AIDS among tuberculosis patients in the state of Espírito Santo, Brazil, 2000–2006.

Factors	Adjusted OR	95% CI	p
Age, years (39–49 vs. other age brackets)	1.22	1.12–1.32	0.021
Level of education, years (1–3 years vs. > 3 years)	1.32	1.23–1.41	0.001
Urban areas vs. rural areas	4.91	1.40–17.25	0.013
Extrapulmonary form vs. pulmonary form	3.19	2.51–4.07	0.001
Outcome (survival vs. death)	0.21	0.05–0.94	0.042