Original Article

Profile of patients with tuberculosis: evaluation of the Brazilian national tuberculosis control program in Bagé, Brazil*

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Abstract

Objective: To present epidemiological data on patients diagnosed with tuberculosis, as well as on associated factors, and to determine the efficacy of the National Tuberculosis Control Program in Bagé, Brazil. **Methods:** A retrospective study was carried out at the Pablo Barcellos Center, analyzing cases of tuberculosis reported from January 2001 to December 2004. Data were collected through the review of clinical charts and from the National Case Registry database. **Results:** During this period, of the 4468 sputum smear microscopies performed, 131 were positive, with higher prevalence among males aged 26 to 35 years old. Prevalence was lower among those aged 65 and above. Over 50% of the patients were Caucasian, had only 1 to 3 years of schooling and worked in low-income jobs (mean salary, 265 Brazilian reals/month). There was no significant difference between smokers and former smokers/nonsmokers, and only 1 of the 131 cases was HIV positive. **Conclusion:** The number of sputum smear microscopies performed in Bagé increased in the past four years. In 2003 and 2004, it exceeded the goal of the National Tuberculosis Control Program. However, the number of new cases decreased, demonstrating the efficacy of the active search for tuberculosis cases in the city.

Keywords: Tuberculosis; Epidemiology; Communicable disease control.

* Study carried out at the Paulo Barcellos Health Center, Bagé (RS) Brazil.

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Introduction

Tuberculosis (TB) is a disease of universal distribution and is transmitted almost exclusively through aerosolization of respiratory secretion.[1] It is calculated that, in a given community, a single source of infection can infect an average of 10 to 15 people per year, through sneezing, speaking, or coughing.[2]

In the late 1930s and early 1940s, there was a decrease in TB-related morbidity and mortality, intimately related to the discovery of penicillin and, subsequently, to the invention of the vaccine.[3] In the 1980s, TB increased significantly worldwide, even in developed countries.[4] This coincided with the indiscriminate use of antibiotics and the HIV pandemic, as well as with increased poverty, consumption of alcohol, and smoking.[3,5]

In 2003, the World Health Organization estimated a total of 40 million HIV-positive individuals worldwide, 650,000 of whom presented TB.[6] Co-infection with HIV and Koch's bacillus constitutes a serious public health problem and has led to an increase in mortality and morbidity in many countries.[3,5] In addition, an HIV-infected patient is 45% more likely to become infected with *Mycobacterium tuberculosis*.[7]

Over the years, the number of new cases have increased, and pulmonary TB remains a very serious public health problem.[2] In 2004, 8.7 million new cases of TB were reported in the world, 1.9 million of which were fatal. Among the 1.9 million deaths, 350,000 occurred in individuals who were co-infected with HIV.[6]

Worldwide, 80% of all TB cases are concentrated in Asia, Africa, and South America. In 2001, 230,203 new cases occurred in the Americas. Of those, 8% occurred in the USA and Canada, compared with 50% occurring in Peru and Brazil.[6] In the same year, Brazil was ranked 15th among the 22 countries that, together, accounted for 80% of the TB cases occurring worldwide.[6] In Brazil, 110,000 new cases were diagnosed in 2001.[8] Of those, 6000 resulted in death. The TB incidence was 47.2/100,000 inhabitants; the most affected individuals being those aged 20-39 years.[8] In the state of Rio Grande do Sul, 4571 new cases of TB were diagnosed in the year 2002, with an incidence of 43.97/100,000 inhabitants, 308 deaths/year, and 1140 cases of HIV/TB co-infection (24.3%). Partial data, in 2004, revealed 5596 new TB cases, among which there were 214 deaths.[9]

The *Programa Nacional de Controle da Tuberculose* (PNCT - National Tuberculosis Control Program), reinitiated in 1999 as an emergency measure, is integrated into the network of public health facilities and is developed through a unified program, carried out conjointly by the federal, state and municipal governments. This program is subordinate to a planning policy that regulates its activities, with well-defined technical and health assistance standards, guaranteeing the distribution of drugs and other necessary materials to the patients at no charge, as well as delineating measures for the prevention and control of the disease. Therefore, the population is granted universal access to the benefits provided by the program. The international goals established by the World Health Organization and agreed upon by the Brazilian government are to identify 70% of the estimated number of TB cases, properly treat 100% of those cases and cure 85% of them.[10]

In Rio Grande do Sul, 75% of all TB cases are concentrated in four cities, which are therefore considered priorities. Bagé is one of those cities, with a population of over 100,000 inhabitants and an incidence rate higher than the national mean of 47/100,000.[10]

The Ministry of Health stipulates that 1% of the population presenting respiratory symptoms should be investigated annually, through direct sputum smear microscopy, estimating that 4% of this population will be diagnosed with TB.[11]

The objective of this study was to present epidemiological data on patients aged 18 or older, of either genders, in whom a diagnosis of TB had been confirmed (through sputum smear microscopy), as well as investigating associated factors and determining the efficacy of the PNCT, in the period from January of 2001 to December of 2004. The parameters and variables used to determine the magnitude of TB in Brazil are not reliable, and, consequently, the estimates vary markedly. Therefore, we attempted to abide by the Brazilian Guidelines for Tuberculosis, established by the Brazilian Thoracic Society in 2004,[12] in which it is recommended that studies and analyses be carried out in various areas of the country in order to define the variables and parameters needed for the establishment of a model that would be more well adapted to the situation in Brazil.

Such a model would make it possible to compare the control program data with the estimates and consequently determine the effectiveness of the program.

Methods

This was a retrospective study of the clinical charts of patients aged 18 or older treated at the Paulo Barcellos Health Center, eventually registered and reported in the National Case Registry database as new cases of TB. Serologic testing for HIV and sputum culture were required for all of the patients. These tests were performed at the Central Laboratory Institute of Public Health in the city of Porto Alegre. However, in some cases, the serologic test results were not recorded on the respective clinical charts.

In the city of Bagé, the patients suspected of having TB are referred to the Paulo Barcellos Health Center, which is exclusively dedicated to the diagnosis, treatment and active search for new cases. In case of a positive diagnosis, the patient is enrolled in the Rio Grande do Sul State Tuberculosis Control Program, which is linked to the Secretary of Health and Environment. Since the adoption of the standards proposed by the program, the distribution of anti-TB drugs has been centralized in the health care services of the city. The treatment is standardized and lasts a minimum of six months.[13] At each visit, the patients receive a quantity of medication that is sufficient for a period of one month.

The variables analyzed were as follows: gender; age; race (White, Black, or Mulatto); schooling (in years); monthly income (in reals); work status (officially employed, unofficially employed, or no data); smoking (smoker, former smoker/nonsmoker, or no data); HIV (positive, negative, or no data); sputum smear microscopy (+, ++, or +++). These data were obtained at the time of diagnosis and recorded in the clinical charts of the patients.

The information collected was codified and tabulated using the program Statistical Package for Social Sciences, version 11.0 for Windows. Significance levels were determined using Pearson's chi-square, and values of $p < 0.05$ were considered significant under null hypothesis testing.

Results

The study comprised 131 individuals with pulmonary TB confirmed by positive sputum smear microscopy.

Despite the fact that the number of tests performed has increased, the number of new positive diagnoses of pulmonary TB has decreased (Table 1). The temporal distribution of the 131 positive diagnoses was as follows: 26.7% (35) in 2001; 27.5% (36) in 2002; 25.2% (33) in 2003; and 20.6% (27) in 2004.

Women sought treatment more often than did men. Nevertheless, the prevalence of TB was higher among males (male/female ratio of approximately 3:1). The mean age was 49 years (range, 18-81 years). Most of the patients were Caucasian. The prevalence of TB was also higher among patients with a limited amount (less than 7 years) of schooling (Table 2).

At the time of diagnosis, most patients held some sort of low-income job (mean, 265 reals/month). The prevalence was similar between smokers and former smokers/nonsmokers (Table 2).

During the period evaluated, only one case of HIV positivity was diagnosed, demonstrating that this is not an impact factor in the magnitude of TB in Bagé (Table 2).

When the association of gender with sputum smear microscopy results was analyzed, 58.8% of the females and 25.8% of the males presented '+++' ($p < 0.001$) (Table 3). In the same analysis, 34.9% of the Caucasians, 40% of the Blacks, and 37.5% of the Mulattos presented '+++' ($p = 0.52$) (Table 3). The '+++' status was presented in the following age brackets at the following percentages: 18-25 years, 43.5%; 26-35 years, 36.7%; 36-45 years, 34.8%; 46-55 years, 29.3%; 56-65 years, 36.4%; and over 66 years, 15.4% ($p = 0.84$) (Table 3). Regarding smoking and sputum smear microscopy results, we observed that 30% of the smokers and 41.7% of the former smokers/nonsmokers presented '+++' ($p = 0.23$) (Table 3).

Table 1 - Search for cases of tuberculosis (TB) by sputum smear microscopy in Bagé.

	Year			
	2001	2002	2003	2004
Sputum smear microscopies performed, n	721	946	1352	1459
Goal (%)	62	81.4	115	124
Estimated cases, n	87	87	87	59
Contagious cases in the study, n	35	36	33	27

Table 2 - Sociodemographic characteristics of patients with confirmed diagnosis of TB in the city of Bagé.

Variables	n	%
Gender		
Males	97	74.0
Females	34	26.0
Age (years)		
18-25	23	17.6
26-35	30	22.9
36-45	23	17.6
46-55	20	15.3
56-65	22	16.8
66 or older	13	9.9
Race		
Caucasians	83	63.4
Blacks	15	11.5
Mulattos	16	12.2
Not reported	17	13.0
Schooling (in years)		
Illiterate	21	16.0
1-3	45	34.4
4-7	37	28.2
8 or more	13	9.9
Not reported	15	11.5
Income (in reals)		
100-250	46	35.1
251-500	24	18.3
501-750	9	6.9
751 or more	6	4.6
No income	24	18.3
Not reported	22	16.8
Work status		
Officially employed	95	72.5
Unofficially employed	28	21.4
Not reported	8	6.1
Smoking		
Smokers	60	45.8
Former smokers or nonsmokers	60	45.8
Not reported	11	8.4
HIV		
Positive	1	0.8
Negative	114	87.0
Not reported	16	12.2

Discussion

The goal of the PNCT is that 1% of the population of the city be investigated through direct sputum smear microscopy.[11] In Bagé, the population predicted for 2005 was 120,129 inhabitants.[14] Therefore, it was stipulated that, from 2001 to 2004, there would be 1180 sputum smear microscopy analyses (of the first sputum sample) performed annually.[11] The expected number of new cases of pulmonary TB for the 2001-2003 period was 87 per year. However, this number dropped to 59 for 2004. The goal of reaching 1% of the population was reached in 2003 and 2004[15] (Table 1).

From 2001 to 2004, the search for new cases of TB in Bagé increased significantly and actually exceeded the goal in the last two years. Simultaneously, the number of new cases has decreased. The fact that the goals were exceeded is likely attributable to increased treatment-seeking behavior, the broader dissemination of the service in the city, and the good quality of the active search for new cases. For comparison purposes, we show the 2003 and 2004 data for the TB priority cities within the 7th Regional Health District[15] (Table 4). It can be observed that Bagé was the only city that managed to reach the goal of investigating 1% of the population through direct sputum smear microscopy, as stipulated by the Ministry of Health, in 2003 and 2004. Nor did the number of tests performed reach the minimum in the other TB priority cities in Rio Grande do Sul[8,15] (Table 5).

In Bagé, the prevalence was higher among males, despite the fact that the number of new TB cases among females increased. In a study conducted from 1990 to 1999 in the city of Belo Horizonte, located in the state of Minas Gerais,[16] only 53.26% of the 8442 reported cases, regardless of age bracket, were in females. A trend forecast was made for pulmonary TB, by gender, within a decade (incidence per 100,000 inhabitants in the 2000-2009 period), and the results were as follows: 2000 – 84.02 and 37.9 per 100,000 inhabitants, for males and females, respectively; 2005 – 120.8 and 53.5 per 100,000 inhabitants, for males and females, respectively; and 2009 – 150.2 and 66.1 per 100,000 inhabitants, for males and females, respectively.[16] In another study, conducted in the Rio Grande do Sul city of Pelotas, males accounted for 69.1% of 152 patients (from 20 to 80 years of age) diagnosed with TB between July of 1994 and July of 1995.[17] Statewide, the majority (67%) of the patients diagnosed with TB in Rio Grande do Sul in 2003 were males.[9]

Most of the patients in the study presented a low income, which makes us wonder whether

Table 3 - Correlation between sputum smear microscopy results and variables such as gender, race, age and smoking.

Variable	Sputum smear microscopy			χ^2 (p)
	+	++	+++	
	n (%)			
Gender				13.02 (<0.001)
Males	47 (48.4)	25 (25.8)	25 (25.8)	
Females	7 (20.6)	7 (20.6)	20 (58.8)	
Race				5.18 (=0.52)
Caucasian	33 (39.8)	21 (25.3)	29 (34.9)	
Blacks	5 (33.3)	4 (26.7)	6 (40)	
Mulattos	5 (31.25)	5 (31.25)	6 (37.5)	
Not reported	11 (64.7)	2 (11.8)	4 (23.5)	
Age (years)				5.58 (=0.84)
18-25	7 (30.4)	6 (26.1)	10 (43.5)	
26-35	14 (46.6)	5 (16.7)	11 (36.7)	
36-45	10 (43.5)	5 (21.7)	8 (34.8)	
46-55	9 (45)	5 (25)	6 (30)	
56-65	7 (31.8)	7 (31.8)	8 (36.4)	
66 or older	7 (53.8)	4 (30.8)	2 (15.4)	
Smoking				5.5 (=0.23)
Smokers	23 (38.3)	19 (31.7)	18 (30)	
Former smokers or nonsmokers	25 (41.7)	10 (16.6)	25 (41.7)	
Not reported	6 (54.5)	3 (27.3)	6 (18.2)	

people in such situation would be more prone to infection with *M. tuberculosis*, due to lack of access to information or to a lack of treatment. In the study conducted in Pelotas, the family income for 63.2% of the 152 patients was less than 3 times the national minimum wage.[17]

Low levels of education were also observed in a study conducted among prisoners in Spain, 53.8% of whom had not finished elementary school.[18] In the study carried out in Pelotas, only 13.2% of the infected individuals were illiterate,[17] compared with 68.4% in another study, conducted in the city of Piripiri, located in the state of Piauí.[19] Therefore, it is not possible to precisely evaluate this information, since the level of education was defined simply as literate or illiterate. An erroneous conclusion could therefore be drawn if we state that the level of education in Pelotas was good. In fact, there is no way to know what the exact level of education was.

Regarding work status, most of the patients held some sort of low income job, in contrast to the findings of the study conducted in Pelotas,

Table 4 - Search for cases of TB by sputum smear microscopy in the 7th Regional Health District.

City	Goal/2003	Performed/2003	Goal/2004	Performed/2004
Aceguá	40	42 (105%)	40	15
Bagé	1180	1354 (115%)	1180	2482
Candiota	88	26 (30%)	88	0
Dom Pedrito	411	317 (77%)	411	73
Hulha Negra	47	52 (110%)	47	2
Lavras do Sul	79	97 (123%)	79	12

Table 5 - Search for cases of TB by sputum smear microscopy in other cities of Rio Grande do Sul.

City	Population	Goal/2003	Performed/2003	Nº of estimated cases	Nº of notified cases
Gravataí	248,525	2485	913	149	77
Passo Fundo	176,930	1767	197	35	19
Pelotas	331,373	3314	1,039	166	116
Santa Maria	254,639	2546	669	115	58

in which 60.5% of the individuals evaluated were unemployed.[17]

Caucasians were the most affected by TB, as reported in the Pelotas study, in which 66.4% of the individuals were Caucasians.[17] Among the patients diagnosed with TB, there were equal numbers of smokers and nonsmokers at the time of diagnosis. However, in the city of Alfenas, located in Minas Gerais, 43 (30.93%) of the 139 patients with TB were smokers.[2]

In the city of Bagé, there were no significant differences among the age brackets, and the cases of TB analyzed referred to patients from 18 to 65 years of age. However, the prevalence was lower among those aged 65 or older, despite the fact that this group presents physiological disadvantages (cellular senescence, hormonal problems, etc.) and socioeconomic disadvantages in comparison with the other groups.[20] In Brazil, the TB incidence has been shown to be higher among those aged 30 or older: 91-97/100,000 inhabitants in 1991; and 84-89/100,000 inhabitants in 1996.[21] In a study carried out from 1985 to 1992 in the city of Brasília, located in the Federal District, 549 of the 2990 patients diagnosed with TB were aged 50 or older.[4] A 50-year trend forecast was made, and it predicted that TB will increase among the elderly, and that TB rates will increase from 5 to 14% nationwide.[21]

As of 1996, the incidence of TB was higher among individuals aged 70 or older in the USA,[22] in England/Wales,[23] and in Japan.[20]. This could be the result of latent TB infection and of the cumulative effect that smoking has on health status.[24]

Despite being indicated as one of the factors responsible for the increased number of TB cases worldwide,[3,5,6] HIV co-infection was not relevant in Bagé. According to the distribution of HIV cases reported by the 7th Regional Health District for this city on July 31, 2005,[25] the absolute incidence of HIV-positive cases was 64. In addition, although most patients in this study were tested for HIV, only one of the 131 cases was HIV positive. In a study conducted in the city of Caxias do Sul, also in Rio Grande do Sul, the number of HIV-positive cases increased an average of 13% in the period from 1988 to 1995, whereas the number of new cases of TB decreased slightly.[26]

The present study demonstrated the efficacy of the active search for cases of TB in the city of Bagé, since the goal of testing 1% of the population was exceeded for two consecutive years, and there was a simultaneous decrease in the number of new cases. This shows the fundamental importance of maintaining this program in the city, since its preventive and disease control measures are apparently working quite efficiently. In the city of Bagé, HIV co-infection was apparently unrelated to the number of new cases of TB (perhaps because the city is not considered an important focus of HIV). In addition, no correlation was found between smoking and higher TB prevalence.

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