Revista de Epidemiologia e Controle de Infecção

ARTIGO ORIGINAL

Análise da tuberculose ocupacional no sistema nacional de vigilância do Brasil de 2007-2011

Occupational tuberculosis analysis according to the Brazilian National Surveillance System, 2007–2011

Análisis de la tuberculosis profesional en el Sistema Nacional de Vigilancia de Brasil en 2007-2011

Gabriela Ferreira Nunes,[1] Thiago Nascimento do Prado,[1] Fernanda Mattos de Souza,[2,3] Lia Gonçalves Possuelo,[4] Ethel Leonor Noia Maciel[1]

[1]Universidade Federal do Espírito Santo, Vitória, ES, Brasil.
[2]Prefeitura Municipal de Campos dos Goytacazes, Rio de Janeiro, RJ, Brasil.
[3]Universidade do Estado do Rio de Janeiro, Rio de Janeiro, RJ, Brasil
[4]Universidade de Santa Cruz do Sul (Unisc), Santa Cruz do Sul, RS, Brasil.

RESUMO

Justificativa e Objetivos: Os profissionais de saúde (PS) estão entre os grupos de maior risco para adquirir tuberculose (TB). Contudo, poucos estudos avaliaram esse risco em outras profissões (N-PS). Diante disso, este estudo caracterizou e analisou os fatores de risco associados com a TB de acordo com o status ocupacional (PS e N-PS). **Métodos:** Estudo transversal utilizando o banco de dados do Sistema de Informação de Agravos de Notificação (SINAN) do Brasil, que incluiu dados relacionados a TB ocupacional, isto é, aquela adquirida no ambiente de trabalho. **Resultados:** A proporção de casos de TB ocupacional com base em dados de 2007-2011 foi de 1,6%. Analisamos 3.049 indivíduos, dos quais 298 (10%) eram PS e 2.751 (90%) foram N-PS. PS foram menos prováveis de serem do sexo masculino (OR = 0,24; IC 95%: 0,18-0,32), etilista (OR = 0,17; IC 95%: 0,05-0,54), cobertos pelo programa DOTS (OR = 0,58; IC 95%: 0,43-0,77) e de serem transferidos (OR = 0,34; IC 95%: 0,16-0,70). Por outro lado, os PS são mais prováveis de terem mais de 8 anos de estudo (OR = 27,47; IC 95%: 16,64-45,34), 43 anos ou mais de idade (OR = 1,96; IC95%: 1,37-2,79) e de terem TB extrapulmonar (OR = 1,60; IC 95%: 1,12-2,28). **Conclusões:** Evidenciou-se a necessidade de atenção para a TB como uma doença ocupacional, sendo importante o fortalecimento das discussões sobre os direitos dos trabalhadores, especialmente para os N-PS e a implementação de medidas de saúde pública para a prevenção e controle da doença nesses grupos.
Descritores: Tuberculose. Saúde do Trabalhador. Sistemas de Informação em saúde.

ABSTRACT

Background and Objectives: Health care workers (HCWs) are among the groups at risk for contracting tuberculosis (TB). However, few studies have analyzed this subject in other professions (non-HCWs). This study aimed to characterize and analyze factors associated with TB according to their occupational status, defined as workplace-acquired TB (HCWs or non-HCWs). **Methods:** Cross-sectional study that used the Brazilian National Surveillance System (SINAN) database, which includes data related to occupational TB transmission. **Results:** The proportion of TB cases attributable to occupational TB based on data from 2007 to 2011 in Brazil was 1.6%. We analyzed 3,049 subjects, of which 298 (10%) were TB – HCWs and 2,751 (90%) were TB – non-HCWs. HCWs were less likely to be male (OR = 0.24, 95%CI:

0.18-0.32), to consume alcohol (OR = 0.17, 95% CI: 0.05 – 0.54), to be "covered" by the DOTS program (OR = 0.58, 95% CI: 0.43-0.77) and to be transferred (OR = 0.34; 95% CI: 0.16-0.70). On the other hand, HCWs are more likely to have more than 8 years of schooling (OR = 27.47, 95% CI: 16.64 – 45.34), to be 43 years or older (OR = 1.96, 95% CI: 1.37-2.79) and to develop extrapulmonary TB (OR = 1.60, 95% CI: 1.12-2.28). **Conclusions:** The study highlighted the need to consider TB as an occupational disease, being important to increase the discussions on workers' rights, especially for non-HCWs, as well as the implementation of public health measures for the prevention and control of TB in both groups.

Keywords: Tuberculosis. Occupational Health. Health Information Systems.

RESUMEN

Antecedentes y Objetivos: Los profesionales de salud (PS) están entre los grupos de mayor riesgo de adquirir tuberculosis (TB). Sin embargo, pocos estudios evaluaron dicho riesgo en otras profesiones (N-PS). Ante ello, este estudio caracterizó y analizó los factores de riesgo asociados a TB según el estatus profesional (PS y N-PS). **Métodos:** Estudio transversal utilizando el banco de datos del Sistema de Información de Enfermedades de Notificación (SINAN) de Brasil, que incluyó datos referentes a TB profesional, es decir, adquirida en el ámbito laboral. **Resultados:** La proporción de casos de TB profesional según datos de 2007-2011 fue de 1,6%. Analizamos a 3,049 individuos, de los que 298 (10%) eran PS y 2,751 (90%) fueron N-PS. Los PS tuvieron menor probabilidad de ser de sexo masculino (OR = 0,24; IC 95%: 0,18-0,32), alcohólico (OR = 0,17; IC 95%: 0,05-0,54); cubiertos por programa DOTS (OR = 0,58; IC 95%: 0,43-0,77) y de ser transferidos (OR = 0,34; IC 95%: 0,16-0,70). Por otro lado, los PS tienen mayor probabilidad de tener más de 8 años de estudios (OR = 27,47; IC 95%: 16,64-45,34), 43 años de edad o más (OR = 1,96; IC 95%: 1,37-2,79) y de tener TB extrapulmonar (OR = 1,60; IC 95%: 1,12-2,28). **Conclusiones:** Se evidenció necesidad de atender la TB como enfermedad profesional, siendo importante fortalecer las discusiones sobre derechos laborales, particularmente para los N-PS; e implementar medidas de salud pública para prevenir y controlar la enfermedad en dichos grupos.

Palabras clave: Tuberculosis. Salud Laboral. Sistemas de Información en Salud.

INTRODUCTION

Brazil is one of 22 countries with a high burden of the tuberculosis (TB) and is one of the five countries that together comprise 48% of worldwide TB cases.[1] Health care workers (HCW) are among the groups vulnerable to acquiring the infection.[2-8] A systematic review showed that the incidence of latent *Mycobacterium tuberculosis* infection (LTBI), demonstrated by converting the tuberculin skin test (TST), can reach 14% in these professionals; and the risk of developing TB disease is 5,361 cases/100,000 health workers every year due to nosocomial exposure.[9] In a multicenter been held in Brazil, identified a high prevalence of LTBI among health professionals in primary care through two diagnostic tests (TST and Interferon-gamma Release Assays-IGRA): 40% and 27%, respectively.[6]

Moreover, other occupational groups are at increased risk of TB, particularly miners exposed to airborne particles such as silica or coal dust and workers handling asbestos. In some settings, such as hospitals and prisons, TB rates are particularly high.[10] However, few studies explore this theme in other professions, either in Brazil or worldwide. [8,11-14] It is necessary to verify the proportion of the disease among other occupational groups to determine the character of occupational TB.

For this reason, the objective of this study was to compare the epidemiological characteristics of occupational tuberculosis between HCW and non-HCW using the Brazilian National Surveillance System. Therefore, our hypothesis is that there is difference from the epidemiological characteristics of cases of tuberculosis in occupational health professionals and those who are not health professionals.

METHODS

Study Design

This was a cross-sectional study utilizing the database of the national TB reporting system (*Sistema de Información de Agravos de Notificação* – SINAN). SINAN was developed in the early 90s, with the objective of collecting and processing data on disease notification throughout the country. SINAN is the primary information system from which data are extracted for epidemiological analyses, including those related to TB that are recorded in SINAN based on data abstracted from forms used in the investigation and follow-up of cases. Although for this particular study, data were obtained from the Tuberculosis National Program at the Ministry of Health in order to avoid replication and misclassification. The SINAN includes data related to occupational illness, which does not include qualitative data regarding the potential sources of infection in the workplace, but rather quantifies the magnitude of the injury. Clinical and epidemiological data for these professionals and possible confounding variables were also available. The occupational status of TB transmission defined as TB acquired at workplace (mainly determined by inadequate environments or conditions of work).[15]

Study Population

The study population included TB cases reported in Brazil between January 1, 2007 and December 31, 2011 whose occupational status of TB transmission was defined as TB acquired at the workplace. Subjects younger than eighteen years old or with missing information in the work category were excluded.

The subjects were classified, according to work category and with the presence of occupational tuberculosis into two groups: health care workers (TB – HCW) and non-health care workers (TB – non-HCW).

A case could be regarded as TB based on symptoms (such as cough for over three weeks, fever, night sweats and weight loss), epidemiological history (having had contact with a known TB patient) and complementary exams suggesting the disease (chest X-ray and tuberculin skin test).[16]

Variable and data collection

The following socio-demographic covariates were evaluated: gender (male, female), age (18 – 29 years, 30 – 42 years and ≥ 43 years), skin color [white, black, brown and other (asian and indigenous)], years of education (0 - 8 years, > 8 years), area of residence (urban or rural) and whether the individual was institutionalized (i.e.: prison, shelter, orphanage, psychiatric hospital).

Regarding comorbidities, we assessed the presence of other non-communicable conditions (i.e.: diabetes, mental disorders and HIV status) and alcoholism. Considering the variables HIV and AIDS together allowed for enumeration of individuals in the asymptomatic phase and individuals with chronic disease, allowing for estimates of incidence and prevalence. Data reporting an unknown status regarding these conditions or a lack of information were considered as missing values.

The covariates related to TB included the type of treatment received as well as the type of case, including cases classified as new TB cases (subjects with a new TB diagnosis), relapse cases (subjects that had completed a previous TB treatment and acquired TB a second time), return after abandonment cases (subjects that abandoned a previous TB treatment and later returned to treatment), unknown cases and cases transferred out of a treatment center (those that were transferred out of a health care center). It also included the presentation of TB (pulmonary, extra pulmonary, pulmonary + extra pulmonary), the results of the TST (positive if greater than 10 mm), the existence of a chest X-ray suspicious for TB, the result of the initial sputum smear test, the result of initial culture examination, Directly Observed Treatment Short-Course (DOTS) and the result of initial histopathologic examination.

The occupational status of TB transmission was defined as TB acquired at the workplace (mainly determined by inadequate environments or conditions of work) and was based on the results of contact tracing procedures.[9] Regarding to field of "work related disease" in the SINAN database, there is no option for input of qualitative information; the responses are limited to yes, no, or ignored, allowing only analysis of absolute numbers for this field. This variable entry routine in Brazil TB surveillance system and this information was obtained by health care worker at the time of notification of the case.

Concerning the final treatment outcome, the subjects were classified as cured (those that had completed the treatment and had at least two negative smear results), abandoned (those that did not present to regular appointments for more than 30 days), died (those that died during the treatment for TB or died from other causes), transferred out of the treatment center (those that were transferred out of the health care center) and development of MDR TB (those that developed MDR TB during TB treatment).

Data Analysis and Statistics

We compared TB – HCW subjects with TB – non-HCW subjects according to socio-demographic characteristics, comorbidities and TB features. The Pearson chi-square test or the likelihood-ratio chi-square tests were used to compare proportions. Covariates associated (p ≤ 0.10) with the outcome of interest were included in a hierarchical logistic regression model.

To address the interrelationships of the conceptual framework of TB determinants, the covariates were grouped into a hierarchy of categories, ranging from distal determinants to proximate ones.[17,18] Level 1 included socioeconomic characteristics (age plus years of education plus skin color), level 2 variables evaluated the environmental characteristics (variables retained from step 1 plus institutionalization plus area of residence), level 3 variables were related to health conditions associated (variables retained from step 2 plus HIV/AIDS plus alcoholism plus other comorbidities), level 4 variables assessed TB features (variables retained from step 3 plus type of treatment plus TB form plus TST plus initial smear plus initial culture plus histopathologic examination) and level 5 variables were TB outcome/care (variables retained from step 4 plus 2nd month smear plus DOTS plus TB treatment outcome). In each level, the covariates that were associated with the outcome (p ≤ 0.10) were retained in the model. Thus, the covariates were evaluated after adjustment for confounders in the same set or in hierarchically superior sets. This approach allowed researchers to quantify the contribution of each level of adjustment, to understand the model building strategy as well as to interpret the independent associations.[18] The results were displayed as odds ratios (OR) and 95% confidence intervals (95% CI). These analyses were performed using Stata, version 12.0.

Ethics statement

The databases were obtained under the rules for release of information from the Secretariat of Health Surveillance and Health Care Department of the Ministry of Health, ensuring the confidentiality and nondisclosure of individual identifiers. The Universidade Federal do Espírito Santo (UFES) Institutional Review Board approved the study design by registration number 242.826.

RESULTS

Figure 1 shows the study flow diagram. Between 2007 and 2011, occupational TB accounted for 1.6% (95% CI, 1.5 – 1.7%) of the 432,958 cases of TB reported at SINAN. We analyzed 3,049 subjects, of whom 298 (10%) were TB – HCW and 2,751 (90%) were TB – non-HCW. We excluded 4,011 subjects with missing information in the work
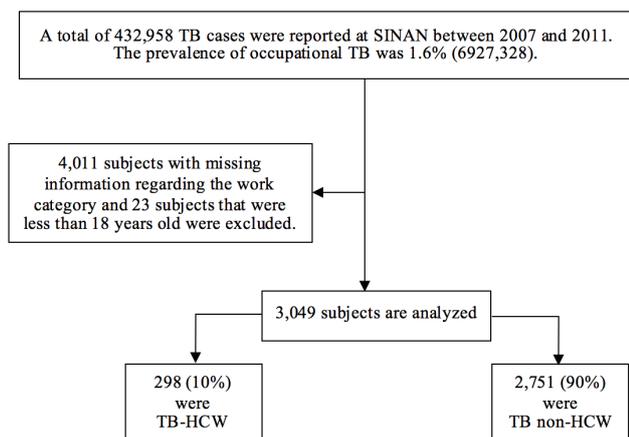
```
┌──────────────────────────────────────────────┐
│ A total of 432,958 TB cases were reported at   │
│ SINAN between 2007 and 2011.                   │
│ The prevalence of occupational TB was 1.6%     │
│ (6927,328).                                    │
└──────────────────────────────────────────────┘

┌──────────────────────────────┐
│ 4,011 subjects with missing  │
│ information regarding the work│
│ category and 23 subjects that │
│ were less than 18 years old   │
│ were excluded.                │
└──────────────────────────────┘

        ┌──────────────────────────────┐
        │ 3,049 subjects are analyzed   │
        └──────────────────────────────┘

┌──────────────────┐        ┌──────────────────┐
│ 298 (10%)        │        │ 2,751 (90%)      │
│ were             │        │ were             │
│ TB-HCW           │        │ TB non-HCW       │
└──────────────────┘        └──────────────────┘
```

Figure 1. Flowchart showing selection of cases for analysis. SINAN: Sistema de Informação de Agravos de Notificação; TB: tuberculosis; HCW: health care work.

category and 23 subjects younger than eighteen years old. Regarding professional category in each group, we identified that between the HCW the most (70%) was nurse or nursing technician while the non-HCW group a significant number of 11.62% were workers related to farming, the bri-

cklayer represented 7.02% and 3.25% of professionals linked to police (police, prison guard and delegate).

Men were more prevalent in the non-HCW group (p< 0.001), comprising 2,052 (95.8%) cases. Differences in age groups was significant between the non-HCW compared to the HCW group (mean age ≥ 43 years) (p= 0.007). Subjects identified as black were more prevalent in the non-HCW group (93.8%) when compared to the HCW group (6.2%), (p< 0.001). The proportion of subjects with less than eight years of education was higher among the non-HCW group (99%) than the HCW group (1%), (p<0.001). Subjects identified as residents of rural areas were more prevalent in the non-HCW group (97.5%) than in the HCW group [(2.5%) (p< 0.001)]. Comorbidities were more prevalent in the non-HCW group (93%) when compared to the HCW group (7%) (p= 0.019), and alcoholism was greater in the non-HCW group (99.3%) when compared to the HCW (0.7%), (p< 0.001). Among those 189 who were HIV / AIDS, most were non-HCW [92.0% (p=0.020)].

Table 2 describes the study subjects according to the characteristics of TB presentation. Relapse was higher in the non-HCW group (6.6% HCW vs. 93.4% no-HCW p < 0.001). The presence of X-ray results that were suggestive of TB was found in 21.8% of the HCW and 78.2% of the non-HCW (p < 0.001). The prevalence of pulmonary TB

Table 1. Comparison of sociodemographic characteristics of tuberculosis (TB) cases according to occupational status.

Characteristics (*)		Non-HCWs	HCWs	P
		n (%)	n (%)	
Gender (3,049)	Male	2,052 (95.8)	89 (4.2)	< 0.001
	Female	699 (77.0)	209 (23.0)	
Age (years) (3,049)	18 - 29	750 (89.7)	86 (10.3)	0.007
	30 – 42	842 (88.2)	113 (11.8)	
	≥ 43	1,159 (92.1)	99 (7.9)	
Skin color (2,976)	White	859 (84.7)	155 (15.3)	< 0.001
	Black	365 (93.8)	24 (6.2)	
	Brown	1,410 (93.3)	101 (6.7)	
	Other	56 (90.3)	6 (9.7)	
Years of education (2,616)	0 - 8 years	1,715 (99.0)	18 (1.0)	< 0.001
	> 8 years	640 (72.5)	243 (27.5)	
Area of residence (2,986)	Urban	2,330 (89.2)	282 (10.8)	< 0.001
	Rural	346 (97.5)	9 (2.5)	
	Periurban	18 (94.7)	1 (5.3)	
Institutionalization (2,838)	No	2,300 (89.5)	271 (10.5)	0.079
	Yes	248 (92.9)	19 (7.1)	
Comorbidities (2,250)	No	1,692 (88.8)	213 (11.2)	0.019
	Yes	321 (93.0)	24 (7.0)	
Diabetes (2,599)	No	2,146 (89.7)	248 (10.3)	0.867
	Yes	183 (89.3)	22 (10.7)	
Alcoholism (2,642)	No	1,914 (87.5)	273 (12.5)	< 0.001
	Yes	452 (99.3)	3 (0.7)	
Mental Disease (2,606)	No	2,297 (89.3)	275 (10.7)	0.366
	Yes	32 (94.1)	2 (5.9)	
HIV/AIDS (1,468)	No	1,099 (86)	180 (14.0)	0.020
	Yes	174 (92.0)	15 (8.0)	

(*) Number of valid observations; p= Pearson chi-square test; HIV/AIDS= Human immunodeficiency virus infection/acquired.

Table 2. Comparison of the presentation and treatment characteristics of tuberculosis (TB) in cases according to occupational status (health care workers – HCW and other professionals – non-HCW).

Characteristics (*)		Non-HCWs n (%)	HCWs n (%)	P
Treatment type (3,046)	New case	2,309 (89.2)	278 (10.8)	< 0.001
	Relapse	142 (93.4)	10 (6.6)	
	Return after abandonment	8 (100.0)	0 (0.0)	
	Unknown	2 (66.7)	1 (33.3)	
	Transferred	207 (95.8)	9 (4.2)	
X Ray suspicious for TB (2,675)	No	129 (78.2)	36 (21.8)	0.001
	Yes	2,276 (90.7)	234 (9.3)	
TB form (3,046)	Pulmonary	2,408 (91.7)	219 (8.3)	< 0.001
	Extrapulmonary	273 (80.8)	65 (19.2)	
	Pulmonary + Extra pulmonary	67 (8.7)	14 (17.3)	
Smear (2,537)	Negative	658 (88.2)	88 (11.8)	< 0.001
	Positive	1,659 (92.6)	132 (7.4)	
Culture (490)	Negative	144 (85.2)	25 (14.8)	0.053
	Positive	292 (91.0)	29 (9.0)	
Histopathologic examination (414)	AFB positive	183 (90.1)	20 (9.9)	0.05
	Suggestive	150 (81.5)	34 (18.5)	
	Not suggestive	23 (85.2)	4 (14.8)	
DOTS (2,943)	No	1,146 (85.3)	197 (14.7)	< 0.001
	Yes	1,501(93.8)	99 (6.2)	
Outcome (2,222)	Cure	1,496 (88.8)	188 (11.2)	< 0.001
	Abandonment	192 (96.0)	8 (4.0)	
	Death from TB	56 (96.5)	2 (3.5)	
	Another cause of death	68 (98.5)	1 (1.5)	
	Transfer of treatment Center	191 (94.5)	11 (5.5)	
	MDR TB	9 (100.0)	0 (0.0)	

(*) number of valid observations; p= Pearson chi-squared; AFB= acid-fast bacilli, DOTS= directly observed treatment, MDR TB= multidrug-resistant tuberculosis; TB= tuberculosis.

was higher among non-HCW (91.7% vs. 8.3%, p < 0.001); similarly, positive smear test results were also higher among non-HCW (92.6% vs. 7.4%, p < 0.001).

The prevalence of positive TB culture results was higher in the non-HCW group when compared with the HCW (91% vs. 9%, p= 0.053). The prevalence of positive histopathologic examination results (AARB-positive) was higher in the non-HCW group (90.1% no-HCW vs 9.9% HCWs, p =0.05). The non-HCW were more likely to be covered under the DOTS program than the HCW (93.8% vs. 6.2%, p < 0.001). Regarding the outcomes of TB treatment, the likelihood of abandonment was higher among non-HCWs than HCWs, reported as 96% of non-HCW and 4% of HCW (p < 0.001).

The multivariable analysis model (Table 3) demonstrated that males were less prevalent in the HCW group (OR= 0.24, 95% CI 0.18- 0.32). An age greater than or equal to 43 years increased the odds of occupational tuberculosis (OR = 1.96, 95% CI 1.37 – 2.79) in the HCW group. The odds were also increased with more than eight years of education (OR = 27.47, 95% CI 16.64 – 45.34). Alcoholism was less prevalent among HCW (OR = 0.17, 95% CI 0.05 – 0.54). The HCW group had smaller odds of developing extrapulmonary TB (OR = 1.60, 95% CI 1.12-2.28) and were less likely to be covered under the DOTS program (OR = 0.58, 95% CI 0.43-0.77).

Table 3. Comparison of the presentation and treatment characteristics of tuberculosis (TB) in cases according to occupational status (health care workers – HCW and other professionals – non-HCW).

Level	Variable		OR	95% CI	
Level 1	Gender	Female	Ref.		
		Male	0.24	0.18	0.32
	Age (years)	18 – 29	Ref.		
		30 – 42	1.92	1.37	2.70
		≥ 43	1.96	1.37	2.79
	Skin color	Whites	Ref.		
		Blacks	0.62	0.37	1.04
		Asians/Indigenous	0.79	0.30	2.12
		Brown	0.62	0.46	0.84
	School level (years)	0 – 8	Ref.		
		> 8	27.47	16.64	45.34
Level 2	Institutionalization	No	Ref.		
		Yes	1.01	0.58	1.75
	Area of residence	Urban	Ref.		
		Rural	0.59	0.28	1.23
		Suburban	1.06	0.12	9.17
Level 3	HIV/AIDS	No	Ref.		
		Yes	0.74	0.40	1.38
	Alcoholism	No	Ref.		
		Yes	0.17	0.05	0.54
	Others comorbidities	No	Ref.		
		Yes	1.00	0.59	1.68
Level 4	Type of treatment	New case	Ref.		
		Relapse	1.04	0.49	2.19
		Return after abandonment	1	---	---
		Unknown	6.05	0.11	329.28
		Transferred	0.34	0.16	0.70
	TB form	Pulmonary	Ref.		
		Extrapulmonary	1.60	1.12	2.28
		Pulmonary + extrapulmonary	2.21	1.07	4.55
		Suspicious of TB	0.79	0.46	1.35
	TST	Negative	Ref.		
		Positive	1.23	0.68	2.19
	Initial bacilloscopy	Negative	Ref.		
		Positive	0.86	0.59	1.25
	Initial culture	Negative	Ref.		
		Positive	0.58	0.29	1.17
	Histopathologic examination	Not suggestive of TB	Ref.		
		AFB +	0.75	0.18	3.11
		Suggestive of TB	0.90	0.22	3.60
Level 5	2nd month	Negative	Ref.		
		Positive	1.29	0.57	2.90
	DOTS	No	Ref.		
		Yes	0.58	0.43	0.77
	TB treatment outcome	Cure	Ref.		
		Abandonment	0.63	0.26	1.52
		Death from TB	0.66	0.14	3.20
		Death from others causes	0.29	0.03	2.52
		Transferred	0.96	0.47	1.94
		MDR TB	1.00	---	---

The multivariate analyses: Step 1: sex+ age + school level + skin color. Step 2: step 1 + institutionalization + area of residence. Step 4: step 3+ type of treatment + TB form + TST + initial bacilloscopy + initial culture + histopathologic examination. Step 5: step 4 + 2nd month + DOTS +TB treatment outcome. OR: odds ratio; AFB= acid-fast bacilli, DOTS= directly observed treatment, MDR TB= multidrug-resistant tuberculosis; HIV/AIDS= Human immunodeficiency virus infection/acquired; TB= tuberculosis; TST= tuberculin skin test.

DISCUSSION

Of the TB cases reported from 2007 to 2011 in Brazil, 1.6% was occupational cases. We found that among those with occupationally-acquired TB, those who were 43 years or older with greater, or had more than eight years of education were more likely to be HCW. The HCW group had a higher chance of developing extrapulmonary TB compared with the non-HCW group. The HCW group was less likely to be male, to have alcoholism, to be transferred when in treatment for tuberculosis and/or to be covered under the DOTS program.

Our study has some limitations that should be mentioned. First, a non-differential bias may have occurred because the 4,011 subjects that were excluded from calculations of proportion were not entered in the comparison of the study groups, which does not affect our results. Second, for the field of "work related disease" in the SINAN database, there is no option for input of qualitative information; the responses are limited to yes, no, or ignored, confirming only that the patient acquired tuberculosis as a result of work conditions or the work environment. Thus, we cannot make any inference regarding the location or conditions of biosafety for the worker. Additionally, data regarding the "occupation" was incomplete for the dataset and only reflected the activity performed by the patient. With respect to the strengths of our study, the magnitude of our findings is quite significant and more representative of national trends than that used in previous literature, allowing us to draw new conclusions and suggest new interventions. In addition, the period of the study (from 2007 to 2011) was an acceptable time to perform the analysis and draw conclusions, avoiding fluctuations in terms of incidence and prevalence.

In our study, we observed that the proportion of tuberculosis was high in non-HCW when compared to the number of cases in HCW. In Brazil, few studies address the prevalence in this population, despite the high relevance for public health.[9,11] Nogueira and colleagues (2013), in their study about risk of latent TB to the professionals that work in a prison, especially the communicants of inmates suggests that the communicant employees have a larger risk of if they infect for the M. tuberculosis and consequently of being sick of tuberculosis.[12] Other study confirmed and quantified the high risk of pulmonary and of extrapulmonary tuberculosis in men with silicosis. The incidence of tuberculosis during this 7-yr study suggests that one quarter of these men with silicosis will have developed tuberculosis by 60 yr of age.[13]

Our study found that between the non-HCWs, 11.62% with occupational TB were workers related to farming, like farmers and graziers. A study from dairy farm workers, identified a high prevalence of LTBI considering the different methods: TST and IGRA (76.2% and 58.5%, respectively) and increased risk among those occupationally exposed in non-ventilated spaces.[19] Given these data, must be intensified the surveillance in public health toward to eradication of zoonosis and evaluate and treat workers exposed to infected animals.

The exposure to silica is known to raise the risk of infection with Mycobacterium tuberculosis.[20] Our data showed that the bricklayer's profession represented 7.02% cases with occupational tuberculosis between of the non-HCWs group, studies have demonstrated this predisposition.[13] A review article mentions that individuals exposed to silica, with or without silicosis are at increased risk of tuberculosis and non-tuberculosis mycobacteria.[21]

The increased risk for tuberculosis in people with silicosis appears to result from a combination of factors, especially a possible chemical effect of silica on the bacterial growth, macrophage toxicity and a greater permanence of bacilli in lung tissue due to lymphatic drainage.[20] It is necessary that strategies are aimed at the prevention of silicosis through the use of individual protection equipment appropriate and guidance on the risk for the disease, since there is not yet an effective therapeutic approach for the treatment and avoid creating a possible association between silicosis and tuberculosis.

A study realized in 24,487 New York State among prison employees in 1992 to verify the incidence of tuberculosis infection through TST conversions, showed that one third of new infections among New York State prison employees were due to occupational exposure.[20] Our findings demonstrated that 3.25% work into the prison system like prison guards and police officers had occupational TB. This is important, because as tuberculosis is highly prevalent among prisoners, it is important that health service professionals and professionals in close contact with prisoners are acquainted with diagnostic, prevention and control basic concepts.[12]

Interventions should include the training of these professionals facing the risk for the disease. It is also important to improve the health of prisoners that will improve the health of the general population, as prisoners often come in contact with family members, employees and other people outside the prisons.[22]

We found that a total of 70.25% into the HCWs, had with occupational TB being that these, the most are of the nursering, such nurses, technicians and auxiliaries in blood transfusion. These findings are supported by many studies, emphasizing that this is nursing within the risk group for tuberculosis.[5,22,23] Direct contact with TB patients leads to an increased risk to become latently infected by Mycobacterium tuberculosis.[24] Health care workers present a higher risk of infection compared to the general population. A longer period of employment as health professional, patient's delayed diagnosis of the disease, professional category certain work locations such as inpatient TB facility laboratory, internal medicine, and emergency facilities in addition to the lack of proper respiratory protection (N95 masks), are factors that can contribute to the infection.[25]

TB is more prevalent in the young adult working-age population than in the general population.[26] Although most studies do not specify a relation between the development of TB and the mean age in HCW and non-HCW, our findings show that among those occupationally-acquired TB, those who were 43 years or older with greater, were

more likely to be in HCW group. We can assume that the higher the exposure time, justified by the longer working time, the higher the average age for occupational tuberculosis, such as demonstrated in our analysis.

TB is a neglected disease with social implications. People with less social protection have a higher risk for infection and develop disease.[17] Low education and alcoholism are risk factors that predispose populations to social misery.[9] In our study, HCW had significantly more years of education than non-HCW have a lower probability of being transferred between treatment types, likely because these professionals have steady work or receive treatment in a treatment unit and are thus less likely to be referred to Directly Observed Therapy, Short course (DOTS).[10] On the other hand, non-HCW had a higher probability of being transferred between treatment types and of being covered by DOTS. Around the mid-1990s, when efforts to improve TB care and control intensified at national and international levels, the WHO developed the DOTS strategy, a five-component package comprising political commitment, diagnosis using sputum smear microscopy, a regular supply of first-line anti-TB drugs, short-course chemotherapy and a standard system for recording and reporting the number of cases detected by national TB control programs (NTPs) and the outcomes of treatment.[1] It is an important strategy that has demonstrated progress on the global control of TB since its implementation.[1] However, it is imperative to offer this program to patients with a greater probability of not completing treatment and less so for patients with a lower probability of abandonment, such as HCW.

We found that the risk of developing extra-pulmonary TB or both pulmonary and extra-pulmonary TB was higher among HCW in which non-HCW. The incidence of pulmonary tuberculosis among health workers, particularly those of nursing, has been the subject of many studies in industrialized countries due to exposures multiple that these professionals are subject the bacillus of Koch and the emergence of forms disease resistant to drugs.[4] An epidemiological study tracing reported cases of tuberculosis among health professionals in the Tuberculosis Control Program, at the University Hospital Cassiano Antonio de Moraes, in Vitória (ES) also reported that the extrapulmonary form of the disease was common, accounting for almost half the cases.[3] However, the literature reports that the pulmonary form predominates in the general population.[27,28] This demonstrates the need for further studies to better understand this relationship. The rate of HIV/AIDS was not significant.

Our study revealed that among the TB cases acquired at the workplace, 90% of them were non-HCW. In addition, HCW had significantly more years of education than non-HCW and have a lower probability of being transferred between treatment types and to be referred to DOTS. While non-HCW had a higher probability of being transferred between treatment types and of being covered by DOTS. These findings support the hypothesis initial to highlight the differences between HCW groups and non-HCW diagnosed and classified as occupational TB status.

In Brazil, the results of our study highlight tuberculosis TB as an occupational disease, which is important for the strengthening of the discussions about labor rights, especially for non-HCW.

The lack of actions and public policies towards TB control in non-HCW, shows the need for a more critical look at this issue. Public health measures are necessary for the prevention and control of disease in this group, in which training strategies for professionals in environments that offer the risk of contamination can be a good alternative.

REFERENCES

1. WHO: "Global tuberculosis report" [Internet]. 2012. [cited 2013 mai 11]. Available in: http://www.who.int/tb/publications/global_report/gtbr12_main.pdf.

2. Sepkowitz KA. AIDS, tuberculosis, and the health care worker. Clin Infect Dis 1995;20(2):232-42.

3. Prado TN, Galavote HS, Fregona G, et al. Epidemiological profile of tuberculosis cases reported among health care workers at the University Hospital in Vitoria, Brazil. J Bras Pneumol 2008; 34(8):607-613.

4. WHO. Global tuberculosis report, 2016. Geneva: World Health Organization; 2016 [internet]. Avaliado em janeiro de 2017. Disponível em: <http://apps.who.int/iris/bitstream/10665/250441/1/9789241565394-eng.pdf>.

5. Roth VR, Garrett DO, Laserson KF, et al. A multicenter evaluation of tuberculin skin test positivity and conversion among health care workers in Brazilian hospitals. Int J Tuberc Lung Dis 2005; 9(12):1335-42.

6. Souza FM, Prado TN, Pinheiro JS, et al. Comparison of interferon-γ release assay to two cutoff points of tuberculin skin test to detect latent Mycobacterium tuberculosis infection in primary health care workers. PLoS One 2014;9(8):e102773. doi: 10.1371/journal.pone.0102773. eCollection 2014

7. Rogerio WP, Prado TN, Souza FM, et al. Prevalência e fatores associados à infecção pelo Mycobacterium tuberculosis entre agentes comunitários de saúde no Brasil, usando-se a prova tuberculínica. Cad Saúde Pública 2015;31(10):2199-2210. doi: 10.1590/0102-311X00152414

8. Nasreen S, Shokoohi M, Malvankar-Mehta MS. Prevalence of Latent Tuberculosis among Health Care Workers in High Burden Countries: A Systematic Review and Meta-Analysis. PLoS One 2016;11(10):e0164034. doi: 10.1371/journal.pone.0164034. PubMed PMID: 27711155; PubMed Central PMCID: PMC5053544.

9. Joshi R, Reingold AL, Menzies D, et al. Tuberculosis among Health-Care Workers in Lowand Middle-Income Countries: A Systematic Review. PLoS Med 2006;3(12):e494.

10. WHO. Global tuberculosis report, 2015. Geneva: World Health Organization; 2016 [internet]. Avaliado em janeiro de 2017. Disponível em: < http://apps.who.int/iris/bitstream/10665/191102/1/9789241565059_eng.pdf>.

11. Fávero JL, Cerqueira ACB, Fregona G, et al. Prevalência de tuberculose em profissionais da área de Enfermagem obtida por método de relacionamento de bancos de dados, 2000 a

2008, Espírito Santo, Brasil. Rev Bras Pesq Saúde 2012;14(2):31-37.

12. Nogueira PA, Abrahao RMCM, Galesi VMN. Infecção tuberculosa latente em profissionais contatos e não contatos de detentos de duas penitenciárias do estado de São Paulo, Brasil 2008. Rev bras epidemiol 2011;14(3):486-494. doi: 10.1590/S1415-790X2011000300013

13. Cowie RL. The epidemiology of tuberculosis in gold miners with silicosis. Am J Respir Crit Care Med 1994;150(5 Pt 1):1460-2.

14. Elkard I, Zaghba N, Benjelloun H, et. al. Silico tuberculosis. Rev Pneumol Clin 2016;72(3):179-83. doi: 10.1016/j.pneumo.2015.10.003.French. PubMed PMID: 26790716

15. Prado TN, Miranda AE, Souza FM, et al. Factors associated with tuberculosis by HIV status in the Brazilian national surveillance system: a cross sectional study. BMC Infect Dis 2014;14(415):1-8. doi: 10.1186/1471-2334-14-415

16. Ministério da Saúde (BR). Secretaria de Vigilância em Saúde. Departamento de Vigilância Epidemiológica. Manual de recomendações para o controle da tuberculose no Brasil 2011. Ministério da Saúde, Secretaria de Vigilância em Saúde, Departamento de Vigilância Epidemiológica. – Brasília: Ministério da Saúde.

17. Louther J, Rivera P, Feldman J, et al. Risk of tuberculosis conversion according to occupation among health care workers at a New York city hospital. Am J Resp Crit Care Med 1997;156: 201-205.

18. Malhão TA, Oliveira GP, Codennoti SB, et al. Evaluation of Data completeness in the Tuberculosis Notification Information System, Brazil, 2001-2006. Epidemiol Serv Saúde 2010;19(3):245-256.

19. Torres-Gonzalez P, Soberanis-Ramos O, Martinez-Gamboa A, et al. Prevalence of latent and active tuberculosis among dairy farm workers exposed to cattle infected by Mycobacterium bovis. PLoS Negl Trop Dis 2013;7(4):e2177. doi: 10.1371/journal.pntd.0002177. Print 2013

20. Barboza CEG, Winter DH, Seiscento M, et al. Tuberculose e silicose: epidemiologia, diagnóstico e quimioprofilaxia. J bras pneumol 2008;34(11):959-966. doi: 10.1590/S1806-37132008001100012.

21. Carneiro APS, Campos LO, Gomes MFCF, et al. Perfil de 300 trabalhadores expostos à sílica atendidos ambulatorialmente em Belo Horizonte. J Pneumol 2002;28(6):329-334.

22. Macedo LR, Macedo CR, Maciel ELN. Vigilância epidemiológica da tuberculose em presídios do Espírito Santo. Rev Bras Promoc Saude 2013;26(2):216-222.

23. Ferreira S, Oliveira HB, Marin-léon L. Tuberculosis attitudes among prisoners and guards in Brazil. J Epidemiol Community Health 2011;65(Suppl 1):A107. doi:10.1136/jech.2011.142976d.41

24. He G, Li Y, Zhao F, et al. The Prevalence and Incidence of Latent Tuberculosis Infection and Its Associated Factors among Village Doctors in China. PLoS One 2015 21;10(5):e0124097. doi: 10.1371/journal.pone.0124097. PubMed PMID: 25996960; PubMed Central PMCID: PMC4440671

25. Casas I, Esteve M, Guerola R, et al. Incidence of tuberculosis infection among health care workers: risk factors and 20-year evolution. Respir Med 2013;107(4):601-7. doi: 10.1016/j.rmed.2012.12.008. Epub 2013 Jan 10

26. Sawanyawisuth K, Chaiear N, Sawanyawisuth K, et al. Can workplaces be predictors for recent onset latent tuberculosis in health care workers? J Occup Med Toxicol 2009;4(20):20-2. doi: 10.1186/1745-6673-4-20

27. Oliveira GP, Torrens AW, Bartholomay P, et al. Tuberculosis in Brazil: last ten years analysis – 2001–2010. Braz J Infect Dis 2013;17(2):218–233. doi: 10.1016/j.bjid.2013.01.005. Epub 2013 Mar 7

28. Maciel EL. Determinantes sociais da tuberculose: elementos para a ação. Promoção da saúde na diversidade humana e nos itinerários terapêuticos. Campinas: Saberes; 2012.