Tuberculosis in elderly people from the state of Maranhão: contribution to the control program

Tuberculose em idosos no Maranhão: contribuição para o programa de controle

Tuberculosis en ancianos en Maranhão: contribución al programa de control

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ABSTRACT

Objective: The study's goal has been to assess the profile and identify the factors related to tuberculosis in elderly people from the State of *Maranhão* over the period from 2010 to 2015. **Methods:** It is an analytical cross-sectional study addressing cases of tuberculosis in elderly people from the State of *Maranhão*. There were used secondary data from the *Sistema de Informações de Agravos de Notificação (SINAN)* [Information System of Notification Aggravations], which is available on Datasus. Aiming to identify the associations between the outcome (tuberculosis in elderly people) and the independent variables, the Poisson regression was then used. **Results:** After the model adjustment, the education < 8 years of study, having hospital discharge without being cured, unperformed HIV test and bearing diabetes, all presented themselves as factors that increase the chance of occurrence of tuberculosis in elderly people. The other variables were presented as protective factors. **Conclusion:** A high prevalence of tuberculosis in elderly people was observed in the State of *Maranhão* (16.6%). There is a need for adopting strategies towards this clientele's follow-up.

Descriptors: Tuberculosis, elderly, risk factors.

RESUMO

Objetivo: Analisar o perfil e identificar os fatores associados à tuberculose em idosos no Maranhão no período de 2010 a 2015. **Métodos:** Estudo transversal analítico com os casos de tuberculose em idosos no estado do Maranhão. Foram utilizados dados secundários do SINAN, disponíveis no Datasus. Para identificar as associações entre o desfecho (tuberculose em idosos) e as variáveis independentes, utilizou-se a regressão de Poisson. **Resultados:** Após o ajuste do modelo, a escolaridade < 8 anos de estudo, ter encerramento por não cura, exame anti HIV não realizado e ter diabetes apresentaram–se como fatores que aumenta a chance da ocorrência de tuberculose em idosos. As demais variáveis apresentaram-se como fator protetor. **Conclusão:** Foi observada alta prevalência de tuberculose em idosos no estado (16,6%). Há necessidade de se adotarem estratégias de acompanhamento dessa clientela.

Descritores: Tuberculose; Idosos; Fatores de risco.

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RESUMEN

Objetivo: Analizar el perfil e identificar los factores asociados a la tuberculosis em ancianos en Maranhão en el período de 2010 a 2015. **Métodos:** Estudio transversal analítico con los casos de tuberculosis en ancianos en el Estado de Maranhão. Se utilizaron datos secundarios del SINAN, disponibles en Datasus. Para identificar las asociaciones entre el desenlace (tuberculosis en ancianos) y las variables independientes se utilizó la regresión de Poisson. **Resultados:** Después del ajuste del modelo la escolaridad < 8 años de estudio, tener cierre por no cura, examen anti VIH no realizado y tener diabetes se presentaron como factor que aumenta la probabilidad de la ocurrencia de tuberculosis en ancianos. Las demás variables se presentaron como factor protector. **Conlusión:** Se observó una alta prevalencia de tuberculosis en ancianos en el Estado (16,6%). Hay necesidad de adoptar estrategias de acompañamiento de esa clientela.

Descriptores: Tuberculosis; Ancianos; Factores de riesgo.

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by *Mycobacterium tuberculosis*, as known as Koch's bacillus. It is considered a public health problem because of its high incidence, prevalence, and more frequent involvement of populations living in precarious socioeconomic conditions, especially in developing countries.[1]

The outlook for TB in the world is related, among others, to the following factors: impoverishment of the population; social inequality; the advent of endemic Human Immunodeficiency Virus (HIV); increased rates of internal and external migration; aging of the world population; high dropout rates and the emergence of resistance to multiple antituberculosis drugs. [2]

Brazil is part of the group of 22 high-burden countries prioritized by the World Health Organization, which account for 80% of all TB cases in the world, ranking 16th in absolute numbers. In Brazil, from 2005 to 2014, an average of 73,000 new TB cases were diagnosed per year, and in 2013, 4,577 deaths occurred.[3]

In Brazil, TB is included among Compulsory Notification Diseases throughout the national territory, and the *Sistema de Informações de Agravos de Notificação (SINAN)* [Information System of Notification Aggravations], from the Secretariat of Health Surveillance, Ministry of Health. According to data obtained by *SINAN*/State Secretariat of Health, 2015, in the State of *Maranhão* alone, 1,763 cases of TB were reported in 2014, thus establishing, in the last five years, the 4th place among the Northeastern States with the highest incidence rates of TB per 100,000 inhabitants.[4,5]

Following the worldwide trend of population aging, the incidence of TB in Brazil has been targeting the elderly. In Brazil, in 2012, the total number of TB cases was 71,230 new cases of the disease, and 9.7% occurred in people aged 60 years or more, a fact that reveals the epidemiological importance of the disease among people the elderly.[6]

The elderly are considered to be 60 years of age or older. Population aging is a phenomenon occurring in both developed and developing countries, where the latter are home to two-thirds of the world's elderly population. Projections indicate that, from 1975 to 2025, the elderly population is expected to grow by 224% compared to the general population growth of 102%.[7]

Older people are particularly susceptible to infection with *Mycobacterium tuberculosis* because of the common biological factors in aging that make the elderly vulnerable to TB illness, such as poor nutrition, compromised immune systems and the presence of comorbidities. Moreover, TB illness is associated with individuals' quality of life, since TB is traditionally known as a marker of precarious living conditions in the population and as a disease in developing countries.[8]

By considering elderly people, the signs and symptoms of TB presentation are difficult to detect due to the frequent coexistence of other respiratory, cardiovascular or systemic diseases, with a similar clinical picture, and their lack of specificity when compared to young adults. Thus, constitutional complaints - fever, hyporexia, weight loss - and non-specific respiratory symptoms - dry cough, dyspnea, chest pain - may be isolated manifestations of the disease. On the other hand, there is also the difficulty of the elderly in reporting their complaints due to memory deficits, confusional states, senility and speech problems, and eventually attribute them, erroneously, to other diseases.[9]

TB as a public health problem requires a collective effort to change its endemic patterns. Public policies formulated and implemented by states and international organizations reflect a social desire for change, reduction of new infections, number of patients and deaths. TB control, in both collective and individual terms, involves several degrees of complexity, both for the establishment of the diagnosis and for the clinical and bacteriological cure of patients in the community.[4]

Given the aforementioned, the present study aimed to assess the profile and identify the factors related to tuberculosis in elderly people from the State of *Maranhão* over the period from 2010 to 2015.

METHODS

It is a cross-sectional and retrospective study based on *SINAN* secondary data from the State of *Maranhão*, which was made available by the Department of Informatics of the *Sistema Único de Saúde* [Brazilian Unified Health System] (named Datasus) over the period from 2010 to 2015. The State of *Maranhão* has an area of 331,936,955 km², counting with 217 municipalities and a population of 6,569,683 inhabitants.

The study population is comprised of all TB cases in elderly people ≥ 60 years in the State of *Maranhão*, reported in the period from 2010 to 2015, and by TB cases in young adults (from 20 to 49 years old), which served as a parameter to defining the factors related to TB in elderly people.

The variables studied were the following: age, gender, race/skin color, education, zone, entrance, clinical form, closure, sputum smear microscopy, HIV tests, x-ray, supervised treatment, AIDS, alcoholism, diabetes, and mental illness.

The data was saved in the Tabwin version 3.5 application and exported to Excel. The analysis was performed in the Stata program version 11.0.

To identify the associations between independent variables and tuberculosis in elderly people, the Poisson regression model was used. Primarily, the univariate analysis was performed, with estimates of unadjusted prevalence ratios and Confidence Interval (CI) of 95% (95% CI). The variables showing *p*-value

≤ 0.20 were included in the multivariate Poisson regression model. The selection of the variables was performed by the stepwise method with a retrograde elimination of variables. Only the variables with a value of $p \leq 0.05$ remained in the final model, for which the Prevalence Ratio (PR) and their respective 95% confidence intervals (95% CI) were estimated. The reference categories were attributed to PR of 1.00.

The present study is an integral part of the larger project named, "Prognostic factors for the outcome of pulmonary tuberculosis treatment." In compliance with the requirements of the Resolution No. 466/2012 of the National Health Council, it was submitted and approved by the Research Ethics Committee of the University Hospital from the *Universidade Federal do Maranhão (UFMA)*, under the Legal Opinion No. 473.975/2013.

RESULTS

In the State of *Maranhão*, 9,055 cases of tuberculosis were reported over the period from 2010 to 2015. Of this total, 6,671 were included in the study, of which 5,166 (77.4%) were young adults within the age group from 20 to 49 years old and 1,505 (22.6%) were elderly individuals aged ≥ 60 years old. Thus, the prevalence of tuberculosis among the elderly in the State of *Maranhão* during the study period was 16.6%.

According to the descriptive analysis of the cases of TB in elderly people, there was a predominance of male (60.4%), non-white race/skin color (85.0%), with educational level < 8 years (89.5%), living in urban areas (70.5%), who were admitted for treatment as a new case (87.4%), had a pulmonary clinical form (92.4%), who had hospital discharge due to cure (69.5%), with positive sputum smear microscopy (48.0%), negative HIV test (57.0%), suspicious X-ray (85.2%), did not use supervised treatment (54.2%), without AIDS (98.4%), no alcoholism (95.1%), no diabetes (82.2%) and without mental illness (98.9%) (**Table 1**).

In the unadjusted analysis, the following variables were associated with tuberculosis in elderly peolple: education < 8 years of study (PR = 3.58; 95% CI = 3.04 - 4.22, $p \leq 0.001$), pulmonary clinical form (PR = 1.34; 95% CI = 1.10 - 1.63, $p = 0.003$), unperformed HIV test (PR = 1.67; 95% CI = 1.50 - 1.84, $p \leq 0.001$) and bearing diabetes (PR = 2.71; 95% CI = 3.38 - 3.09, $p \leq 0.001$) (**Table 2**).

After the model adjustment, the education < 8 years of study (PR = 3.43, C95% = 2.92 - 4.02, $p \leq 0.001$), having hospital discharge without being cured (PR = 1.20; 95% CI = 1.09 - 1.32; p ≤ 0.001), unperformed HIV test (PR = 1.37; 95% CI = 1.26 - 1.49, $p \leq 0.001$) and bearing diabetes (PR = 2.24; 95% CI 2.03 - 2.47, $p \leq 0.001$) presented themselves as factors that increase the chance of occurrence of tuberculosis in elderly people. The other variables were, as follows: male gender (PR = 0.86; 95% CI = 0.79 - 0.93, $p \leq 0.001$), non-white race/skin color (PR = 0.77; 95% CI = 0.69 - 0.86, $p \leq 0.001$), hospital admission by retreatment (PR = 0.74; CI% 95 = 0.63 - 0.86, $p \leq 0.001$), positive HIV test (PR = 0.24; 95% CI = 0.08 - 0.73, $p = 0.012$), did not have supervised treatment (PR = 0.87; 95% CI = 0.80 - 0.94, $p = 0.002$), bearing alcoholism as a comorbidity (PR = 0.53; 95% CI = 0.42 - 0.66, $p \leq 0.001$) and bearing mental illness (PR = 0.47; 95% CI = 0.31 - 0.73, $p \leq 0.001$) (**Table 3**).

Table 1 - Demographic and epidemiological profile of tuberculosis cases in elderly people that were reported in the State of *Maranhão* from 2010 to 2015. *São Luis* city, State of *Maranhão*, 2017.

TUBERCULOSIS IN ELDERLY PEOPLE (≥ 60 y/o)	
Variable	**n (%)**
Gender	
Female	596 (39.6)
Male	909 (60.4)
Race/skin color	
White	225 (15.0)
non-white	1,280 (85.0)
Education	
≥ 8 years	157 (10.5)
< 8 years	1,348 (89.5)
Zone	
Rural	443 (29.5)
Urban	1,062 (70.5)
Entrance	
New case	1,315 (87.4)
Retreatment	134 (8.9)
Transfer	56 (3.7)
Clinical form	
Extrapulmonary	110 (7.3)
Pulmonary	1,391 (92.4)
Pulmonary + extrapulmonary	4 (0.3)
Discharge	
Cure	1,046 (69.5)
No cure	362 (24.0)
Transfer	97 (6.5)
Sputum smear microscopy	
Negative	501 (33.3)
Positive	722 (48.0)
Unperformed	282 (18.7)
HIV test	
Negative	858 (57.0)
Positive	27 (1.8)
Unperformed	620 (41.2)
X-ray	
Normal	40 (2.7)
Suspicious	1,282 (85.2)
Unperformed	183 (12.1)
Supervised treatment	
Yes	689 (45.8)
No	816 (54.2)
AIDS	
No	1,481 (98.4)
Yes	24 (1.6)
Alcoholism	
No	1,432 (95.1)
Yes	73 (4.9)
Diabetes	
No	1,238 (82.2)
Yes	267 (17.8)
Mental illness	
No	1,488 (98.9)
Yes	17 (1.1)
Total	**1,505 (100.0)**

Source: *SINAN*.

Table 2 - Unadjusted analysis of factors related to tuberculosis in elderly people that were reported in the State of *Maranhão* from 2010 to 2015. *São Luis* city, State of *Maranhão*, 2017.

Variable	TUBERCULOSIS IN ELDERLY PEOPLE			
	Young adult (from 20 to 49 y/o)	Elderly (≥ 60 y/o)	PR (95% CI)	*p-value*
	n (%)	n (%)		
	5,166 (77.4)	1,505 (22.6)		
Gender				
Female	1,742 (74.5)	596 (25.5)	1	
Male	3,424 (79.0)	909 (21.0)	0.82 (0.74 – 0.91)	≤ 0.001
Race/skin color				
White	575 (71.9)	225 (28.1)	1	
non-white	4,591 (78.2)	1,280 (21.8)	0.77 (0.67 – 0.89)	≤ 0.001
Education				
≥ 8 years	1,808 (92.0)	157 (8.0)	1	
< 8 years	3,358 (71.4)	1,348 (28.6)	3.58 (3.04 – 4.22)	≤ 0.001
Zone				
Rural	1,290 (74.4)	443 (25.6)	1	
Urban	3,876 (78.5)	1,062 (21.5)	0.84 (0.75 – 0.94)	0.002
Entrance				
New case	4,278 (76.5)	1,315 (23.5)	1	
Retreatment	639 (82.7)	134 (17.3)	0.73 (0.62 – 0.88)	≤ 0.001
Transfer	249 (81.6)	56 (18.4)	0.78 (0.59 – 1.02)	0.07
Clinical form				
Extrapulmonary	526 (82.7)	110 (17.3)	1	
Pulmonary	4,598 (76.8)	1,391 (23.2)	1.34 (1.10 – 1.63)	0.003
Pulmonary + extrapulmonary	42 (91.3)	4 (8.7)	0.50 (0.18 - 1.36)	0.177
Discharge				
Cure	3,798 (78.4)	1,046 (21.6)	1	
No cure	1,067 (74.7)	362 (25.3)	1.17 (1.04 - 1.32)	0.009
Transfer	301 (75.6)	97 (24.4)	1.12 (0.91 – 1.38)	0.254
Sputum smear microscopy				
Negative	1,395 (73.6%)	501 (26.4%)	1	
Positive	2,846 (79.8%)	722 (20.2%)	0.76 (0.68 – 0.85)	≤ 0.001
Unperformed	925 (76.6)	282 (23.4%)	0.88 (0.76 – 1.02)	0.098
HIV test				
Negative	3,358 (79.7)	858 (20.3)	1	
Positive	600 (95.7)	27.0 (4.3)	0.21 (0.14 – 0.31)	≤ 0.001
Unperformed	1,208 (66.1)	620 (33.9)	1.67 (1.50 – 1.84)	≤ 0.001
X-ray				
Normal	189 (82.5)	40 (17.5)	1	
Suspicious	4,327 (77.1)	1,282 (22.9)	1.30 (0.95 – 1.79)	0.094
Unperformed	650 (78.0)	183 (21.9)	1.25 (0.89 – 1.77)	0.189
Supervised treatment				
Yes	1,837 (72.7)	689 (27.3)	1	
No	3,329 (80.3)	816 (19.7)	0.72 (0.65 – 0.79)	≤ 0.001
AIDS				
No	4,619 (75.7)	1,481 (24.3)	1	
Yes	547 (95.8)	24 (4.2)	0.17 (0.11 – 0.26)	≤ 0.001
Alcoholism				
No	4,615 (76.3)	1,432 (23.7)	1	
Yes	551 (88.3)	73 (11.7)	0.49 (0.39 – 0.62)	≤ 0.001
Diabetes				
No	4,942 (79.97)	1,238 (20.03)	1	
Yes	224 (45.62)	267 (54.38)	2.71 (3.38 - 3.09)	≤ 0.001
Mental illness				
No	5,044 (77.2)	1,488 (22.8)	1	
Yes	122 (87.7)	17 (12.2)	0.53 (0.33 – 0.86)	≤ 0.011

Source: *SINAN.*

Table 3 - Adjusted analysis of factors related to tuberculosis in elderly people that were reported in the State of *Maranhão* from 2010 to 2015. *São Luis* city, State of *Maranhão*, 2017.

TUBERCULOSIS IN ELDERLY PEOPLE		
	PR (95% CI)	*p-value*
Gender		
Female	1	
Male	0.86 (0.79 – 0.93)	≤ 0.001
Race/skin color		
White	1	
non-white	0.77 (0.69 – 0.86)	≤ 0.001
Education		
≥ 8 years	1	
< 8 years	3.43 (2.92 – 4.02)	≤ 0.001
Entrance		
New case	1	
Retreatment	0.74 (0.63 – 0.86)	≤ 0.001
Transfer	0.88 (0.70 – 1.10)	0.283
Discharge		
Cure	1	
No cure	1.20 (1.09 – 1.32)	≤ 0.001
Transfer	1.15 (0.97 – 1.37)	0.085
HIV test		
Negative	1	
Positive	0.24 (0.08 – 0.73)	0.012
Unperformed	1.37 (1.26 – 1.49)	≤ 0.001
Supervised treatment		
Yes	1	
No	0.87 (0.80 – 0.94)	0.002
Alcoholism		
No	1	
Yes	0.53 (0.42 – 0.66)	≤ 0.001
Diabetes		
No	1	
Yes	2.24 (2.03 – 2.47)	≤ 0.001
Mental illness		
No	1	
Yes	0.47 (0.31 – 0.73)	≤ 0.001

Source: *SINAN*.

DISCUSSION

Herein, a high prevalence (16.6%) of cases of tuberculosis in elderly people in the State of *Maranhão* was observed. Very close results were also recorded in the State of Paraíba during the period from 2010 to 2014, where 5,444 cases of tuberculosis were reported, of which 786 (14.4%) occurred in elderly people.[10]

In poor countries, the prevalence of tuberculosis remains high in all age groups, including in the geriatric age, where it is worsened by the sum of the aging process.[11]

Low education in elderly people with tuberculosis has also been reported in several studies. In the State of *Paraíba*, the level of education of the elderly that had confirmed cases of tuberculosis presented incomplete education 24,8%.[10] In *Porto Alegre*, similar results were demonstrated where almost 75.9% of the cases had 7 years or less of study.[12] In *São Paulo*,

it was found that 77.8% of the reported cases showed a low level of education.[13]

Education has been identified as the best among the indicators used to measure the socioeconomic level, precisely because it is easy to obtain and has great importance as a determinant of health, manifesting itself in the perception and capacity to understand the information and health issues; adoption of healthy lifestyle; in the consumption and use of health services and in adherence to therapeutic procedures.[14]

Accordingly, low education increases the vulnerability to tuberculosis and becomes an important factor responsible for the increased incidence and abandonment of treatment, since it may compromise the understanding of treatment and disease.[15,16] Thus, health education actions become a mechanism that enables a greater understanding and apprehension of the knowledge raised about living with illness or being sick.[17]

Regarding the condition of closure, the discharge due to non-cure was an associated factor for tuberculosis in elderly people. A study showed that 35.4% of the elderly with tuberculosis were discharged because they did not cure.[8] It is emphasized that failure to adhere to the treatment and the use of medication for an insufficient time and/or incorrectly are factors that prevent the reach of cure by increasing the time and cost of treatment.[18]

The lower cure rate in elderly people population is due to the fact that, together with aging, some types of cardiorespiratory system disorders, such as: congestive heart failure, chronic obstructive pulmonary disease and cases of pneumonia, which can make it difficult to identify the disease early, making the diagnosis more difficult and requiring more time, which delays the treatment. Furthermore, the symptomatology presented by the elderly is scarce and nonspecific, the mishaps regarding the performance and interpretation of complementary exams, as well as the appearance of other comorbidities.[19,20]

Another variable that increased the chance of tuberculosis in elderly people was not having performed the HIV test. A result also found by Eduardo *et al.*[21] where the majority (66.01%) of the elderly were not tested for HIV testing. The fact that many older people do not perform the HIV testing can be a problematic factor, since it is extremely important, since HIV-TB co-infection is characterized as a risk factor for death among individuals with tuberculosis and the degree of immunodeficiency is the major determinant of mortality in individuals affected by the syndrome.[22]

HIV seropositivity is often discovered during the diagnosis of tuberculosis. It is estimated in Brazil that, although the supply of testing is approximately 70%, only 50% have access to their results in a timely manner, with a prevalence of positivity of 15%. Additionally, tuberculosis is the leading cause of death among people living with HIV, with a 20% coinfection death rate.[23]

Furthermore, aspects related to the sexual practices of the elderly are often a factor that is not taken into account by health professionals, which may reflect social development itself, which creates and recreates myths, taboos, and prejudices, building a limited view on the sexuality of the elderly. Thus, the non-focus on the sexuality of the elderly person and the

non-realization of health education for this population can contribute to the increase of the appearance of diseases and sexually transmitted infections for these individuals, such as HIV infection.[21]

Hence, the factors associated with TB/HIV co-infection in elderly people tend to aggravate the morbidity and mortality indicators of this population over the years, which requires more attention to health professionals in education, promotion, prevention, and treatment.[9]

Having diabetes increases the chance of tuberculosis in elderly people. A similar result was found in *Teresina* city[7] with 15% of cases, and in *Rio de Janeiro*, with 16.4% of cases.[4]

Diabetes *Mellitus* (DM) is a risk factor, increasing 2 to 4 times the development of active tuberculosis.[24] In addition to the inherent risks associated with the association of two serious DM/TB diseases and the decrease in quality of life, the literature also points out that diabetes in patients with TB can affect clinical presentation, radiology, disease severity, duration and/or response to TB treatment, making such association difficult to be diagnosed, controlled and treated.[7]

Although tuberculosis in all age groups is more frequent in males, in this study this category presented as a protector, showing a greater chance in females. There is a silencing of the elderly in the situation, which may be related to the domestic occupations referred to by them in the study performed by them, which may compromise the treatment and aggravation of the disease.[25]

Regarding the variable named race/skin color, the majority of cases of tuberculosis in elderly people occurred in non-white individuals, which is in agreement with several studies, such as the one in the Northeast Region of Brazil, where they observed that the brown color was the one with the highest number of reported cases, corresponding to 48.11%.[21] In the State of *Paraíba* in the period 2001-2010, also, they indicated a higher prevalence of the disease in brown individuals.[26] Nonetheless, in this study, as a protective factor for tuberculosis in elderly people. However, it should be noted that race/skin color difference among individuals, although susceptible to classification subjectivity, is not an isolated risk factor, but may constitute a vulnerability characteristic associated with social problems.[27]

The majority of the elderly were admitted to the health service as a new case, a similar result found in *Belém* city, where 95.1% of the elderly were also new cases.[28] On the other hand, in *Rio de Janeiro*, they found that 42.6% of the elderly with TB underwent retreatment.[29]

Although less frequently, the entry for retreatment in this study was shown to be a protective factor for tuberculosis in elderly people. This is in disagreement with the literature, since retreatment has been negatively influencing the performance of the Tuberculosis Control Program indicators, being considered one of the greatest challenges for the control of tuberculosis in Brazil.[30]

This group, formed by cases of relapse and re-admission after abandonment, presents a greater chance of developing an unfavorable outcome for the disease, such as death, abandonment and multidrug resistance to treatment drugs for TB, and also leading to an increase on patient costs. In Brazil, 96% of reported cases of resistance are acquired, as more than half shows a history of three or more previous treatments for tuberculosis.[30,31]

The variable, positive HIV test was shown to be a protective factor for tuberculosis in elderly people, probably because this association may be related to the low frequency of HIV positivity in elderly people, who are less vulnerable to the HIV virus. Since TB/HIV co-infection predominates in the economically active age group (from 15 to 50 years old),[32] it may be related to the lifestyle of young adults who adopt behaviors of vulnerability, such as lack of condom use and lack of resulting in increased exposure to HIV and *Mycobacterium tuberculosis*, resulting in very important economic and social losses, as it reaches the productive stage of the sick individual.[33] Therefore, the lifestyle of the elderly reduces the susceptibility to TB/HIV co-infection.

Failure to perform supervised treatment was also a protective factor for tuberculosis illness, which may be related to the fact that most of the elderly did not do the Dots, which can be explained due to the low coverage of this service in the State of *Maranhão* (15.5%) or by the fragility of the *SINAN* database due to underreporting.[34]

In a study carried out with elderly people in the Brazilian Northeast, 28.09% of the cases underwent supervised treatment, 25.15% did not and 46.75% were ignored or blank results. This condition is associated with the precariousness of tuberculosis surveillance, especially with regard to deficiencies in the capacity of municipalities to capture new cases or adequately record the data gathered on the notification and follow-up.[21,35]

In elderly people, particularly, studies show that supervised treatment is of paramount importance, since memory deficits, polypharmacy, and frequent occurrences of adverse effects in elderly people require that treatment must be supervised as a means of early detection of adverse effects, a guarantee of medication intake and consequent increase in the cure indicator.[36]

Supervision of the treatment of the elderly should be delegated to the health professional, family member or caregiver of the patient, and in this case, the patients should be advised of the correct dose and timing of drug administration, drug interaction and adverse effects.[36]

Studies indicate that supervised treatment has been instrumental in achieving satisfactory results.[16,37] And this may ensure greater adherence of this population, but it is not yet sufficient to solve the problem that, within a vision of health promotion, could occur through negotiation between health and education managers for greater investments in programs which already exist in the municipality.[16]

Alcoholism was another variable that presented a protection association for tuberculosis illness. However, the literature presents evidence of the association between tuberculosis incidence and alcoholism or the association between chronic alcoholics and/or elderly with susceptibility to tuberculosis disease.[38]

It is known that alcoholism generates abnormalities in the liver and heart, which leads to the possibility of impairment of lung function. Corroborating this hypothesis, it is known

that ethanol metabolites can accumulate in the lungs.[39] In addition, excessive alcohol consumption predisposes the treatment regimen to unfavorable results, as it increases the chance of development of side effects and hepatotoxicity.[40] Thus, this protective association may be related to the low frequency recorded in this study for alcohol use, less than five percent. The authors further explain that the problems related to alcohol consumption in elderly people are common; however, because they are little known, they are called by some authors as "a invisible epidemic event".

The frequency of mental illness among the elderly with tuberculosis was less than two percent, which may have contributed to the association of protection for TB illness recorded in this study. It is well known that non-psychotic mental disorders, including Common Mental Disorders, are common among individuals with TB, which contributes to the increase in the number of symptoms reported by patients and the low adherence to treatment.[41]

Although Common Mental Disorders, such as TB, are more prevalent in widowed or divorced individuals, blacks with low education and worse socioeconomic conditions, there is a shortage of studies of any nature, including epidemiological studies, on their association.[42] It is known, it is estimated that common Mental Disorders may be associated with several physical pathologies, a history of more serious mental health problems and impairment of quality of life, increasing chronic morbidities such as hypertension, diabetes, joint disorders, bronchopulmonary diseases and heart failure, and impairment in the ability to work,[43,44] factors that increase vulnerability to tuberculosis infection and development.

The literature reports that the high proportion of anxiety and depression in people with TB decreases the response to interventions, increases the utilization of health services, increases the severity of the symptoms mentioned, increases the time of treatment and the period of hospitalization. Contributing to worsening the prognosis, raising health costs and reducing TB control, besides contributing to a reduction in the quality of life of the patient.[41]

The situation of vulnerability in which the elderly are found is a predictor of TB involvement and seems to be related to the low income that conditions inadequate housing and unsanitary conditions in domestic activities, inadequate feeding, and other factors such as the difficulty of access to health services and the low resolution of care policy for the elderly, in addition to the immunological comorbidities and lows related to aging.[45]

CONCLUSIONS

A high prevalence (16.1%) of tuberculosis among elderly people (≥ 60 years old) was observed in the State of *Maranhão* during the period from 2010 to 2015, and it is clear that the elderly with a education level of < 8 years of study, cure, unperformed HIV testing and bearing diabetes might be contributing to this increase. Therefore, it is necessary the adoption of special strategies to accompany this clientele, seeking to reduce this prevalence rate.

The elderly constitute a population group at risk for tuberculosis and, therefore, deserve a special approach to disease control programs, which should take into account the peculiarities of this age group.

The increase in the detection of cases of tuberculosis necessarily goes through the increase in coverage of the Family Health Strategy, facilitating the individual's access to health services, increasing the coverage of directly observed treatment, which will certainly result in an increase in treatment adherence rates, and cure leading to the reduction of medicine withdrawal and resistance.

It is essential that the training in tuberculosis offered to health professionals must include the importance of carrying out health education activities aimed at education not only for patients with tuberculosis, but also within the communities. Professionals need to be prepared with regards to the importance of acting towards improving the health practices and seeking to disseminate knowledge about tuberculosis.

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