

Impact of population aging on the global burden of tuberculosis: A systematic review

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Abstract: *Background: Tuberculosis (TB) is a very old and still important disease and a major public health problem that threatens human health, and elder adults over 65 years of age are the most prevalent group for TB. The average life expectancy of the world population is now increasing and the rate of aging is accelerating, and it is increasingly important to explore the impact of population aging on the burden of tuberculosis. The author reviews the causes of susceptibility to tuberculosis in the elderly and the countermeasures, with the aim of contributing to the future prevention and control of tuberculosis in the elderly. Methods: We identified 502 studies published between 1953-2022 from the PubMed database by using combinations of the keywords "tuberculosis[All Fields/MeSH Terms]" and "aging[All Fields/MeSH Terms]" and "elderly[All Fields/MeSH Terms]". These 502 papers were screened in terms of content and format and finally included 9 in this review. Conclusions: The number of elderly people is increasing and the aging of the population has become an inevitable trend in the development of the world population. The major burden of tuberculosis will also shift to elderly patients. More research on TB control in the elderly is necessary, which will contribute to the achievement of global TB control goals.*

Keywords: tuberculosis; elderly; aging

1. Introduction

The COVID-19 epidemic, which is currently sweeping the globe, reverses years of human efforts to reduce the burden of TB, with the number of new diagnoses and reported cases of TB declining dramatically globally in 2021^[1]. On top of the impact of the new crown epidemic, countries around the world are facing another common dilemma-aging populations. The common international perception is that a country or region is in an aging society when 10% of the population is over 60 years old or 7% of the population is over 65 years old. The burden of disease is the pressure of disease, disability, and premature death on the economy and health of the entire society, and it includes both the epidemiological burden of disease and the economic burden. New onset of TB in young people and reactivation of TB in the elderly are two causes of the burden of TB, with the latter accounting for a significantly greater proportion^[2]. The fact that smear conversion in elder people with TB may take longer and that the prognosis appears to be worse than in younger patients is ample evidence that the aging process of the world's population places a significant burden on TB control and that TB prevention and control in elderly populations is urgent^[3].

2. Methods

We identified 502 studies published between 1953-2022 from the PubMed database by using combinations of the keywords "tuberculosis[All Fields/MeSH Terms]" and "aging[All Fields/MeSH Terms]" and "elderly[All Fields/MeSH Terms]". From 502 studies, we excluded those which not written in English and review studies (n=70), and those which abstract not available, published ten years ago (n=230), owing to not eligible based on title or other reasons, we removed a portion of studies (n=193). This left 9 studies used in this review. The details of the inclusion process are shown in Fig.1

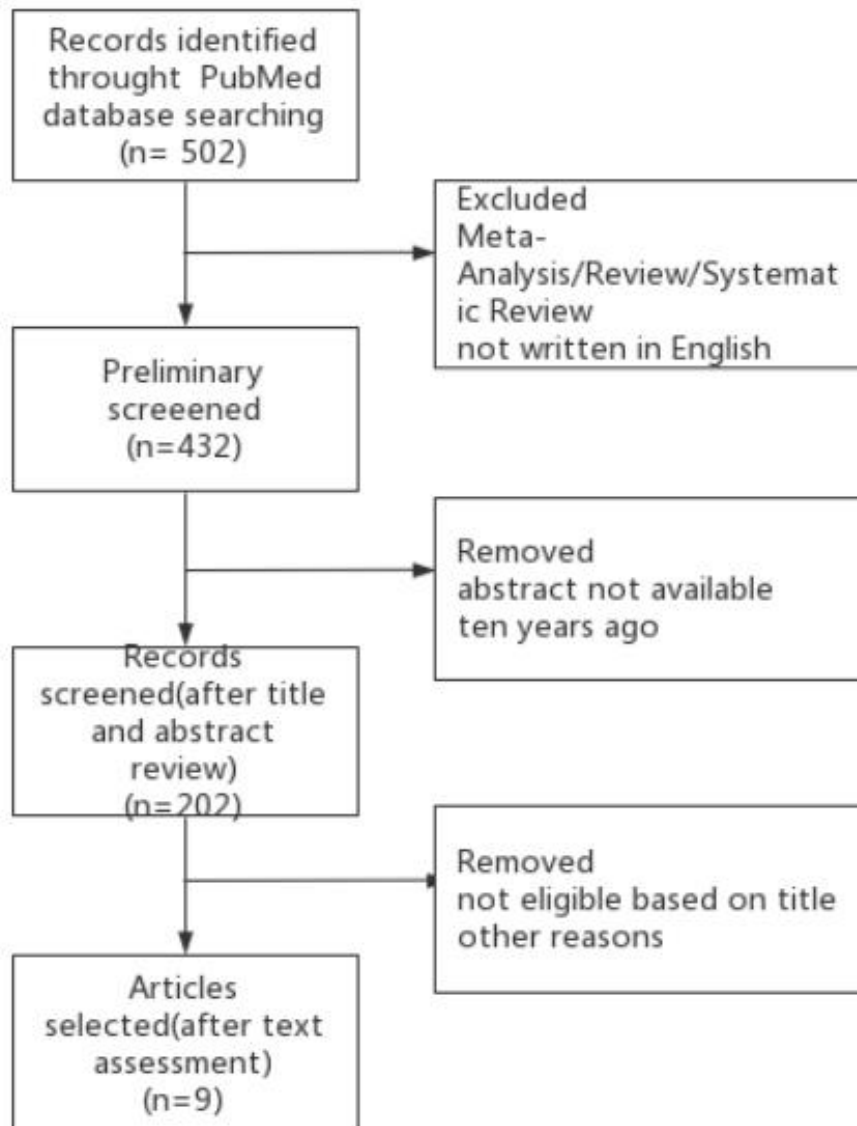


Figure 1: Flow diagram illustrating study selection

3. Results

There are 9 epidemiological studies included in this review from the database search of PubMed [4-12]. They are summarized in the Table.1 below:

The studies included in this review revealed the following outcomes:

A study in Zambia [13] comparing the prevalence and sociodemographic characteristics of tuberculosis in people over 55 years of age with those aged 15 to 54 years found that the incidence of tuberculosis was much higher in people over 55 years of age than in younger age groups and that elderly people were more likely to be affected by national tuberculosis planning for various reasons such as poverty, limited mobility, and living in rural areas, in addition to the fact that elderly patients with lower levels of education should be more focus on control. Therefore, priority should be given to the elderly group in carrying out TB prevention efforts. Several other studies [14-16] have collectively reached similar conclusions that elderly TB patients may have higher mortality rates due to weakened

autoimmunity, suffer from comorbidities or experience untimely TB diagnosis and treatment. New TB cases in the elderly are common in men and cases tend to have a history of smoking or alcohol consumption, low body weight, and comorbidities such as COPD or diabetes [17], and focusing on the elderly with these characteristics and understanding their epidemiological characteristics and trends will make the implementation of control measures easier.

Table 1: Table summarizing the findings of the studies used in this review

First author	Year of publication	Country	Study design and sample size	Influence factors	Main results
Jose Fernando Garcia-Goez	2020	Colombia	Cohort 108	Drug-drug interactions	Drug-drug interactions can reduce tuberculosis treatment success rates
Yiran Cui	2020	China, India, United States	Cohort	Smoke Diabetes	The elderly men who smoke or have diabetes lead to the incidence of TB rises
Can-You Zhang	2019	China	Cross-sectional 34269	Underweight Diabete Close contact history Previous TB history	Active case finding implements among elderly people aged 65 and above with risk factors as a priority, which will get significant yields and be cost-effective
Juan Pablo Aguilar	2019	Brazil	Case-control 284	Smoke Age	Over 50 years of age was found to increase the likelihood of treatment failure by 2.8 times
Jun Cheng	2020	China	Cohort 34076	Male Ex/current smoker BMI<18.5	For developing active TB, the contribution from non-Han nationality (35.40%),male(26.80%) and age at 75 years and above(10.85%)
Toshi taka Suzuki	2018	Japan	Cohort 146	Nursing- and healthcare-associated pneumonia (NHTB)	Elderly TB patients with NHTB, poor general health and the existence of comorbidities appeared to have a greater impact on prognosis than the severity of TB
Yong Soo Kwon	2013	Korea	Case-control 470	Dyspnea Comorbid medical conditions Intervention programme in communities	Elderly TB patients had more frequent dyspnea and less frequent active TB finding on chest CT
Xuhui Li	2018	China	Community-based trial 201	(health education, psychotherapy, family and community support intervention)	The intervention programme in communities can improve the social support for elderly patients with TB compared with single health education

In a study on the transmission of *Mycobacterium tuberculosis* in an elderly population conducted in Yamagata Prefecture, Japan [18], it was found that elderly TB patients usually lack the typical symptoms of cough or fever and they are more likely to delay the diagnosis due to some latent diseases such as aspiration pneumonia, chronic obstructive disease, etc., resulting in the occurrence of aggregation situations. Therefore, preventive measures in places where elderly people congregate may yield better results. A large Chinese study [19] included 20,486 older adults aged 50 to 70 years, in which men with a history of HBV or HCV infection, heavy smokers, and participants with a previous history of tuberculosis or silicosis were more likely to be infected with *Mycobacterium tuberculosis*. Currently, China has not developed a complete national guideline for the management of patients with latent *M. tuberculosis* infection, and a modeling analysis [2] suggests that limiting reactivation of latent infection in the elderly population would have a greater impact on reducing the burden of TB, which would contribute to China's early achievement of the global goal of ending TB by 2035.

Chu-change Ku et al [20] applied the Lee-Carter model to simulate temporal trends in age-specific TB incidence in Taiwan from 2005 to 2018, and the model predicted that elder Taiwanese TB patients will account for 78% of all TB cases by 2035 and that TB incidence will be 39% higher in 2035 than it would have been in the absence of an aging population. This shows that early adoption of TB surveillance and prevention in the elderly population is essential. In addition to this, a national long-term cohort study in Taiwan [21] found that influenza vaccination has the potential to reduce the risk of TB in elderly adults. However, researchers need more comprehensive studies to prove this finding and explain the underlying biological mechanism of this association.

Compared to younger people, the kidneys of the elderly have significantly weaker metabolic capacity, reduced activity of the microsomal enzyme system, and more accumulation of drugs in the body. And it is well known that anti-tuberculosis drugs can burden the liver and kidneys [22], so acute kidney injury caused by anti-tuberculosis drugs is not uncommon in the elderly population, and about 27% of patients will have permanent damage [23]. During the course of anti-tuberculosis treatment, changes in liver and kidney function should be routinely detected, and once liver and kidney injury is detected, changes in the condition need to be closely monitored and actively treated, with discontinuation of anti-tuberculosis drugs and active liver and kidney protection therapy if necessary.

A study [6] used a multi-stage sampling method to conduct a questionnaire survey on the current status of knowledge, attitudes, and behaviors regarding tuberculosis among 1078 elderly adults in Baoan District, Shenzhen, China, and found that elderly adults with low education and high per capita household income had a lower rate of knowledge about tuberculosis and poorer awareness of attitudes and behaviors. The early symptoms of TB are atypical and easily ignored, and many elderly people are also unaware of the national policy of free TB treatment and are reluctant to go to the clinic for fear of adding a burden to their children, all of which contribute to the delay in consultation and add to the burden of TB treatment in the elderly [24]. Moreover, the most predominant way of detecting TB cases in China is currently passive detection, such as seeking medical attention for symptoms [25], and it is particularly important to promote proactive patient behavior. Community workers should enhance TB health education for the elderly, so that every elderly person can understand and correctly recognize TB, the era of sputum consumption is over, the modern medical level is capable enough to fight TB, and people should also put their minds at ease and take a positive attitude toward TB prevention and treatment.

4. Conclusions

Tuberculosis is a dying disease in the minds of most people, when in fact it has never left our world. The elderly have a weaker immune system, are prone to malnutrition and have a higher rate of chronic degenerative diseases such as diabetes, and have less access to medical care due to poverty. The elderly as a social group are easily neglected in many ways, but when it comes to health, they deserve more attention than younger people. The current accelerated rate of population aging and the increase in the number of elderly people is certainly a great challenge for TB prevention and control. In the future, we should make the elderly population a focus of observation, especially in developing countries, and develop effective TB planning for the elderly as soon as possible, in a joint effort to achieve the great goal of ending the TB epidemic by 2035.

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