J Prima Med Sains (2023) 5(2):89-93
https://doi.org/10.34012/jpms.v5i2.4002

ORIGINAL ARTICLE

Individual and environmental risk factors for tuberculosis disease

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Abstract

This study aimed to analyze the association between individual and environmental factors and tuberculosis infection. A cross-sectional study was conducted in Puskesmas Sering, located in the Medan Tembung subdistrict, North Sumatra, in November 2022. A total of 56 people were sampled in this study. Data were collected directly from the participants through an interview using a questionnaire distributed to the respondents. The chi-squared test was used to determine the significance of the risk factors for tuberculosis. The results of this study showed a tuberculosis prevalence of 73.21%. The chi-squared test showed that all the risk factors, such as age (0.002), sex (0.006), smoking habit (0.009), population density (0.014), and environmental sanitation (0.002) were significantly associated with tuberculosis disease.

Keywords: tuberculosis, individual factor, environmental factor

Introduction

Infectious diseases continue to grow rapidly, causing an economic burden and loss of productivity. Priorities for prevention and control of infectious diseases are focused on diseases that occur frequently and cause economic and social losses, including diseases such as HIV/AIDS, tuberculosis, pneumonia, hepatitis, and neglected diseases.[1,2] Tuberculosis is a disease caused by *Mycobacterium tuberculosis* that caused 1.5 million deaths in 2018.[3,4] WHO projections show that the number of people with tuberculosis will reach 10.6 million people in 2021.[5] The results of the Basic Health Research in 2018 reported that the prevalence of the Indonesian population diagnosed with tuberculosis by health workers reached 0.42% or equivalent to 420,994 cases.[6] In North Sumatra, Medan City ranked first in the number of tuberculosis patients in 2019, with a total of 12,105 cases.[7]

Previous studies have identified factors associated with tuberculosis disease, including endogenous and exogenous factors, proximity to contacts, and social and behavioral factors. In some studies, age was one of the most common risk factors, occurring in 75% of the cases. Although it varies by age group, symptoms and disease progression are associated with decreased immunity.[8–11] Gender is also associated with an increased risk of tuberculosis infection.[12–14] The risk of tuberculosis infection is also associated with smoking behaviour and alcohol consumption.[15–18] High contact in crowded settlements and poor ventilation also increase the risk of TB transmission.[19,20] Previous studies have identified other risk factors, including family history of infection, poor waste management and access to clean water.[21]

Early observations in the Medan Tembung area showed an increase in the number of cases over the last 3 years. In 2020, 113 people were diagnosed with tuberculosis, and 215 new cases were identified in 2021. Data from August 2022 show an additional 117 cases. Tuberculosis has become the most common

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disease.[22] Therefore, this study aimed to analyze the factors associated with tuberculosis. The results of this study can help stakeholders prioritize and formulate future TB control strategies.

Method

A cross-sectional study was conducted to determine the relationship between tuberculosis and age, sex, smoking habits, housing density, and sanitation. The study was conducted in November 2022 in Puskesmas Sering, Medan Tembung subdistrict, North Sumatra. A total of 56 people were sampled in this study. Data were collected directly from the participants through an interview using a questionnaire distributed to the respondents. Age and sex were general information at the beginning of the questionnaire. Smoking habits were related to whether the participant was an active smoker and the number of cigarettes consumed per day. House density was measured by comparing the area of the house with the number of occupants.[23] To measure sanitation, subjects were given a questionnaire with 5 questions about the condition of the dwelling, ventilation and clean water facilities. All subjects were given an explanation of the background and purpose of the study, and provided consent to be sampled. Data analysis included univariate and bivariate analyses. The univariate analysis aims to provide an overview of the frequency distribution of each variable. Bivariate analysis was conducted using the chi-squared test to determine the significance of the relationship between age, sex, smoking habit, house density, and sanitation with tuberculosis disease (α=0.05). This study was approved by the Ethics Committee of Universitas Prima Indonesia (number 001/KEPK/UNPRI/X/2022).

Results

Table 1 shows that most participants were in the productive age group (15–64 years) (78.6%). The majority of respondents were male (83.9%). In terms of cigarette consumption, the majority of respondents were active smokers, who consumed more than 10 cigarettes per day (57.1%). The majority of respondents had an unqualified house density (80.4%). The majority had poor sanitation (80.4%). The prevalence of tuberculosis in this study was found 73.21%.

Table 1. Frequency distribution of tuberculosis risk factors

Variable	n	%
Age		
Productive (15 - 64 years)	44	78.6
Unproductive (> 65 years)	12	21.4
Sex		
Male	47	83.9
Female	9	16.1
Smoking habit		
No smoking	5	8.9
Smoking ≤ 10 cigarettes/day	19	33.9
Smoking > 10 cigarettes/day	32	57.1
House density		
Not eligible	45	80.4
Eligible	11	19.6
Sanitation		
Not good	45	80.4
Good	11	19.6

Table 2 shows that all variables (age (0.002), gender (0.006); smoking habit (0.009); house density (0.014) and sanitation (0.002)) were significantly associated with tuberculosis. Thus, statistically, age,sex, smoking habit, house density, and sanitation can be considered to be associated with or risk factors for tuberculosis.

Table 2. Relationship between age, sex, smoking habit, occupancy density, and sanitation with tuberculosis

Predictor	Tuberculosis				*p*
	Yes		No		
	n	%	n	%	
Age					
Productive (15 - 64 years)	31	70.5	13	29.5	0.002
Unproductive (> 65 years)	10	83.3	2	16.7	
Sex					
Male	33	70.2	14	29.8	0.006
Female	8	88.9	1	11.1	
Smoking habit					
No smoking	3	60.0	2	40.0	0.009
Smoking ≤ 10 cigarettes/day	16	84.2	3	15.8	
Smoking > 10 cigarettes/day	22	68.8	10	31.3	
House density					
Not eligible	34	75.6	11	24.4	0.014
Eligible	7	63.6	4	36.4	
Sanitation					
Not good	32	71.1	13	28.9	0.002
Good	9	81.8	2	18.2	

Discussion

Understanding these risk factors is essential for planning prevention and control strategies to protect the population from infection and to expand the area of tuberculosis transmission. In this study, individual factors such as age and sex were associated with tuberculosis. Productive-age is susceptible to tuberculosis infection because they spend more time outdoors and have high mobility.[24,25] The increased risk of tuberculosis with age is associated with decreased immunity.[8–10] Previous studies comparing treatment outcomes by gender have reported that males tend to be at risk for transmission and have a higher risk of death.[26–29] A recent systematic review confirmed that men are at high risk and have the potential for secondary infection.[30] Humayun et al.[12] reported a higher prevalence of tuberculosis among men, especially in low- and middle-income countries. The results of previous studies explain the higher prevalence in men, because women have less access to health services. Therefore, it is necessary to consider gender bias in such situations.[30] Gender differences are also associated with disparities in TB incidence and treatment outcomes.[31]

Smoking is also a risk factor for tuberculosis. This finding is similar to those of several previous studies.[32,33] In this study, the majority of subjects consumed more than 10 cigarettes per day. A study reported an increased risk of tuberculosis due to an increased amount of cigarette consumption.[34] A study in Portugal found a significant increase in risk in men who smoked more than 20 cigarettes per day.[35] Even a study in Tanzania reported that it was one of the causes of death among tuberculosis patients.[36] Other study results mentioned a significant reduction in the risk of death among tuberculosis patients who quit smoking.[37]

The environmental aspects examined in this study, house density, and sanitation, were significantly associated with an increased risk of tuberculosis infection. This finding confirms the results of previous studies.[19,20] Individuals living in areas with inadequate house density are more likely to develop tuberculosis due to high levels of contact, thereby accelerating the transmission of the virus if a family member has tested positive. The SDGs call for adequate housing to minimize the spread of infectious diseases, including tuberculosis. The SDGs state that an adequate house should minimize the spread of infectious diseases, including tuberculosis, not only in buildings, but also in supporting materials and facilities.[38] Previous studies have noted that overcrowded living conditions, poor ventilation, and poor personal hygiene can increase the risk of tuberculosis transmission. These conditions can be caused by low income, which affects the ability to live in decent and clean housing.[39] Poorly ventilated housing makes air exchange difficult, increasing the risk of infection for people in the room.[40]

Conclusion

The prevalence of tuberculosis in this study was 73.21%. The results showed that all individual factors investigated, including age, sex, and smoking habits, were significantly associated with tuberculosis. The same was true for environmental factors such as house density and sanitation. A comprehensive strategy involving patients, family members, and relevant stakeholders is needed to reduce the prevalence and success of the tuberculosis eradication program.

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