ORIGINAL ARTICLE

Smart Medical Journal

Smart Medical Journal (SMedJour) April 2024, Vol. 7, No.3, pp : 129 - 134
DOI: https://doi.org/10.13057/smj.v7i3.88225
E-ISSN: 2621-0916 | P-ISSN: 2621-1408

Investigating Factors Influencing Treatment Outcomes of Pulmonary Tuberculosis: A Cross-Sectional Study Based on Community Health Center Registry in Surakarta

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Recived: 02/07/2024
Accepted: 22/01/2025
Published: 03/02/2025

ABSTRACT

Introduction: Pulmonary tuberculosis (TB) is an infectious disease caused by the bacteria Mycobacterium tuberculosis. The successful treatment of pulmonary TB can be influenced by several factors, namely gender, age, body mass index (BMI), and comorbid diseases. This study aims to investigate whether those factors influence the treatment outcome of pulmonary TB patients in Surakarta.
Method: This study is an analytical observational study with a cross-sectional design. The research subjects were pulmonary tuberculosis patients treated in 2020-2022 at Ngoresan, Setabelan, and Sibela Community Health Center of Surakarta. The inclusion criteria was pulmonary TB patient over 15 years old. Patients suffering from other pulmonary diseases or with incomplete medical record were excluded.
Results: This study involved 101 subjects. Multivariate analysis was conducted using the logistic regression test and bivariate analysis showed that there were not any significant effect of age, BMI, and comorbid diseases observed on treatment outcome with p=0.571, p=0.147, and p=0.13 respectively. Interestingly, gender was found to be significantly influencing the outcome of pulmonary TB treatment (p=0.020)
Conclusion: Gender influencing the treatment outcome of pulmonary TB patients in Surakarta. Further study covering more cases across all Community Health Center of Surakarta is required.

Keywords: BMI; gender; age; comorbidity; pulmonary tuberculosis

INTRODUCTION

Pulmonary tuberculosis (TB) is an infectious disease caused by microorganisms called Mycobacterium tuberculosis that are resistant to acid, aerobic, and rod-shaped. This pulmonary tuberculosis disease attacks the lungs of patients causing coughing up phlegm, night sweats, fever, malaise, decreased appetite and weight, and shortness of breath. This clinical manifestation is closely related to bacterial infections that cause irritation in the patient's bronchi[1,2].

Pulmonary tuberculosis can be influenced by several factors, namely smoking habits, environmental factors, gender, social and economic circumstances, age, and nutritional status[2]. Men are more susceptible to being infected with tuberculosis than women. Some of the causes include greater workload, lack of rest, more social interaction, and unhealthy lifestyles such as smoking and drinking alcohol[3]. The adult and elderly age groups are more susceptible to tuberculosis infection. Adult age is a productive age with more mobility and social interaction. This condition increases the risk to be

exposed to people who are positive for pulmonary tuberculosis[4]. Underweight nutritional status can be one of the factors that increase the risk of pulmonary tuberculosis infection. Person with underweight nutritional status tend to have weakened immune system, and hence will be more susceptible to suffer from Mycobacterium TB infection compared to individuals with good nutritional status[5]. Therefore, pulmonary tuberculosis has a close relationship with Diabetes Mellitus (DM). DM disease is one of the conditions that can facilitate the reactivation of pulmonary tuberculosis infection6.

Age, body mass index (BMI), and comorbidity also influencing the successful treatment of pulmonary TB. Older patient, malnutrition, and comorbidity affecting the immune condition of the patients. The declining immune system due to malnutrition and comorbidity will lower the body's ability to fight infections effectively[7,8]. Research conducted by Panggayuh et al (2019), reported a correlation between BMI and comorbid diseases with treatment outcomes of pulmonary tuberculosis patients, with p-values 0.000 and 0.006, respectively6. Older patient is also more vulnerable toward the side effect of multiple drug therapy, in addition older patients may also face challenges related to adherence to treatment regimens[8]. Gender was also reported to have contribution to treatment outcome, where female pulmonary TB patients was predicted to have more favorable outcome than male patients[9]. On the other hand, a study in Indonesia conducted by Damayanti and Hikmah in 2017 observed that the favorable outcome of TB treatment was higher in male patients compare to female patients[10].

This study aims to investigate whether age, BMI, gender and comorbidity influence the treatment outcome of pulmonary tuberculosis patients in three Community Health Center of Surakarta, Central Java, Indonesia.

METHOD

This study was conducted based on ethical clearance approved by Surakarta City Health Department with reference number KS.18.03/11152/XI/2023. This retrospective analytical observational study was designed with cross-sectional approach involving pulmonary TB patients recorded in 2020-2022. The study was conducted at Ngoresan, Setabelan, and Sibela Community Health Center in Surakarta, Central Java, Indonesia. The inclusion criteria of the subjects in this study were pulmonary tuberculosis patients aged 15 years and over. Patients with complete medical record data, including information about age, gender, height, weight, comorbid diseases, and diagnosed pulmonary tuberculosis were selected in this study. This study excluded pulmonary tuberculosis patients with other pulmonary disease or those with incomplete medical record. Patients were categorized according the treatment outcome based on WHO guideline which is adapted in "Sistem Informasi TB", namely Cured, Treatment Completed, Treatment Fails, Died, Not Evaluated and Lost to Follow Up[4].

The data were subsequently examined applying multivariate analysis to identify factors significantly influencing the trearment outcome. The analysis was conducted applying multivariate log regression method using SPSS 27. The p-values <0.05 were considered statistically significant.

RESULT

Descriptive Analysis of Research Data

This study gathered data from 101 pulmonary TB patients taken from Ngoresan, Setabelan, and Sibela Community Health Center registry. The distribution of subject according to gender, age, BMI, Comorbidity, and treatment outcome was summarized in Table 1. Table 1. showed 66 male patients (65.3%) and 35 (34.7%) meet the restriction criteria of this study. Among 101 patients involved in this study, only one patient was in geriatric age (80 year), and 100 patients aged under 65 years. The majority of patients aged 15-50 years (88.1%) and 12 (11.9%) of the patients aged over 50 years. The distribution of subject according to BMI showed that 42 (41.6%) had normal BMI while 34 (33.7%) and 25 (24.7%)

were underweight and overweight respectively. The comorbidity status showed that the majority of patients (81/80.2%) did not suffering from any comorbidities. There were 19 patient suffering from diabetes melitus and 1 patient with hepatitis. The data did not give any information regarding HIV infection status of all subject.

This study categorized the treatment outcome into Cured, Treatment Completed, Treatment Fails, Died, Not Evaluated and Lost to Follow Up according the WHO categories. Cure and treatment completion were collectively considered successful TB treatment and were the referent outcome. Treatment failure, death due to any cause, treatment incomplete, and not evaluated were collectively considered unsuccessful TB treatment, which was the outcome of interest. The treatment outcome of all patients involving in this study showed a favorable result with 87,1% off patients were cured and 12,9% of patient were considered treatment completed. This study did not observe any unsuccessful outcome, this result may be related to small number of patients included in this study. Therefore, further investigation involving bigger number of patients should be conducted in the future research. Table 1. describe the distribution of the research subjects.

Table 1. Distribution of Research Subjects

Characteristics	n	%
Gender		
Man	66	65.3
Woman	35	34.7
Age (years)		
15-50	89	88.1
>50	12	11.9
BMI		
Underweight	34	33.7
Normal	42	41.6
Overweight and Obesity	25	24.7
Comorbid Diseases		
Diabetes Melitus	19	18.8
Hepatitis B	1	1
HIV/AIDS	0	0
No	81	80.2
Outcomes		
Cured	88	87.1
Treatment Completed	13	12.9
Treatment Failed	0	0
Die	0	0
Not Evaluated	0	0
Lost to Follow Up	0	0

BMI: Body Mass Index

Statistical Analysis

A multivariate analysis was conducted to examine the influence of each variable on the outcome of pulmonary TB patients. As illustrated in Table 2. the analysis showed that patient's gender made a statistically significant influence on the treatment outcome of pulmonary TB patients, with p-value 0.020. However, the age, BMI, and comorbid diseases variables were not significantly influenced the treatment outcome of pulmonary TB patients with p-values of 0.571, 0.147, and 0.231, respectively.

Table 2. Results of Multivariate Analysis between Each Variables with Pulmonary Tuberculosis Patients

	Outcome		p-value
	Cured n (%)	Treatment Completed n (%)	
Gender			
Man	62 (61.3)	4 (4)	0.020
Woman	27 (26.8)	8 (7.9)	
Total	89 (88.1)	12 (11.9)	
Age (years)			
15-50	65 (64.4)	10 (9.9)	0.571
>50	24 (23.7)	2 (2)	
Total	89 (88.1)	12 (11.9)	
BMI			
Underweight	28 (27.7)	6 (5.9)	
Normal	37 (36.6)	5 (5)	0.147
Overweight and Obesity	24 (23.8)	1 (1)	
Total	89 (88.1)	12 (11.9)	
Comorbid Diseases			
Yes	20 (19.8)	0 (0)	0.136
No	69 (68.3)	12 (11.9)	
Total	89 (88.1)	12 (11.9)	

BMI: Body Mass Index

DISCUSSION

This study analyzed the influence of gender, age, BMI, and comorbidity on the treatment outcome of pulmonary TB patients in Ngoresan, Setabelan, Sibela Community Health Center. The data described that the number of patients end up with Mycobacterium TB not converted was more in patients with underweight category. This result indicated that patients with underweight status have weakened immune system to fight the Mycobacterial TB infection, therefore those patients did not convert from bacterial positive into bacterial negative after the treatment completed[7]. The statistical analysis showed that BMI had no significant influence on the treatment outcomes of pulmonary tuberculosis patients. This result was in line with the study of Niviasari et al (2015) which showed no relationship between BMI and the recovery status of pulmonary TB patients[11]. The lack of significant influence of BMI on the treatment outcome might be caused by the nutritional intervention given to patients with underweight BMI during the treatment period. Moreover, the limited number of subjects involved in this study may also responsible for the insignificant result on the influence of BMI on pulmonary TB treatment outcome.

The majority of patients analyzed in this study were at productive age, in the range of 15-50 years, only one patient was in geriatric age. This finding was similar to research finding reported by Damayanti and Hikmah (2017) which showed that around 78.6% of pulmonary tuberculosis patients were at productive age[10]. The high level of mobility of productive age group contributes to the increase risk of exposure to *Mycobacterium tuberculosis*[12]. The statistical analysis of this study showed that there was no significant influence of age on the treatment outcomes of pulmonary TB patients. This is also similar to data reported by Maulidya *et al* (2017) which showed that there was no relationship between age and treatment success in pulmonary TBC patients[13]. This was because age is not the only factor that determines a person's risk of tuberculosis. The previous study showed that the obedient in taking medication and undergoing treatment with discipline were the main factor contributing to the successful treatment[14].

In respect to gender category, this study showed that most pulmonary TB patients were male with a percentage of 64.4%. The results of this study are also in line with research conducted by Harfiani and Nurhakim (2020) which showed that the majority of TBC patients were male with a percentage of 59.4%. Pulmonary tuberculosis is more common in men than women because the majority of men have smoking habits that can increase the risk of developing pulmonary tuberculosis[15]. In addition, there are several other reasons which put men to be more susceptible to tuberculosis infection than women. Some conditions which increase the risk of TBC infections in man are greater workload, lack of adequate rest periods, more frequent social interaction, and alcohol consumption[3]. Although the proportion of male patient higher than female patient, this study shows that the number of female patients with treatment status "treatment Completed" were more than male patients. Statistical analysis showed that gender significantly influenced the pulmonary TB treatment outcome (p=0.020). Further investigation showed that there was no difference in the distribution of BMI between men and women. This suggests that in this study, the treatment outcomes are influenced only by gender. According to research conducted by Damayanti and Hikmah (2017), there was a correlation between gender and the successful outcome of pulmonary tuberculosis treatment[10]. Another study also reported that the majority of patients who successfully cured from pulmonary tuberculosis treatment were men[12]. This was due to the lower frequency of visits from women to health facilities on time, even though the distance and access to health facilities were adequate. Women's delay in getting health care is caused by incorrect understanding on the disease. The stigma on tuberculosis causes fear of exclusion from their families and surroundings. Therefore, significant support from the closest people is very important for female patients with pulmonary tuberculosis to receive treatment and achieve cure[16].

This study found that diabetes is the main comorbidity on pulmonary TB patients. Among 21 patients with comorbidity 20 patients contracting diabetes, while 1 patient with hepatitis B. The statistical analysis showed that comorbidity was not significantly influence the treatment outcomes of pulmonary tuberculosis patients. This finding is not in accordance with research conducted by Yanti in 2017 which showed that there was an influence of Diabetes comorbidity on the successful of pulmonary TB treatment. Patients with diabetes and tuberculosis have a high risk of experiencing a recurrence of the disease. Furthermore, multiple drug regimen of TBC treatment possesses hepatotoxic effects which increase the risk of treatment failure among pulmonary TBC patients with diabetes[17].

Limitation of study

This study only involved 101 subjects with eligible medical record. The limited number of research subjects analyzed in this study might explained some inconsistencies between the result of this study and the result other studies. Further investigation involving bigger number of subjects is required to re-evaluate the effect of age, BMI, gender, and comorbidity on the outcome of pulmonary TBC treatment.

CONCLUSION

This study found that gender significantly influenced the treatment outcomes of pulmonary tuberculosis patients. However, in contrast to the theoretical hypothesis this study found that BMI, age, and comorbidity status not significantly influenced the treatment outcomes of pulmonary tuberculosis patients in Surakarta City.

ACKNOWLEDGEMENT

The authors reported no competing interests.

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