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FACTORS ASSOCIATED WITH TUBERCULOSIS TREATMENT SUCCESS IN BANTUL, INDONESIA: SECONDARY DATA ANALYSIS OF TUBERCULOSIS INFORMATION SYSTEM 2020–2022

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Abstract

Indonesia has the world's second-highest number of tuberculosis (TB) patients. Patients with TB frequently experience boredom and a lack of medication adherence, resulting in lower treatment rates. This study was conducted to identify factors associated with successful TB treatment using a Tuberculosis Information System (SITB), the centralized system used to record and report TB cases. We conducted the cross-sectional study using secondary data from SITB for 2020-2022. Treatment success was the sum of cure and treatment completion. Loss to follow-up, death, and treatment failure were defined as unsuccessful treatment. Age, gender, contact investigation, type of TB diagnosis, anatomical site, treatment history, diabetes status, and HIV status were the independent variables. The dependent variable was the treatment outcome. Inclusion criteria include TB patients over the age of 15 with treatment results, whereas incomplete data was excluded. Total sampling was used. We applied multiple logistic regression to analyze the factors associated with treatment results. Only 421 of the 1377 data obtained were complete and analyzed. Most of them received standard therapy (92.53%), aged 15-64 years (95.03%), females (96.30%), and had contact investigation (97.45%). The significant factors for TB treatment success were age (aOR 5.61; 95% CI 2.42-12.99), gender (aOR 2.68; 95% CI 1.01-7.07), type of TB diagnosis (aOR 0.43; 95% CI 0.19-0.99), and contact investigation (aOR 3.37; 95% CI 1.09-10.39). TB patients of productive age, female, bacteriologically confirmed, and performing a contact investigation had a greater probability of successful therapy. Multisectoral collaboration is required for tuberculosis control; contact tracing should be encouraged to improve treatment outcomes for tuberculosis in index cases and other risk factors should be explored to establish a population-level intervention.

Keywords: tuberculosis, successful, treatment, factors, contact investigation

Introduction

Tuberculosis (TB) is the primary cause of a single infection and one of the top ten causes of death, as per the World Health Organization (World Health Organization, 2020). Identification of TB issues and strategies in high-prevalence countries are crucial for global TB control (Pradipta et al., 2021). TB,

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caused by Mycobacterium tuberculosis, is a common infectious disease that usually affects the lungs but can also affect other organs (Raviglione & Sulis, 2016).

In 2019, Southeast Asia had 44% of global new TB cases, followed by Africa (25%), and the Western Pacific (18%). Eight countries account for two-thirds of global TB incidence, with Indonesia ranking second after India. (World Health Organization, 2020)

Since 1995, Indonesia has used the DOTS (Directly Observed Treatment Short-course) approach to prevent TB. This approach emphasizes supervision to ensure that patients complete treatment according to the rules until they are cured. (Kurniawan et al., 2015).

DOTS is currently the most effective approach to tuberculosis control. The five key components of DOTS are government commitment to TB management, sputum smear microscopy for those with symptoms, a standardized program of treatment of six to eight months for confirmed sputum smear-positive cases, with directly observed treatment (DOT) for the initial two months, an ongoing distribution of anti-TB drugs, and a standardized recording and reporting system (World Health Organization, 1999)

A patient's awareness of the treatment program influences treatment outcomes in TB patients. Knowledge of health is defined as an individual's behavior in treatment or care, diet, and daily behaviors that conform with health standards. Lack of participation in health-related activities, such as skipping staff meetings, refusing treatment, and disobeying advice from health experts are all signs of ignorance about health. (Tukatman et al., 2021).

In the Yogyakarta Province's Special Region, the percentage of TB cases detected in 2022 was 51%, a considerable increase from the 33.50% in 2021. Over the past five years, this year's achievement figure is the highest. However, the success rate for TB treatment in 2022 drop by 3.75% to 84.30%. Of the two regions, Bantul Regency had the highest treatment success rate (92.3%) while Gunung Kidul Regency had the lowest (56.0%). (Dinas Kesehatan DIY, 2023). The success rate for TB treatment in Bantul Regency is attributed to the launch of the STOP TB program in the community in 2021. (Dinas Kesehatan Bantul, 2022).

To prevent and manage the infection, the Indonesian government implemented tuberculosis control regulations. One of these is the Tuberculosis Information System (SITB). It is used to record and report tuberculosis cases online. (Peraturan Menteri Kesehatan Republik Indonesia, 2016)

Many factors can contribute to TB treatment success. The most efficient way to stop the spread of tuberculosis in the community is to cure infectious TB patients. Other methods include TB patient compliance with taking anti-tuberculosis medication (OAT), microscopic case detection, as well as discovery and curing infectious TB patients. Based on these problems, this research was conducted to analyze the factors that contribute to the success of TB treatment using the Tuberculosis Information

System (SITB), in order to provide advice to the district health office regarding the prevention and control of TB disease in the community of Bantul Regency.

Materials and Methods

This cross-sectional study used 2020–2022 Tuberculosis Information System (SITB) data from Bantul Regency. All of the tuberculosis patients listed in SITB made up the study population. This study included individuals diagnosed with tuberculosis (TB) who were 15 years of age or older and had complete treatment results. However, individuals with incomplete data were excluded from the study. The sample was determined by total sampling.

The dependent variable was treatment results, which included successful and unsuccessful treatments. Treatment success was defined as the total of cure and treatment completion. Loss to follow-up, death, and treatment failure were all considered unsuccessful treatment. Age (15-64 years vs > 64 years), gender (male vs female), contact investigation (yes vs no), type of diagnosis (bacteriologically confirmed vs clinically confirmed), TB classification (pulmonary TB vs extrapulmonary TB), treatment history (relapse treatment and new treatment), treatment status (standard treatment vs non-standard treatment), HIV comorbidity (yes vs. no), and diabetes comorbidity (yes vs. no) were the independent variables.

Univariate, bivariate, and multivariable analysis are used in this study. Univariate analysis was used to identify the respondents' characteristics, which were then tabulated for explanation. These characteristics included age, gender, type of diagnosis, TB classification, treatment history, HIV comorbidity, and diabetes comorbidity. Bivariate analysis used the chi-square test to analyze each independent variable and treatment outcome. Factors with p-values < 0.25 are included in the multivariable analysis. In multivariable analysis, multiple logistic regression determined the adjusted odds ratio (aOR) with a 95% CI. The adjusted odds ratio (aOR) was used to assess the level of association between predictor factors and treatment outcome.

Results and Discussion

This study found 421 TB patients with 92.6% success rate. Most TB patients with successful treatment received standard therapy (92.53%), aged 15-64 years (95.03%), females (96.30%), had contact investigation (97.45%), bacteriologically proven (94.96%), had extrapulmonary tuberculosis (95.56%), received new TB therapy (92.73%), had HIV comorbidities (100%), and had no diabetes comorbidities (93.69%)

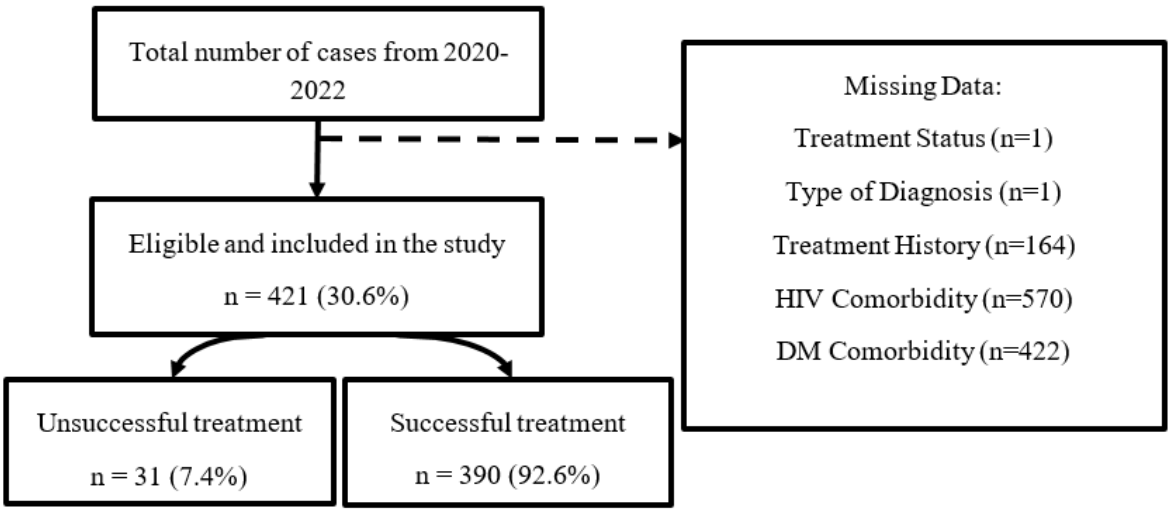

Figure 1. Flowchart of TB treatment outcome in Bantul, Indonesia, from 2020-2022.

Bivariate analysis revealed that those who were female, between the ages of 15 and 64, got contact investigations, and had TB that was bacteriologically confirmed had the highest likelihood of completing TB treatment. According to this study, individuals between the ages of 15 and 64 had a 5.40-fold higher chance of completing TB treatment successfully than those who did not. Then, for multivariable analysis, variables with a p-value of less than 0.25 are included in the following analysis using multiple logistic regression.

The results of the multivariable analysis showed that the variables most strongly linked with the outcomes of tuberculosis therapy were age, gender, contact investigation, and type of diagnosis. After adjusting for other variables, a significant predictor of successful TB therapy includes age (aOR 5.61; 95% CI 2.42-12.99), gender (aOR 2.68; 95% CI 1.01-7.07), type of TB diagnosis (aOR 0.43; 95% CI 0.19-0.99), and contact investigation (aOR 3.37; 95% CI 1.09-10.39). This demonstrates that, after adjusting for other variables, the success of TB therapy was 5.61 times higher in those aged 15-64 years than in those who failed TB therapy.

We discovered that productive age (15 to 64 years old) has a higher likelihood of successful treatment than older age. Research indicates that elderly individuals have lower treatment completion rates and a higher chance of treatment failure. (Guthmann et al., 2020). Old age in carrying out TB treatment increases the likelihood of failure due to the presence of other accompanying diseases that cause increased drug side effects, drug withdrawal, and increased cases of re-treatment and resistance to anti-Tuberculosis drugs (OAT). (Kurniawan et al., 2015). Meanwhile, people in the productive age group

are more likely to receive social interventions and information for tuberculosis therapy due to their significant social engagement and socioeconomic mobility.

Table 1. Characteristics of Respondent Based on TB Treatment Status

Characteristics	**Treatment Results**		**Total***
	Unsuccessful Treatment	**Successful Treatment**	
	n (%)	**n (%)**	**n (%)**
Treatment Status			
Non-Standard Treatment	0 (0.0)	6 (100)	416 (98.6)
Standard Treatment	31 (7.47)	384 (92.53)	6 (1.4)
Age			
15-64 years old	18 (4.97)	344 (95.03)	362 (86.0)
> 64 years old	13 (22.03)	46 (77.97)	59 (14.0)
Gender			
Males	25 (9.65)	234 (90.35)	162 (38.5)
Females	6 (3.70)	156 (96.30)	259 (61.5)
Contact Investigation			
No	27 (10.23)	237 (89.77)	157 (37.3)
Yes	4 (2.55)	153 (97.45)	264 (62.7)
Type of Diagnosis			
Bacteriologically Confirmed	14 (5.04)	264 (94.96)	143 (34.0)
Clinically Confirmed	17 (11.89)	126 (88.11)	278 (66.0)
TB Classification			
Extrapulmonary TB	2 (4.44)	43 (95.56)	376 (89.3)
Pulmonary TB	29 (7.71)	347 (92.29)	45 (10.7)
Treatment History			
Relapse Treatment	2 (9.09)	20 (90.91)	399 (94.8)
New Treatment	29 (7.27)	370 (92.73)	22 (5.2)
HIV Comorbidity			
Yes	0 (0.0)	9 (100)	412 (97.9)
No	31 (7.52)	381 (92.48)	9 (2.1)
Diabetes Comorbidity			
Yes	11 (10.58)	93 (89.42)	317 (75.3)
No	20 (6.31)	297 (93.69)	104 (24.7)

*this is the total percentage column

This study demonstrates that females are more likely than males to have favorable treatment results. Females are known to adhere to therapies better and complete TB treatments more often than males. (Berry et al., 2019) In low-and middle-income nations, the male-to-female TB morbidity and mortality

ratio is approximately 2:1. (Horton et al., 2016). Studies reveal that males are less likely to receive a prompt diagnosis of TB due to stigmatization. (Horton et al., 2016) Additionally, in the context of HIV, males are more likely not to take treatment and have worse results. (Ifebunandu & Ukwaja, 2012). It is also found that females had better treatment outcomes than males, perhaps due to higher risk behaviors (alcohol, drug, and tobacco usage) among males (Johansson et al., 2000).

From this study, tuberculosis patients who underwent contact tracing had a threefold better treatment outcome. This is consistent with another study that found contact tracing increased treatment success and cure by threefold in index TB cases and decreased treatment loss to follow-up and death by more than 60% (Baluku et al., 2021). These findings emphasize the importance of contact investigations to detect undiagnosed TB in contacts and improve index TB treatment outcomes. Furthermore, by involving the home and social contacts, contact tracing improves social support for the index TB case, which is critical for reducing follow-up loss (Tola et al., 2015)

Clinically diagnosed tuberculosis patients had a higher mortality rate than bacteriologically confirmed patients, despite comparable treatment success rates. However, treatment outcomes were similar for both diagnoses (Abdullahi et al., 2021). Previous research showed empiric diagnosis may increase TB false-positives. A simulated analysis revealed that using microscopy and clinical diagnostics could result in 37% false positives between 2017 and 2020 (Lalli et al., 2018). The higher fatality rate may be due to inadequate treatment of serious illnesses other than tuberculosis (Glynn et al., 1998).

Table 2. Bivariate and Multivariable Analysis Based on TB Treatment Status

Characteristics	**Bivariate Analysis**		**Multivariable Analysis**	
	OR (95% CI)	**P-value**	**aOR (95% CI)**	**P-value**
Treatment Status				
Standard Treatment	0 (0-8.17)	0.48		
Non-standard Treatment	Ref			
Age				
15-64 years old	5.40 (2.26-12.49)	< 0.001	**5.61 (2.42-12.99)**	**< 0.001**
>64 years old	Ref		Ref	
Gender				
Females	2.77 (1.07-8.45)	0.02	2.68 (1.01-7.07)	0.04
Males	Ref		Ref	
Contact Investigation				

Yes	4.35 (1.47-17.42)	0.003	3.37 (1.09-10.39)	0.03
No	Ref		Ref	
Type of Diagnosis				
Clinically Confirmed	0.39 (0.17-0.87)	0.01	0.43 (0.19-0.99)	0.04
Bacteriologically Confirmed	Ref		Ref	
TB Classification				
Pulmonary TB	0.55 (0.06-2.33)	0.42		
Extrapulmonary TB	Ref			
Treatment History				
New Treatment	1.27 (0.13-5.69)	0.75		
Relapse Treatment	Ref			
HIV Comorbidity				
No	0 (0-5.38)	0.39		
Yes	Ref			
Diabetes Comorbidity				
No	1.75 (0.73-4.00)	0.14	2.24 (0.94-5.37)	0.06
Yes	Ref		Ref	

Based on these data, a significant number of patients with TB who have been clinically diagnosed may be suffering from co-occurring serious illnesses. However, the extent of co-occurring diseases in individuals diagnosed with tuberculosis remains unclear. The previous results may indicate a considerable correlation between diagnostic ambiguity and death. (Abdullahi et al., 2021)

Our analysis of surveillance data has considerable limitations, such as the fact that only one-third of the cases include information on treatment outcomes, implying that only a small proportion of cases have been analyzed. Furthermore, this study was limited to a few variables, leaving many others out. More study with a larger number of samples and variables is required to identify the factors that contribute to successful treatment.

Conclusion

This study discovered that the success rate for tuberculosis treatment is quite high, with positive predictors including the tuberculosis patient being female, of productive age, bacteriologically confirmed, and having contact investigation. These factors have an impact on treatment success. Multisectoral collaboration in tuberculosis control is needed to improve index case treatment results,

especially to increase contact investigations and monitor elderly patients. Contact investigation supervision in TB patients' homes, social, and work environments must be improved to detect more cases. In elderly patients, supervisors taking TB medication are required frequently.

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Declaration of Interest Statement

The authors declare that they have no conflict of interest.

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