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Original Research

Determinant of Successful Tuberculosis Treatment in Puskesmas

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Abstract—*Indonesia is one of the countries that contribute the most mortality of TB in the world. The tuberculosis treatment success rate in Indonesia is 86% meanwhile is still far from the target coverage of the TB treatment success rate (90%). This study conducted to determine the determinant factors of successful TB treatment in Puskesmas Singosari. A cross-sectional design study was constructed for this study and used SITB and form TB as a research instrument. The population of this study were all drug-susceptible TB patients who had completed treatment at the Puskesmas Singosari in 2020, 2021, and QI-QII in 2022. The sample of this study was 71 people from 99 total population. The dependent variable is the success of drug-susceptible TB treatment. Independent variables are sex, age, weight, regular use of anti-tuberculosis drugs, and comorbidities. The data processing and analysis are being conducted using SPSS software. Chi-square analysis showed that the variable weight changes have a significant assosiation to successful tuberculosis treatment (p = 0,014; OR = 9,818). Puskesmas Singosari's TB Team can collaborate with the nutritionist team to optimize TB treatment by monitoring nutritional status and weight gain of drug-susceptible TB patients.*

Keywords: *tuberculosis, drug-susceptible, successful treatment, determinant*

Abstrak—Indonesia termasuk salah satu negara penyumbang sebagian besar kasus kematian TB secara global. Persentase keberhasilan pengobatan TB di Indonesia ialah 86%, dimana masih jauh dari target cakupan keberhasilan pengobatan TB (90%). Penelitian ini dilaksanakan untuk mengetahui faktor determinan yang berhubungan dengan keberhasilan pengobatan TB Sensitif Obat di Puskesmas Singosari. Desain studi *cross sectional* digunakan dengan data sekunder bersumber dari SITB dan arsip formulir TB. Populasi dari penelitian ini adalah seluruh pasien TB-SO yang telah menyelesaikan pengobatan di Puskesmas Singosari pada tahun 2020, 2021, dan TW I-II tahun 2022. Sampel penelitian berjumlah 71 orang dari total populasi 99 orang. Variabel terikat dari penelitian ini yaitu keberhasilan pengobatan TB-SO. Variabel bebas yang diteliti yaitu jenis kelamin, usia, BB awal pengobatan, perubahan BB selama pengobatan, keteraturan minum OAT, dan komorbid. Hasil analisis membuktikan bahwa variabel perubahan berat badan berhubungan secara signifikan dengan keberhasilan pengobatan TB (p = 0,014; OR = 9,818). Rata-rata kenaikan berat badan pada pasien yang berhasil menjalani pengobatan TB adalah sebesar 2,19 kg. Tim P2TB Puskesmas Singosari dapat bekerjasama dengan program gizi masyarakat dalam optimalisasi pengobatan pasien TB melalui pemantauan status gizi dan kenaikan BB Pasien.

Kata kunci: *tuberkulosis, sensitif obat, keberhasilan pengobatan, determinan*

INTRODUCTION

Tuberculosis (TB) is an infectious communicable disease caused by Mycobacterium tuberculosis (M.TB). Tuberculosis primarily affects the lung parenchyma, and patients with M.TB in the lung parenchyma are Pulmonary TB patients. Tuberculosis can also infect other organs, where patients with M.TB outside the lungs are Extra-pulmonary TB patients. Additionally, TB is classified based on drug susceptibility. Drug susceptibility testing can be used as rapid molecular tests to determine whether the TB patient is resistant or still sensitive to anti-TB drugs. Patients with Drug-Resistant TB will be categorized into various types of Drug-Resistant TB based on the specific drug resistance patterns. Patients who are not resistant to anti-TB drugs while can still be treated using first-line drugs are categorized as Drug-Susceptible TB patients [1].

Tuberculosis remains a public health challenge in Indonesia and globally, and it is one of the priorities of the Sustainable Development Goals (SDGs) health development program [2]. Based on the latest data from WHO in 2019 regarding the top causes of death, TB is one of the leading causes of mortality from a single infectious agent, ranking higher than HIV/AIDS at 13th place. In 2019, TB contain on the list of top causes of death in Indonesia. The discovery of new TB cases during the COVID-19 pandemic hampered, leading to an increase in the number of undiagnosed and untreated individuals with TB, resulting in a rise in TB-related mortality

rates. In 2019, there were around 1.4 million deaths due to TB worldwide. However, during the pandemic, there was an increase to 1.5 million TB-related deaths in 2020, which further escalated to 1.6 million in 2021. Indonesia is one of the four countries contributing to the mostly TB-related deaths globally. In 2021, Indonesia was among the eight countries responsible for two-thirds of TB cases worldwide [3].

The treatment success rate for TB patients in Indonesia in 2021 was approximately 86% [2]. The number of TB cases detected and treated in Indonesia experienced a decrease in 2020, with 568,987 cases in 2019 decreasing to 393,323 cases in 2020. In the following year, 2021, there were 443,235 cases, and as of August 1, 2022, the updated data from the Tuberculosis Information System (SITB) shows a total of 258,355 TB cases [2]. East Java is among the tenth provinces in Indonesia with the lowest Case Notification Rate (CNR). The treatment success rate is an indicator used to evaluate tuberculosis treatment by considering the number of all tuberculosis cases that have been cured and completed treatment among all reported and treated TB cases. The treatment success rate of TB in East Java in 2021 reached 89.13%, which is considered quite good, but it has not yet met the target set by the Ministry of Health's Strategic Plan for 2021, which is a TSR (Treatment Success Rate) of >90%. Malang Regency has also not yet reached the target for TB treatment success, with a TSR of approximately 88.52% [4].

Research related to the treatment success of TB, especially in patients with Drug-Susceptible TB, is crucial to conduct. Treatment failure in Drug-Susceptible TB patients can increase risk of them being Drug-Resistant TB patients. In efforts to combat TB in Indonesia, the National Target and Strategy for Tuberculosis Elimination have established. The target for treatment success rate of Drug-Susceptible TB in Indonesia is up to 90% [5]. The treatment success rate for Drug-Resistant TB patients in Indonesia is lower than treatment success rate of Drug-Susceptible TB. The treatment success coverage for Drug-Resistant TB in Indonesia in 2021 has only reached 46% [6]. The treatment process for drug-resistant TB patients requires a much longer duration, approximately 2 years. Therefore, achieving treatment success in drug-susceptible TB patients have to be optimized to prevent treatment failure. If treatment fails and the patient develops drug-resistant TB, it can increase disease burden.

The success of TB treatment can be affect by various factors. The theory proposed by H.L. Blum posits that varied factors affect the health status of a community [7]. Previous research in Bima Regency has shown that age and gender factors influence increasing the chances of TB treatment success [8]. Further research conducted at Malawili Health Center shows a significant relationship between the success of TB treatment and patient adherence to medication [9]. Furthermore, comorbidities such as Diabetes Mellitus, as evidenced by previous literature reviews, have been shown to have an impact on the success of pulmonary TB treatment. Respondents without comorbid DM during TB treatment have a 2.056 times higher chance of recovery or successful TB treatment [10]. Optimizing TB treatment can also be done by monitoring nutritional status. Improving nutritional status can support nutrient absorption, which facilitates successful treatment.

Researchers have found that several previous articles still have differences in research results regarding variables that can be affected TB treatment success [11]. Therefore, further research on the determinants of TB treatment success is still needed. This study utilizes the modified H.L. Blum theory as the theoretical framework. An analysis will conducted regarding the relationship between variables such as age, gender, weight, medication adherence, and comorbidity with the success of Drug-Susceptible TB treatment. These variables have shown differences or gaps in previous research, highlighting the need for this current study. What sets this study apart from previous research is the inclusion of weight as a variable. The weight of TB patients at the beginning of treatment and changes in weight during the treatment will be analyzed in relation to the final treatment outcome. Additionally, the comorbidity in TB patients will be analyzed without categorizing the specific types of comorbidities, focusing on the overall treatment success.

The research was conducted at the working area of Singosari Primary Health Center (UPT Puskesmas Singosari). Singosari Primary Health Center ranks among the top three health centers with high TB case findings in Malang Regency as of October 10, 2022 (12). Although the treatment success rate for Drug-Susceptible TB in Singosari Primary Health Center is already quite good, there has been an increasing trend in treatment failure cases among Drug-Susceptible TB patients in the early months of 2022 compared to the two previous years (13). There has been no previous research conducted in the Singosari area regarding factors related to TB treatment success. This study is necessary to identify the determinant factors associated with TB treatment success in Singosari Primary Health Center. The results of the research can be used as considerations for developing effective and targeted prevention programs for treatment failure cases in Drug-Susceptible TB patients.

METHODS

Design Study and Variables

This quantitative study employs an analytical observational design with a cross-sectional approach. The dependent variable in this study is the treatment success of drug-susceptible tuberculosis (TB) patients, indicated by either 'cured' status or 'completed treatment' status. Drug-susceptible TB patients are considered cured if they test negative for sputum acid-fast bacilli (AFB) at the end of treatment and one prior examination. Patients are classified as having completed treatment if they finish the treatment regimen without evidence of treatment failure, even if sputum AFB results are unavailable. Drug-susceptible TB patients in this study who were classified as treatment failures exhibited persistent positive sputum AFB results either in the fifth month or at the end of treatment, or they passed away during TB treatment. Patients classified as drug-susceptible TB were selected based on their records in the Tuberculosis Information System (SITB) drug susceptibility testing table. Drug susceptibility testing using the Rapid Molecular Test was conducted at the initial TB diagnosis. If the diagnosis remained drug-susceptible throughout the six-month treatment period, the patient was categorized as drug-susceptible TB.

The independent variables in this study include age, gender, initial weight at the start of treatment, weight changes during treatment, medication adherence, and comorbidities in TB patients. The Age variable was categorized into three groups based on the adult, pre-elderly and elderly age group classifications by the Ministry of Health of Indonesia [14]. The initial weight variable is divided into three groups based on weight categorization for determining the dosage of anti-TB drugs recommended by the Ministry of Health of Indonesia [15]. Patient adherence to anti-TB drugs is assessed based on medication records in the Tuberculosis Information System (SITB) and cross-checked with the TB-01 form. Comorbidities in patients are assessed based on the comorbidity table in the additional information section of the SITB. They are categorized based on their presence or absence during TB treatment, without specifying specific comorbidity types during the analysis.

Population and Sample

The population of this study consists of Drug-Susceptible TB patients in Singosari Primary Health Center (UPT Puskesmas Singosari), with a total population of 99 individuals. The research sample was selected using a purposive sampling technique, including all Drug-Susceptible TB patients who completed TB treatment and were recorded in the Tuberculosis Information System (SITB) of Singosari Primary Health Center from 2020 to 2022 and met the criteria for the research sample. The minimum sample size is determined using the hypothesis testing formula for the difference of proportions (Lemeshow 1977).

$$n = \frac{\{ Z_{1-\alpha/2} \sqrt{2P(1-P)} + Z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)}\}^2}{(P_1 - P_2)^2}$$

The sample size in this study is 71 individuals. The inclusion criteria for the research sample are Drug-Susceptible TB patients who completed treatment and were recorded in the SITB of Singosari Primary Health Center during the periods of Q1-Q4 (January-December) in 2020-2021 and Q1-Q2 (January-June) in 2022. The exclusion criteria for the research sample are patients who had previously undergone TB treatment, patients who transferred to other healthcare facilities during TB treatment, referred TB patients from other healthcare facilities, patients who were pregnant during TB treatment, patients with incomplete data regarding age, gender, initial weight, weight during advanced treatment, medication adherence, comorbidity history, and patients who were not evaluated for the final treatment results.

Instrument and Data Analysis

The research instrument uses secondary data from the Tuberculosis Information System (SITB) of Singosari Primary Health Center, supplemented by medical records and TB form archives. Patient data used in the study covers the period from the first quarter (January-March) of 2020 to the second quarter (April-June) of 2022. Data collection is conducted through documentation techniques, which include recording available reports and compiling them into analyzable data. The collected raw data is processed through stages that include editing, coding, data entry, cleaning, and tabulation. In the editing stage, data is checked for completeness and conformity to the required data. Subsequently, the data is coded according to the categorization of each variable. Data entry is performed, and data processing is initiated using SPSS software. The SPSS analysis results are cross-checked to avoid missing data. Once the data analysis results are accurate and secure, they are compiled into tables to facilitate the researcher's interpretation of the data analysis results. Data interpretation occurs concurrently with the organization of research findings and discussions.

After the data processing stage, the next step involves univariate, bivariate, and multivariate analyses. Univariate analysis utilizes statistical tests, with the results presented in the form of frequency distributions and percentages. Next bivariate analysis initially uses the chi-square (x^2) test, but if the assumptions for this test are not met, an alternative test, such as Fisher's exact test, is employed. Then, multivariate analysis is conducted using multiple logistic regression to measure the size of the association through adjusted odds ratios (OR) calculation with a 95% confidence interval (CI) at a significance level of α=0.05. Multivariate analysis identifies the independent variables with the most dominant association with the dependent variable. It also determines the likelihood of treatment success in Drug-Susceptible TB patients exposed to specific factors compared to those not affected by these factors. This research has obtained ethical approval from the Ethics Commission of the Faculty of Dentistry, Universitas Airlangga on January 30, 2023, under number 076/HRECC.FODM/I/2023.

RESULTS

Respondent Characteristics

Based on the data collected through the Tuberculosis Information System (SITB) of Singosari Primary Health Center, a total of 99 individuals completed TB treatment at Singosari Primary Health Center during the period of 2020 until the first two quarters of 2022. Furthermore, 94 Drug-Susceptible TB patients met the inclusion criteria. Five samples were excluded as they were not Drug-Susceptible TB cases but rather classified as TB in children. Subsequently, an exclusion criteria assessment was performed, leading to a total of 71 research samples. A total of 23 samples were excluded due to one person being pregnant, one person transferring to another health facility, eight people lacking complete data, and thirteen people having previously undergone TB treatment. More than half of the research samples were female (*n*=40). The research samples were dominated by the age group of 15-44 years (59.2%). The majority of research samples had an initial treatment weight ranging from 38 to 54 kg. A total of 78.9% of research samples experienced weight gain during their TB treatment. Nearly all research samples consistently adhered to OAT (anti-TB medication). Comorbid

conditions were present in only 18.3% of the research samples. The majority of the research samples successfully completed Drug-Susceptible TB treatment (Table 1).

Table 1
Characteristics of The Research Samples (n=71)

Variable	Frequency (*n*)	Persentase (%)
Gender		
Female	40	56,3
Male	31	43,7
Age		
15-44 years	42	59,2
45-59 years	21	29,6
≥60 years	8	11,3
Initial Weight		
30-37 kg	12	16,9
38-54 kg	45	63,4
≥55 kg	14	19,7
Weight Changes		
Weight Gain	56	78,9
No Weight Gain	15	21,1
Medication Adherence		
Regular	64	90,1
Irregular	7	9,9
Comorbid		
No Comorbidity	58	81,7
With Comorbidity	13	18,3
Drug Susceptible TB Final Treatment		
Successful Treatment	65	91,5
Treatment Failure	6	8,5
Total	71	100

The average weight gain of successfully treated Drug-Susceptible TB patients (*n*=54) was 2.19 kg. Then, the average initial weight of patients successfully treated with TB treatment was 46.35 kg and the average weight at an advanced stage was 48.54 kg. Among the 13 Drug-Susceptible TB patients with comorbidities, 9 had Diabetes Mellitus, 3 had HIV, 1 had both HIV and DM comorbidities (Table 2).

Table 2
The Weight Gain of Successfully Treated Drug-Susceptible TB Patients and Types of Comorbidities in Drug-Susceptible TB Patients

Variable	*n*	%	Mean ± SD
Weight Gain of Successfully Treated Drug-Susceptible Tuberculosis Patients	54		2,19 ± 1,813
Initial Weight of Successfully Treated Drug-Susceptible Tuberculosis Patients	54		46,35 ± 8,644
Weight of patients successfully treated with TB treatment at an advanced stage	54		48,54 ± 8,373
Comorbidity			
Diabetes Mellitus	9	69,2	
HIV	3	23,1	
DM and HIV	1	7,7	

Bivariate Analysis

Based on the results of bivariate analysis, it is proven that there is a significant relationship between the variable of weight change in Drug-Susceptible TB patients during treatment and the success of their treatment. The chi-square test has shown that the weight change variable has a *p*-value of less than 0.05, indicating a relationship between the variable of weight change during treatment and the dependent variable, which is the success of treatment in Drug-Susceptible TB patients. On the other hand, variables with chi-square test results of $p > 0.05$ have no significant relationship with the success of drug-sensitive TB treatment. The variables of gender, age, initial treatment weight, medication adherence, and comorbid conditions were not proven to have a significant relationship with the success of Drug-Susceptible TB treatment (Table 3).

Table 3
The Bivariate Analysis Results

Variable	Treatment Success				*p-value*	Crude OR	95% CI
	Successful	%	Failure	%			
Gender					1	1,321	0,248 - 7,047
Female	37	92,5	3	7,5			
Male	28	90,3	3	9,7			
Age					0,165		
15-44 years	40	95,2	2	4,8		3,266	0,204 - 52,375
45-59 years	19	90,5	2	9,5		4,113	0,226 - 74,84
≥60 years	6	75	2	25		Ref	
Initial Weight					0,979		
30-37 kg	11	91,7	1	8,3		Ref	
38-54 kg	41	91,1	4	8,9		0,371	0,01 - 13,649
≥55 kg	13	92,9	1	7,1		2,458	0,047 - 127,788
Weight Changes					0,016	9,818	1,596 - 60,414
Weight Gain	54	96,4	2	3,6			
No Weight Gain	11	73,3	4	26,7			

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Variable	Treatment Success				*p-value*	Crude OR	95% CI
	Successful	%	Failure	%			
Medication Adherence					0,477	1,967	0,196 - 19,723
Regular	59	92,2	5	7,8			
Irregular	6	85,7	1	14,3			
Comorbid					0,07	5,5	0,969 - 31,222
No Comorbidity	55	94,8	3	5,2			
With Comorbidity	10	76,9	3	23,1			

Multivariate Analysis

The Multivariate Analysis was conducted to identify which independent variable has the most dominant relationship with the dependent variable. Based on the Bivariate Analysis results, only the variable of weight changes was found to have a significant association with the treatment success of Drug-Susceptible TB patients. However, all independent variables were included in the multiple logistic regression analysis to examine the strength of the relationship between the variable of weight changes and the treatment success of Drug-Susceptible TB patients when influenced by other independent variables (Table 4). The results of the Multivariate Analysis showed that only the variable of weight changes remained significant until the final stage, with a *p-value* of 0.014. Furthermore, the calculation of the measure of association was conducted through the adjusted Odds Ratio with a 95% confidence interval (α=0.05). The variable of weight changes had an OR of 9.818 (OR>1), indicating a positive association (Table 5). Therefore, the variable of weight changes during TB treatment is a risk factor for the treatment success of Drug-Susceptible TB patients. It can be said that Drug-Susceptible TB patients who experience weight gain during treatment have a 9.818 times greater potential for successful TB treatment.

Table 4
Initial Model of Multivariate Analysis Results

Variable	B	S.E	Wald	*p-value*	Adjusted OR	95% CI
Gender	0,452	1,179	0,147	0,701	0,636	0,063 - 6,414
Age Group ≥60 years			1,069	0,586		
Age Group 45-59 years	1,414	1,480	0,913	0,339	4,113	0,226 - 74,840
Age Group 15-44 years	1,184	1,416	0,699	0,403	3,266	0,204 - 52,375
Initial Weight 30-37 kg			1,554	0,46		
Initial Weight 38-54 kg	0,993	1,840	0,291	0,589	0,371	0,01 - 13,649
Initial Weight ≥55 kg	0,899	2,016	0,199	0,655	2,458	0,047 - 127,788
Weight Gain	2,457	1,174	4,379	0,036	11,669	1,169 - 116,512
Medication Adherence	0,99	1,681	0,347	0,556	2,692	0,1 - 72,542
Comorbidity	1,544	1,324	1,36	0,244	4,681	0,35 - 62,677

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Table 5
Final Model of Multivariate Analysis Results

Variable	B	S.E	Wald	*p-value*	Adjusted OR	95% CI
Weight Gain	2,284	0,927	6,071	0,014	9,818	1,596 - 60,414

DISCUSSION

The Association Between Gender and Treatment Outcome of Drug-Susceptible Tuberculosis

The difference in lifestyle between women and men influences an individual's immune system. For example, smoking habits, which are predominantly found in men, are one of the risk factors for someone to be more susceptible to TB. A study conducted by Sharani et al. on TB patients who smoke depicted that the majority of respondents were male TB patients (95.7%) [16]. Therefore, the researchers wanted to determine whether there is a relationship between gender and the success of TB treatment. The analysis results showed that there was no significant relationship between gender and the success of TB treatment (p>0.05). Hence, statistically, it was not proven that gender differences in TB patients affect the success of TB treatment. These research findings are consistent with a study conducted at primary health centers in Kota Kupang, where the p-value for gender was 0.594 (p>0.05), indicating no significant difference between female and male genders concerning the completion of pulmonary TB treatment [17]. In this study, gender differences did not influence the outcome of TB treatment because both female and male TB patients received the same healthcare treatment during their TB treatment. Although there may a potential differences in lifestyle [16], but these potentials can still be controlled. For instance, male TB patients who were previously smokers will receive guidance to quit smoking after being diagnosed with TB, and their healthy lifestyle will be closely monitored. There were no differences in the dosage or types of anti-TB drugs based on gender between female and male TB patients (1).

The Association Between Age and Treatment Outcome of Drug-Susceptible Tuberculosis

Based on the results of bivariate analysis, the variable of age does not have a significant relationship with the success of TB treatment (p=0.165). These findings are consistent with the results of a study conducted in Nigeria, which also demonstrated that age groups do not have a significant relationship with the success of TB treatment [18]. It's similar to the findings of a previous study conducted at RSUD Ungaran in Kabupaten Semarang, which indicated that the age of TB patients did not have a significant relationship with the duration of treatment for TB category I until recovery [19]. Previous studies have indicated a similar pattern among TB patients, with the highest burden observed in the age groups ranging from young to middle-aged individuals [18]. The Drug-Susceptible TB patients who became the samples in this study were predominantly in the age group of 15-44 years, and the highest percentage of successful TB treatment was found in the age group of 15-44 years (95.2%). Age can be one of the risk factors influencing the severity of TB in a person due to its association with the immune system. The immune system in the young adult age group is generally stronger compared to the elderly age group. During old age, the body experiences a decline in physiological function and reduced immune resistance, which makes the elderly more susceptible to diseases [20]. However, this can still be controlled with more monitoring for elderly Drug-Susceptible TB patients. Moreover, TB screening programs and health promotion related to TB are often conducted together with elderly health posts (Posyandu Lansia). This ensures that the elderly group receives sufficient information about TB, its prevention, and treatment.

The Association between Initial Body Weight at The Start of Treatment and The Treatment Outcome of Drug-Susceptible Tuberculosis

The initial body weight of a patient at the beginning of TB treatment is used as a reference to determine the dosage of Anti-Tuberculosis Drugs given to the patient. In this study, the results of the analysis showed no significant relationship between the variable of patients' body weight at the start of TB treatment and the success of TB treatment, with a p-value of 0.979 (p>0.05). The majority of TB patients in the study had initial body weights between 38-54 kg, with an average initial body weight of 47 kg. The percentage of TB patients who successfully completed their treatment in each body weight group did not differ significantly. This means that Drug-Susceptible TB patients with a body weight of 30-37 kg at the start of treatment have a similar chance of successful TB treatment compared to Drug-Susceptible TB patients with a body weight above 37 kg.

The results of this study are consistent with the research conducted at the Semanding Primary Health Care Center, where nutritional status at the beginning of TB treatment is not related to the success of TB treatment. This is because during the TB treatment period, the nutritional intake can affect changes in the patient's nutritional status. Therefore, it cannot be concluded that the nutritional status of patients at the beginning of TB treatment has an impact on the success of TB treatment [21]. Furthermore, a study at the East Perak Health Center indicated that the treatment phase can be associated with the weight of Tuberculosis patients. The results of the study showed that individuals in the intensive treatment phase were 2.33 times more likely to experience underweight compared to those in the continuation treatment phase [22]. The dosage of Anti-Tuberculosis Drugs administered to TB patients is carefully regulated to ensure precise dosing in accordance with the TB management guidelines. The dosage of Anti-Tuberculosis Drugs is adjusted based on the patient's body weight grouping, enabling the medication to work effectively [1]. Hence, it can be concluded that it is not the initial body weight at the start of TB treatment that affects the success of TB treatment, but rather the accuracy of the dosage consumed by the TB patients that influences the final treatment outcome [23].

The Correlation between Weight Change during TB Treatment and The Treatment Success of Drug-Susceptible Tuberculosis

The increase in patient's body weight during the final stage of TB treatment serves as an indication that the patient has successfully undergone TB treatment. This finding is consistent with the analysis results from this study, which showed that the variable of body weight changes during TB treatment is significantly associated with the success of TB treatment (p<0.05). The variable of body weight changes has a p-value of 0.016, and after conducting multiple logistic regression analysis, the statistical relationship between the variable of body weight changes and the success of TB treatment becomes stronger (p=0.014). Drug-Susceptible TB patients who experience a change in body weight during treatment have a 9.818 times greater chance of successfully completing TB treatment. The research findings also revealed that the average increase in body weight among the study sample who successfully completed TB treatment is approximately 2.19 kg. Therefore, it can be concluded that a weight gain of 2.19 kg in Drug-Susceptible TB patients is highly significant in improving the chances of successful TB treatment.

The results of this study are in line with previous research conducted at the Pulmonary Polyclinic of RSPAD Gatot Soebroto, where almost all Pulmonary TB patients undergoing TB treatment with a complete treatment outcome experienced an increase in body weight of approximately 35%, with statistically significant analysis (p=0.037) [24]. This is also consistent with the findings from a study at the Bandarharjo Semarang Community Health Center, which demonstrated weight gain in TB patients who achieved negative BTA results at the end of the intensive phase of treatment [25]. Individuals with tuberculosis are susceptible to changes in appetite. The absence of weight gain can affect the Body Mass Index (BMI) of TB patients, and

a low BMI during the end of the intensive phase can increase the risk of treatment failure. This underscores the importance of undertaking efforts for nutritional interventions for tuberculosis patients. Guidance from TB healthcare practitioners is also necessary for implementing a wholesome and consistent dietary regimen, with the aim of expediting the recuperative course of TB patients [26]. Monitoring the body weight of TB patients during treatment is crucial for assessing the nutritional status of Drug-Susceptible patients and supporting the success of TB treatment.

The Association between Adherence to Anti-TB Medication Intake and The Treatment Success of Drug-Susceptible TB

Patient adherence to regularly taking Anti-Tuberculosis Drugs is one of the factors that can support the success of TB treatment. Just like in previous research at the Sungai Betung Bengkayang Community Health Center, it was proven that adherence to taking Anti-Tuberculosis Drugs significantly correlates with the recovery of TB patients [27]. However, in this current study, it was not found to be statistically significant that the variable of adherence to taking Anti-Tuberculosis Drugs is related to the success of TB treatment (p=0.477). This result is consistent with research at the Kedungmundu Community Health Center, where no correlation was found between TB patient adherence to regularly taking Anti-Tuberculosis Drugs and the success of treatment for Pulmonary TB patients [28]. Similarly, the findings of a study conducted at the Bantul District Health Center revealed no correlation between treatment adherence and clinical outcomes among pulmonary tuberculosis patients. The clinical outcomes demonstrated improved progress in both the adherent and non-adherent groups [29]. Nevertheless, in the bivariate analysis table, it can be observed that TB patients who adhere to taking Anti-Tuberculosis Drugs regularly have a higher percentage of successful treatment compared to TB patients who do not adhere regularly to Anti-Tuberculosis Drugs intake.

In this study, the variable of adherence to taking Anti-Tuberculosis Drugs did not emerge as a determinant factor in the success of TB treatment, possibly because the majority of the research sample was recorded to have adhered to Anti-Tuberculosis Drugs intake regularly. The compliance to regularly take anti-TB medication can also be influenced by other factors such as the patient's level of knowledge [30]. Additionally, for the research samples who did not adhere to Anti-Tuberculosis Drugs intake regularly, they discontinued taking Anti-Tuberculosis Drugs for a period not exceeding two weeks. Therefore, these patients did not need to restart the dosage and schedule of Anti-Tuberculosis Drugs intake from the beginning. This factor did not significantly impact Drug-Susceptible TB patients in potentially changing into Drug-Resistant TB, as seen in patients who stopped Anti-Tuberculosis Drugs intake for more than two weeks and restarted from the initial dosage.

The Association between The Presence of Comorbidities and The Treatment Outcomes of Drug-Susceptible Tuberculosis

Previous research has shown that the presence of comorbidities, especially Diabetes Mellitus and HIV/AIDS, can influence the success of TB treatment. For instance, a study conducted by Izudi et al. found that the comorbid status of HIV in TB patients significantly increased the risk of treatment failure in Pulmonary TB patients [31]. A previous study also has demonstrated that blood glucose levels determine the success of pulmonary TB treatment in patients with comorbid Type-2 DM. The risk of treatment failure for TB patients with abnormal HbA1c levels is three times higher compared to patients with normal HbA1c levels [32]. However, the results of this current study indicate that the variable of comorbidity in Drug-Susceptible TB patients is not statistically significantly related to the success of TB treatment, with a p-value of 0.07 (p>0.05). Currently, the presence of comorbidities no longer has a significant impact on the success of TB treatment. The results of this study are consistent with the findings from the research conducted at the Tapos Health Center, where the history of comorbid Diabetes Mellitus was not proven to have a significant relationship with the success

of TB treatment [33]. This is due to the implementation of many integrated programs, such as collaborative management for TB patients with comorbid DM, TB-HIV programs, and others. Additionally, at the start of treatment, according to TB patient management guidelines, comprehensive screening and health checks are performed to assess the patient's condition. Patients with comorbidities are carefully noted and monitored to ensure that their TB treatment is not disrupted [1]. Even though during the COVID-19 pandemic, patients with comorbidities are still monitored very closely because patients with comorbidities have the potential to be more affected by COVID-19.

CONCLUSION

The results of this study have shown that variables such as age, gender, initial body weight at the start of treatment, adherence to Anti-TB medication, and comorbidities in Drug-Susceptible TB patients are not significantly associated with the treatment success of TB at Singosari Community Health Center. The treatment success of Drug-Susceptible TB at Singosari Community Health Center is proven to be related to the variable weight gain of patients during treatment. A weight gain of approximately 2.19 kg in Drug-Susceptible TB patients can increase their chances of treatment success by approximately 9.818 times. Monitoring the weight of patients throughout the treatment period is of utmost importance in supporting the success of TB treatment. This study only analyzes the weight gain of patients without considering BMI, so future researchers may conduct a more in-depth analysis. The TB Prevention and Control Program (P2TB) can collaborate with community nutrition programs during TB patient visits and contact investigations to provide education regarding the importance of weight gain and nutritional status monitoring for TB patients undergoing treatment. The authors hope that this research can be beneficial and contribute to the efforts towards Tuberculosis Elimination in Indonesia.

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