Research Article

Factors Associated with Successful Tuberculosis Treatment in the Primary Health Care of Bekasi

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ABSTRACT

Background: Tuberculosis is still a significant disease problem globally as it is one of ten causes of death worldwide and in Indonesia. Bekasi is the second-largest city with tuberculosis patients after Bandung, with 3,355 patients in 2015. The success rate of treatment that has not reached the standard in the primary health care of Bekasi, West Java, can be related to medication adherence, age, and nutritional status. Inadequate nutritional intake in tuberculosis patients will increase the recovery time. The more days of irregularity in taking the drug increases the likelihood of the patient having a default that can lead to drug-resistant tuberculosis. This study aimed to determine the correlation between anti-tuberculosis drug adherence, age, and nutritional status with tuberculosis treatment in new tuberculosis cases in the primary health care of Bekasi.

Method: This was analytic observational research with a cross-sectional design study in 311 new tuberculosis cases at 30 primary health care in Bekasi city period 2015. Data were analyzed using univariate data and then continued with the chi-square test and logistic regression test.

Results: The results of the univariate analysis were found to obtain patients' compliance by 84.9% adherent, productive age (91%), and nutritional status with IMT under 18.5 kg/m2 (68.8%). Chi-square test shown there was a significant relationship between medication adherence (*p-value* = 0.000; OR = 5917.5; 95%CI = 525.57 – 66626.6), age (*p-value* = 0.003; OR = 3.81; 95%CI = 1.63 – 8.90), and nutritional status (*p-value* = 0.000; OR = 7.88; 95%CI = 2.38 – 26.08) with therapeutic outcome. Logistic regression analysis showed that anti-tuberculosis drug adherence (*p-value* = 0.000; OR = 5917.5) was the most dominant variable related to tuberculosis treatment success.

Conclusion: We conclude that the success of tuberculosis treatment in the primary health care of the Bekasi period 2015 relates to anti-tuberculosis drug (medication) adherence, age, and nutritional status, while medication adherence has the most significant influence on the success of tuberculosis treatment.

INTRODUCTION

Tuberculosis (TB) is one of the significant infectious disease problems closely related to the environment and community behavior. This inflammatory disease of the lung parenchyma is caused by Mycobacterium tuberculosis. This disease is one of ten causes of death globally (1). In Indonesia, TB cases rose from 331,703 in 2015 to 562,049 in 2019. The new cases of tuberculosis had a mortality rate of 1.8 million people. Globally, the reduction in TB incidence between 2015 and 2019 was 9% (from 142 to 130 new cases per 100,000 population) (2). Indonesia had an incident rate of 395 cases/100,000 population in 2015, then increased to 845 cases/100,000 population in 2019 (2). The prevalence of tuberculosis in Indonesia is mainly found in West Java amount 28,901 cases, with a success rate of 82.5%. Bekasi is the second-largest city with tuberculosis patients after Bandung, with 3,355 patients in 2015 (3). If we refer to the standard from the WHO, it means that Bekasi has not succeeded in treating TBC.

Several factors influence the success of TB therapy, including drug adherence, age, and nutritional status of the patient. Drug adherence is adherence to tuberculosis treatment regularly and thoroughly without interruption during the treatment period determined by the health worker (4). Aulia (2014) stated there was a relationship between age and occupation and successful tuberculosis treatment (5). There was a correlation between nutritional status and recovery of tuberculosis patients (6). The condition of tuberculosis patients can be restored by consuming nutritional foods to fulfill the energy and protein needed to prevent and repair the damage to body tissues, gain weight until it reaches normal, and balance weight and height (7). WHO's 2030 target is to decrease 90% the mortality rate of the total death rate in 2015. This target follows the SDGs (Sustainable Development Goals) to end the tuberculosis epidemic by 2030 (2). This research is expected to contribute to understanding the situation of TB in Bekasi, which will be helpful for policymakers in creating a proper intervention.

METHOD

This research was an observational analytic study with a cross-sectional approach. Drug adherence is obedience to regular and complete treatment without interruption during the treatment period determined by health workers (Yuanasari, 2009). We defined the age group as productive age (18 – 64 years) and non-productive age (more than 64 years). For the nutritional status, we classified as obese (BMI>25kg/m2), normal (18.5 – 25 kg/m2) and underweight (BMI <18.5kg/m2).

The population in this study were all new cases of TB patients with BTA positive from 30 primary health care in Bekasi city in 2015 with 2,925 patients. The sample in this study consisted of new TB patients with BTA positive results who took anti-tuberculosis drugs in all primary health care in Bekasi city in 2015 and had fulfilled the inclusion criteria, amounting to 311 patients. The inclusion criteria in this study were patients with new cases of Pulmonary Tuberculosis in Bekasi city primary health care who had performed sputum checks with BTA positive results who get OAT (Anti-Tuberculosis Drugs) at least six months with a complete medical record and are more than 18 years old.

RESULTS

This research was conducted in 30 primary health care out of 31 in the city of Bekasi because the patient's medical records in one primary health care were incomplete, so the researchers excluded that primary health care.

Table 1. The characteristic of new cases of tuberculosis patients in Bekasi 2015

	N = 311	%
Gender		
Male	195	62.7
Female	116	37.3
Drug's Adherence		
Yes	264	84.9
No	47	15.1
Age		
Productive	283	91
Non-Productive	28	9
Nutritional Status		
Obese	4	1.3
Normal	93	29.9
Underweight	214	68.8

Source: Secondary data in 30 primary health care in Bekasi City, 2015.

Table 1 shows that among the 311 patients, most were male, 195 patients (62.7%), and 116 female patients (37.3%). The number of patients with medication adherence was 264 (84.9%), and without medication adherence were 47 patients (15.1%). Most patients were productive age patients, 283 patients (91%), and new cases of non-productive age were 28 patients (9%). There were 214 patients (68.8%) patients with underweight BMI, 93 patients were in the normal BMI category (29.9%), and four patients were in the obese BMI category (1.3%).

We found a significant correlation between medication adherence and successful treatment. Table 2 shows the statistical tests of drug adherence using Chi-square, obtaining a *p-value* <0.005. The odds ratio (OR) value in this statistical test is 5917.5, which means that patients who were adherent to taking the anti-tuberculosis drug (OAT) have the possibility (odds) of 5917.5 times for successful treatment compared with patients who were not adherent to taking OAT. For age versus the success of TB treatment, we found a *p-value* <0.05, which means that there was a correlation between age and the successful treatment of new cases of pulmonary tuberculosis patients. The OR value was 3.81, meaning that new cases of pulmonary tuberculosis patients with productive age have 3.81 times the possibility of successful treatment compared to patients with non-productive age. Last, we found a significant correlation between nutritional status and successful treatment. The OR value is 7.88, meaning that obese and normal BMI patients are 7.88 times more likely to succeed in therapy than underweight patients. Table 3 indicates that drug adherence is the most influential variable in successful treatment, with a *p-value* of 0.000.

Table 2. Association between medication adherence, age, and nutritional status with the success of TB treatment in Bekasi 2015

Variables	Successful Treatment (n=265)						OR (95% CI)	*P-value*
	Yes		No		Total			
	N	%	N	%	N	%		
Drug Adherence								
Yes	263	99.6	1	0.4	264	100		
No	2	4.3	45	95.7	47	100	5917.5	0.000
Age								
Productive	247	87.3	36	12.7	283	100	3.81	0.003
Non-Productive	18	64.3	10	35.7	28	100		
Nutritional Status								
Obese and Normal	94	96.9	3	3.1	97	100	7.88	0.000
Underweight	171	79.9	43	20.1	214	100		

Source: Secondary data in 30 primary health care in Bekasi City, 2015.

Table 3. Logistic Regression Result

Variable	*P-value*	OR (Exp(B))
Drug Adherence	0.000	7467.18
Age	0.503	3.366
Nutritional Status (Obese)	0.179	-
Nutritional Status[1] (Normal)	0.999	7992312.5
Nutritional Status[2] (Underweight)	0.063	16.252

Source: Secondary data from 30 primary health care in Bekasi City, 2015

DISCUSSION

The work of OAT to kill the bacteria, both dormant and active bacteria, will be maximized in patients of productive age so that successful treatment can be achieved by carrying out treatment to completion. This research is in line with the study conducted by Aulia (2014) that there is a correlation between age and successful treatment at the Sakti Community Health Center, Pidie District (5). The unproductive age patient can affect the drug's effectiveness because drug metabolism and organ function are less efficient in infants and the elderly, so that it can have a more powerful and more prolonged effect in both age groups. The older the age, the more physiological and pathological changes and a decrease in the body's defense system, which affects the body's ability to handle the OAT given. In this case, the body must deal with two problems at once, namely the tuberculosis bacilli, which damage the tissues as well as the OAT itself, and this situation gets worse if there are diseases that interfere with the function of the kidneys, liver and cardiovascular system (8). Elderly patients often become apathetic about their treatment and usually lack the determination or desire to complete a six-month treatment program. They are almost three times more likely to react to OAT than patients of productive age (9).

Patient compliance is influenced by the willingness and motivation to recover. In addition, pulmonary tuberculosis patients with medication adherence can have maximum effect of OAT, so it causes death to both dormant and active bacteria. According to Kurniawan's research

(2015), of the 43 respondents studied, 30 respondents with medication adherence had negative BTA results at the end of treatment (10). OAT should be taken regularly according to schedule to avoid treatment failure and recurrence, especially in the intensive treatment phase (11). Widiyanto's research (2016) states that medication adherence in tuberculosis treatment is essential. By taking the medication regularly within two weeks, the bacteria have broken down and have no potential to spread (12). Therefore, it can be concluded that if medication adherence is high, the recovery rate of positive pulmonary tuberculosis patients will also increase so that the risk of drug-resistant tuberculosis cases can also be prevented. Health behavior or a person's level of health is determined by a person's attitude towards health objects. The better a person's attitude towards health, the level of one's health will also be better. A person's adherence to medication is influenced by the person's attitude towards the illness (13)(14).

Our finding shows a significant correlation between nutritional status and successful treatment. Nutritional status can determine the condition of their immune system. A poor nutritional quality that occurs before the patient suffers from Tuberculosis can increase the patient's susceptibility to infection with *Mycobacterium tuberculosis.* The poor nutritional status after a patient is infected can be caused by decreased appetite in tuberculosis patients, so the successful treatment is also supported by patient compliance in taking OAT. Poor nutritional status in tuberculosis patients is caused by anorexia, impaired nutrient absorption, or increased body catabolism (1). There is a correlation between nutritional status (BMI) and recovery in pulmonary tuberculosis patients at the pulmonary clinic of RSUD Sidoarjo. There is clear evidence that poor nutrition reduces the immunity to Tuberculosis. Malnutrition in tuberculosis patients can reduce the healing period and increase the mortality rate compared to tuberculosis patients who are not malnourished (6). Nutritional status affects the successful treatment of Tuberculosis. Normal and obese BMI increases immunity so that people can survive pulmonary Tuberculosis and accelerate the healing process (15). Based on Puspitasari *et al*. (2017), there is a relation between nutritional status and successful treatment in pulmonary tuberculosis patients. Good nutritional status has a faster recovery time. Balanced nutrition can help to maintain immunity and prevent various diseases, especially pulmonary Tuberculosis (12).

Medication adherence in tuberculosis treatment is essential because by taking the medication regularly for 2 weeks, the bacteria have been divided and have no potential to be transmitted (16). In the intensive (initial) stage, the patient receives medication every day to prevent the occurrence of resistance to all OATs, especially rifampicin. If the intensive treatment is given appropriately, usually, the infectious patient becomes non-infectious within 2 weeks. Most of the positive BTA became negative within 2 months (at the end of intensive treatment). In the advanced stage, the patient gets fewer drugs but for a more extended period. The progressive step is essential to kill the remaining bacteria still in the body, especially persistent bacteria, so the patient can recover and prevent the recurrence. So medication adherence is vital to successful treatment (6)(15).

The final result in multivariate analysis with logistic regression is that medication adherence is the most influential variable in the successful treatment, with a *p-value* of 0.000. Patient compliance is influenced by the willingness and motivation to recover (13). Health workers

have conveyed to tuberculosis patients through health promotion and education so that patients take medication according to the type, dose, method, time to drink, and the number of days of taking the appropriate medicine recommended by the doctor. Medication adherence is essential because if the treatment is not carried out regularly and does not follow the predetermined time, there will be resistance to the bacteria called Multi Drugs Resistance (MDR) (15). Various drugs in standard therapy have different target populations for mycobacterium tuberculosis. Isoniazid is an inhibitor of cell wall synthesis, actively kills growing bacteria, and plays a crucial role in eradicating replicating bacteria. Rifampicin is an inhibitor of RNA synthesis, active against both replicating and non-replicating bacteria. Pyrazinamide, considered an inhibitor of proton motive force, only appears in its active form under acidic conditions during the first 2 months of therapy. Rifampicin and pyrazinamide played a significant role in shortening the duration of treatment from more than 24 months to only 6 months. Each agent's mechanism of action determines the drug's role in the treatment of mycobacterium tuberculosis (10).

CONCLUSION

Based on the results of research analysis and discussion, it can be concluded that the success rate of treatment on 30 primary health care in Bekasi City in 2015 was high, with the majority of new cases of pulmonary tuberculosis patients with successful medication on 265 patients (85.2%). In 2015, new cases of pulmonary tuberculosis patients on 30 primary health care in Bekasi City were 264 patients (84.9%). Most of the new cases of pulmonary tuberculosis patients were patients of productive age, as many as 283 patients (91%). Patients with underweight BMI were 214 patients (68.8%). There was a significant correlation between medication adherence (*p-value*=0.000), age (*p-value*=0.003), and nutritional status (*p-value*=0.000) with the successful treatment at 30 primary health care in Bekasi in 2015. Medication adherence is the most dominant variable of the successful treatment at 30 primary health care in Bekasi in 2015 compared to nutritional status and age variables.

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Authors' contribution

K, E, and S contributed to the research design. K developed the theory, collected the data, and performed the computations. S and E verified the analytical methods. All authors discussed the results and contributed to the final manuscript.

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Conflict of interest

There is no conflict of interest in this research.

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