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Comparative study of DOTS treatment outcomes among pulmonary tuberculosis patients at Bondongan and Bogor Timur primary health centers

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ABSTRACT: Tuberculosis (TB) remains a major infectious disease and a significant public health concern in Indonesia. The Directly Observed Treatment Short-course (DOTS) strategy has been widely implemented to improve treatment adherence and outcomes among patients with TB. This study aimed to compare the treatment outcomes of patients with pulmonary tuberculosis undergoing DOTS therapy at Bondongan Primary Health Center and Bogor Timur Primary Health Center. This study used a descriptive and inferential research design with retrospective data collection conducted in 2024. A total of 159 patients with pulmonary TB were included in the study. Data were analyzed based on patient characteristics, including age, sex, comorbidities, type of diagnosis, duration of treatment, and treatment outcomes. The results showed that the majority of patients at Bondongan Primary Health Center were aged 38–47 years (30.13%), whereas most patients at Bogor Timur Primary Health Center were aged 18–27 years (36.03%). Female patients accounted for 54.10% of the total population. Most patients received six months of treatment (84.91%), were bacteriologically confirmed (76.10%), and all patients received fixed-dose combination (FDC) therapy. At Bondongan Primary Health Center, the comorbidity status of diabetes mellitus (DM) was largely unknown (80.82%), whereas most patients at Bogor Timur Primary Health Center had no DM comorbidity (87.21%). The treatment success rates were 83.56% and 97.67% at the Bondongan and Bogor Timur Primary Health Centers, respectively. Statistical analysis indicated that patient characteristics were not significantly associated with treatment success ($p \geq 0.05$).

KEYWORDS: DOTS strategy; primary health center; treatment outcomes; tuberculosis.

INTRODUCTION

According to the latest global report published in 2025 by the World Health Organization, tuberculosis (TB) continues to be a major cause of morbidity and mortality worldwide. As reported in 2025, TB remains a major global health problem, with approximately 10.7 million cases and 1.23 million deaths [1]. These estimates indicate that in 2024, approximately 10.7 million people developed TB. Following a temporary decline during the COVID-19 pandemic, TB has re-emerged as the leading cause of death from a single infectious agent worldwide. Indonesia remains among the high-burden countries, ranking second globally, with an estimated 1.09 million cases annually, underscoring the urgent need for strengthened prevention and control strategies [2].

TB is caused by *Mycobacterium tuberculosis*, which primarily infects the lungs and spreads through airborne droplets released when infected individuals cough, sneeze or speak [3]. Owing to its airborne transmission and high potential for rapid spread, TB continues to pose a major global public health challenge [4].

According to the Global Tuberculosis Report 2025, Indonesia ranks second among countries with the highest TB burden, contributing to approximately 10% of the global TB cases [2]. To address this issue, the Indonesian Ministry of Health has developed a Roadmap for TB Elimination, which includes achieving a TB treatment target of at least 90% TB treatment success rate [5]. However, the Indonesia Health Profile 2023 reported a national TB treatment success rate of 86.5%, indicating that the target has not yet been achieved [6]. Various factors may influence TB treatment outcomes, including sociodemographic characteristics, patient

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adherence to treatment, comorbidities, access to healthcare services, and support from family members and healthcare providers [7].

To improve TB treatment outcomes, Indonesia has implemented the Directly Observed Treatment Short-course (DOTS) strategy recommended by the World Health Organization (WHO) since 1995. This strategy emphasizes supervised treatment to ensure patient adherence and completion. DOTS has been implemented nationwide, particularly in primary healthcare facilities, such as community health centers (Puskesmas), which play a critical role in TB detection, treatment, and monitoring [8], [9]. The strategy includes several key components, including case detection through microscopic examination, direct observation of treatment, standardized short-course chemotherapy, and a reliable supply of anti-tuberculosis drugs [10].

Despite the nationwide implementation of DOTS, variations in TB treatment outcomes are still observed across different regions and healthcare facilities. Bogor City, located in West Java Province, continues to have a high burden of TB cases. According to the West Java Health Profile 2023, Bogor City reported 10,354 weighted TB cases with a treatment success rate of 75.70% [11]. Data from the Bogor City Health Office also indicate that several community health centers still report relatively low TB treatment success rates, including the Bondongan Primary Health Center (84%) and Bogor Timur Primary Health Center (87%). These findings suggest the need for further evaluation of TB treatment outcomes at the primary healthcare level in the country.

However, numerous studies have examined tuberculosis (TB) treatment outcomes and associated factors across different settings, highlighting the influence of patient characteristics, comorbidities, treatment adherence, and health system factors on the treatment success. Previous studies conducted in hospital and primary healthcare settings have reported varying treatment success rates and identified key determinants, such as age, HIV status, and behavioral factors. Nevertheless, most studies have focused on single-center analyses and have not adequately compared treatment outcomes between different healthcare facilities, particularly at the community health center level. In addition, the influence of facility-level differences on treatment outcomes remains insufficiently explored in the literature. Therefore, understanding these context-specific variations is important for identifying potential gaps in TB control programs and improving treatment outcomes. [12], [13], [14].

Therefore, this study aimed to compare the outcomes of DOTS treatment among pulmonary tuberculosis patients at Bondongan Primary Health Center and Bogor Timur Primary Health Center based on patient characteristics (age, sex, comorbidities, and type of diagnosis), treatment observer (PMO) status, treatment duration, type of anti-tuberculosis drugs, and treatment outcomes.

▪ MATERIALS AND METHODS

Study design

This study was approved by the Health Research Ethics Committee of Universitas Pancasila (approval no. 070/KEPK-FFUP/I/2025. This study had a retrospective cross-sectional design using secondary data obtained from patients with pulmonary tuberculosis (TB) treated at the Bondongan Primary Health Center and Bogor Timur Primary Health Center, Bogor City, Indonesia, during 2024. Data were collected from the Tuberculosis Information System (Sistem Informasi Tuberkulosis [SITB]) database maintained at both primary health centers. These two facilities were selected because, despite operating at the same level of care, they differ in the number of confirmed TB cases, which may influence treatment outcomes.

Study population and sampling

The study population consisted of patients with pulmonary TB registered with sensitivity TB at Bondongan Primary Health Center and Bogor Timur Primary Health Center in 2024. A total sampling technique was used, in which all patients who met the inclusion and exclusion criteria were included in the study.

Inclusion and exclusion criteria

The inclusion criteria were adult pulmonary TB patients aged 18–59 years who were classified as Category I TB patients, with or without non-communicable comorbidities, and who received treatment at

Bondongan Primary Health Center or Bogor Timur Primary Health Center during 2024. The exclusion criteria included patients with relapse, loss to follow-up, pregnant women, and breastfeeding women.

Variables and data collection

The variables analyzed in this study included patient characteristics (age, sex, comorbidities, and type of diagnosis), treatment observer status (PMO), treatment duration, type of anti-tuberculosis drugs (OAT), and treatment outcomes. These data were extracted from the SITB database of the respective primary health centers.

Data analysis

Data analysis was conducted using Microsoft Excel and the Statistical Package for the Social Sciences (SPSS). Descriptive analysis was used to present the distribution of patient characteristics, treatment profiles, and treatment outcomes among patients with pulmonary TB at both primary health centers. Inferential analysis was performed to examine the association between patient characteristics and treatment success. Treatment outcomes were categorized as successful or unsuccessful. Successful treatment included patients who were classified as cured or treatment was completed, whereas unsuccessful treatment included patients who experienced treatment failure, death, loss to follow-up, or were not evaluated. The relationship between patient characteristics and treatment success was analyzed using the chi-square test, with a significance level of $p < 0.05$.

▪ RESULTS

Characteristics of pulmonary TB patients

This study used data from adult patients with pulmonary TB at Puskesmas Bondongan and Puskesmas Bogor Timur in 2024 who met the inclusion and exclusion criteria. The patient characteristics in this study are presented in Table 1, consisting of age, sex, diabetes mellitus comorbidity, and diagnosis type.

Table 1. Characteristics of patients with pulmonary Tuberculosis at Bondongan primary health center and Bogor Timur primary health center in 2024.

Variable	Bondongan primary health center		Bogor Timur primary health center		*p*-value
	n (73)	%	n (86)	%	
Age (years)					0.199
18–27	20	27.40	31	36.05	
28–37	16	21.92	23	26.74	
38–47	22	30.13	14	16.28	
48–59	15	20.55	18	20.93	
Gender					0.520
Female	42	57.53	44	51.16	
Male	31	42.47	42	48.84	
DM Comorbidity					<0.001
Yes	0	0.00	5	5.81	
No	14	19.18	75	87.21	
Unknown	59	80.82	6	6.98	
Type of Diagnosis					0.468
Bacteriologically confirmed	58	79.45	63	73.26	
Clinically diagnosed	15	20.55	23	26.74	

This study had several limitations. First, the absence of PMO-related data in the SITB system limited our ability to evaluate the role of treatment observers in TB treatment outcomes. This may be due to incomplete or non-mandatory recording of PMO variables, as well as variability in data entry practices across health centers. Second, reliance on secondary data restricted the possibility of validating or supplementing missing information through primary data collection. Consequently, the potential association between PMO status and

treatment success could not be assessed, which may have implications for the comprehensiveness of the findings.

Pulmonary tuberculosis (TB) treatment in Indonesia follows national guidelines that recommend the use of fixed-dose combination (FDC) as the first-line therapy. In this study, all pulmonary TB patients at Bondongan Primary Health Center and Bogor Timur Primary Health Center received treatment with fixed-dose combinations (FDC), in accordance with national standards aimed at improving treatment adherence and optimizing treatment success.

Table 2. Type of Anti-Tuberculosis Drugs (OAT) at Bondongan primary health center and Bogor Timur primary health center in 2024.

Type of OAT	Bondongan primary health center		Bogor Timur primary health center	
	n (73)	%	n (86)	%
FDC	73	100	86	100
Separate tablets	0	0	0	0

In this study, most patients with pulmonary TB at the Bondongan Primary Health Center and Bogor Timur Primary Health Center completed treatment according to the standard six-month duration recommended for Category I TB treatment. Patients with a treatment duration of less than six months included those who died during treatment or were lost to follow-up.

Table 3. Duration of treatment at Bondongan primary health center and Bogor Timur primary health center in 2024.

Duration of Treatment	Bondongan primary health center		Bogor Timur primary health center	
	n (73)	%	n (86)	%
<6 months	12	16.44	2	2.33
6 months	58	79.45	77	89.53
>6 months	3	4.11	7	8.14

TB treatment outcomes were categorized into six groups: cured, treatment completed, treatment failure, death, loss to follow-up, and not evaluated. In this study, the majority of patients with pulmonary TB at the Bondongan Primary Health Center and Bogor Timur Primary Health Center in 2023 were classified as cured (57.23%).

Table 4. Treatment outcomes at Bondongan and Bogor Timur primary health centers in 2024.

Treatment outcome	Bondongan primary health center		Bogor Timur primary health center	
	n (73)	%	n (86)	%
Cured	41	56.16	50	58.14
Treatment completed	20	27.40	34	39.54
Died	2	2.74	1	1.16
Lost to follow-up	10	13.70	1	1.16

▪ DISCUSSION

This study compared the characteristics and treatment outcomes of patients with pulmonary tuberculosis (TB) at the Bondongan Primary Health Center and Bogor Timur Primary Health Center in Bogor City. The findings showed variations in patient characteristics and treatment outcomes between the two health centers, which may reflect differences in patient profiles, healthcare access, and treatment monitoring.

Based on age distribution, the majority of pulmonary TB cases occurred in the 38–47 years age group at Bondongan Primary Health Center and in the 18–27 years age group at Bogor Timur Primary Health Centre. These findings are consistent with the Global Tuberculosis Report 2024 and the Indonesian Health Survey 2023, which indicate that TB prevalence is highest among individuals in the productive age group (15–44 years old). Individuals in this age group tend to have higher mobility, more frequent social interactions, and

demanding work schedules, which may lead to fatigue, reduced immune function, and increased exposure to TB [2], [15], [16].

In terms of gender distribution, this study found that patients with pulmonary TB at both primary health centers were predominantly female. This finding differs from global and national reports, which generally show a higher prevalence of TB among men [2], [15]. However, similar results were reported in a study conducted by Favian (2023) in the Semarang health region, where TB cases were more frequently reported among females [17]. This difference may be influenced by behavioral and social factors. Women may be more likely to seek healthcare services and report symptoms earlier than men, which may result in a higher proportion of diagnosed and recorded cases in women [18], [19].

The distribution of diabetes mellitus (DM) comorbidity also differed between the two health centers. At the Bondongan Primary Health Center, most patients had unknown DM comorbidity status, whereas at the Bogor Timur Primary Health Center, the majority of patients did not have DM comorbidity. Diabetes weakens the immune response and increases the risk of developing active TB. Therefore, identifying DM comorbidity among patients with TB is important to ensure appropriate monitoring and management during treatment, as the presence of diabetes may influence treatment outcomes and increase the risk of complications [20].

Regarding the type of diagnosis, most pulmonary TB cases in this study were bacteriologically confirmed. This finding is consistent with the DOTS strategy, which emphasizes bacteriological confirmation through laboratory examination as a key component of TB case detection. Accurate bacteriological diagnosis is essential to ensure appropriate treatment and reduce the risk of misdiagnosis or inappropriate therapy [21].

In this study, all patients with pulmonary TB received fixed-dose combination (FDC) anti-tuberculosis drugs**,** which are recommended as first-line therapy according to the national TB treatment guidelines. The use of FDC regimens aims to improve treatment adherence, simplify drug administration, and reduce the risk of drug resistance in patients. Furthermore, most patients completed treatment within the standard six-month duratio**n**, indicating good adherence to the recommended treatment protocol.

The treatment outcomes showed that the majority of patients with pulmonary TB were classified as cured or treatment completed, indicating relatively high treatment success rates at both primary health centers. However, a small proportion of patients experienced unfavorable outcomes, such as death or loss to follow-up, which may have affected the overall treatment success rate. These findings highlight the importance of strengthening patient monitoring and follow-up mechanisms within TB control programs at the primary health care level.

In this study, pulmonary TB treatment outcomes were categorized as successful or unsuccessful. Successful treatment included patients who were cured or completed treatment, whereas unsuccessful treatment included patients who experienced treatment failure, death, loss to follow-up, or were not evaluated. Based on the Chi-square test results, there was no significant association ($p \geq 0.05$**)** between patient characteristics, namely age, sex, comorbidity of diabetes mellitus, and type of diagnosis, and the success of pulmonary TB treatment at Bondongan Primary Health Center and Bogor Timur Primary Health Center.

These findings are consistent with a study conducted at the Rapak Mahang Primary Health Center, Tenggarong, which also reported that TB treatment success was not significantly associated with patient characteristics, including age, sex, diabetes mellitus comorbidity, and type of diagnosis [22]. However, recent evidence indicates that tuberculosis treatment outcomes are influenced not only by demographic and clinical factors but also by behavioral, psychosocial, and health system–related determinants. Medication adherence, the role of treatment supporters (PMO), adverse drug reactions, and patients' knowledge and understanding of TB and its therapy have been consistently identified as important predictors of treatment success and completion [23], [24], [25] Studies published in recent years also emphasize that patient-centered adherence interventions such as digital reminders, counseling, education, and structured treatment support significantly improve adherence and treatment outcomes, highlighting the importance of integrating these factors into TB control programs

According to Nisa et al**.**, one of the most important factors influencing TB treatment success is patient adherence to medications. Adequate adherence to anti-tuberculosis therapy plays a crucial role in ensuring treatment completion and preventing unfavorable outcomes, such as treatment failure or loss to follow-up

[26]. This suggests that treatment success may be more strongly influenced by patient adherence, treatment supervision, and healthcare support systems than by demographic or clinical characteristics alone.

Overall, the comparison between the two primary health centers provides valuable insights into TB patient characteristics and treatment outcomes in Bogor City. Understanding these differences may help healthcare providers and policymakers identify potential gaps in TB management and strengthen TB control programs at the primary healthcare level. This study had several strengths and limitations**.** One of its strengths is the use of real-world data from the SITB system, which reflects routine TB program implementation at the primary health care level. Additionally, the comparison between two primary health centers provides a contextual understanding of variations in patient characteristics and treatment outcomes. However, this study had some limitations. The use of secondary data resulted in incomplete or unavailable variables, such as PMO status, which limited the further analysis. The presence of missing data may also affect the robustness of our findings.

▪ CONCLUSION

This study compared the characteristics and treatment outcomes of patients with pulmonary tuberculosis (TB) receiving DOTS therapy at Bondongan Primary Health Center and Bogor Timur Primary Health Center in Bogor City. Most patients were within the productive age group, predominantly female, bacteriologically confirmed, and treated with FDC therapy for the standard six-month duration. The treatment success rate at both primary health centers was relatively high, with the majority of patients classified as cured or having completed their treatment. Statistical analysis showed that patient characteristics, including age, sex, diabetes mellitus comorbidity, and diagnosis type, were not significantly associated with treatment success.

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