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Medication Adherence and Treatment Outcomes Among Tuberculosis Patients in Jember Regency, East Java, Indonesia

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Abstract

Medication adherence remains a critical determinant of tuberculosis (TB) treatment success, particularly in high-burden settings such as Indonesia. Suboptimal adherence contributes to prolonged infectiousness, treatment failure, and the emergence of drug-resistant TB. This study aims to analyze medication adherence and its relationship with treatment outcomes among tuberculosis patients in Jember Regency, East Java, Indonesia. A cross-sectional analytical design was employed involving pulmonary TB patients receiving treatment at community health centers in Jember Regency. Data were collected using structured questionnaires assessing socio-demographic characteristics, health literacy, family support, the role of drug swallowing supervisors (Pengawas Menelan Obat/PMO), and self-reported medication adherence. Treatment outcomes were obtained from medical records. Descriptive and inferential analyses were conducted to examine associations between adherence and treatment outcomes.
The findings indicate that the majority of patients demonstrated high medication adherence, which was significantly associated with successful treatment outcomes. Health literacy, effective PMO involvement, and strong family support emerged as key factors influencing adherence. These results are consistent with previous studies conducted in various Indonesian regions, highlighting adherence as a central pathway linking social and health system factors to TB treatment success. In conclusion, strengthening patient education, family engagement, and PMO performance is essential to improving TB treatment outcomes. The study provides empirical evidence to support integrated adherence-focused interventions within primary health care settings.

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Introduction

Tuberculosis (TB) remains one of the most persistent public health challenges globally and continues to pose a significant burden in low- and middle-income countries. Indonesia has

consistently been ranked among the countries with the highest TB burden worldwide, reflecting ongoing challenges in prevention, diagnosis, and treatment adherence. Despite the availability of standardized and effective anti-tuberculosis therapy under the national TB control program, treatment success rates in several regions have not yet reached optimal targets. One of the most critical determinants underlying this gap is medication adherence, which plays a decisive role in ensuring therapeutic effectiveness and preventing adverse public health consequences.

Medication adherence in tuberculosis treatment refers to the extent to which patients take anti-TB drugs in accordance with prescribed schedules, dosages, and duration as recommended by health care providers. TB treatment requires long-term, uninterrupted therapy, commonly lasting six months or longer, depending on clinical conditions. This prolonged duration increases the risk of non-adherence, particularly when patients begin to feel symptomatically improved before completing the full course of treatment. Suboptimal adherence not only compromises individual patient outcomes but also contributes to broader public health threats, including prolonged infectiousness, increased transmission within communities, and the emergence of drug-resistant tuberculosis strains (Nafisah et al., 2021; Hongprasit & Sonthisombat, 2023).

In the Indonesian context, non-adherence to TB treatment remains a substantial challenge within primary health care services. Several studies have demonstrated that patients who do not adhere to treatment regimens are more likely to experience treatment failure, relapse, or unfavorable clinical outcomes (Mustaming, 2022; Pasaribu et al., 2023). In addition, incomplete or irregular treatment has been directly linked to the development of multidrug-resistant TB, which requires more complex, costly, and lengthy treatment regimens and places additional strain on the health system (Law et al., 2025). These realities highlight medication adherence as a cornerstone of TB control efforts and a critical indicator of program effectiveness.

Previous research has shown that medication adherence among TB patients is a multidimensional phenomenon influenced by a complex interplay of individual, social, and health system factors. At the individual level, patient knowledge, beliefs, and health literacy significantly shape adherence behavior. Health literacy encompasses an individual's ability to access, understand, appraise, and apply health-related information to make informed decisions regarding treatment. Patients with adequate health literacy are better equipped to comprehend the importance of completing TB therapy, recognize potential side effects, and maintain consistent medication-taking behavior throughout the treatment period (Nur Qomariyah & Piyabanditkul, 2023). Conversely, limited health literacy has been associated with misconceptions about TB, premature discontinuation of treatment, and inconsistent adherence patterns.

Beyond individual factors, social support systems play an essential role in sustaining medication adherence. Family support, in particular, has been repeatedly identified as a key determinant of adherence among TB patients in Indonesia. Family members often provide practical assistance, such as reminding patients to take medication, accompanying them to health facilities, and offering emotional encouragement during treatment. Empirical studies have demonstrated that strong family involvement positively influences patients' motivation and commitment to completing TB treatment (Supriadi et al., 2023; Andriani et al., 2023). In contrast, lack of family support has been associated with higher rates of treatment interruption and non-adherence.

Within Indonesia's TB control framework, the role of the Drug Swallowing Supervisor or Pengawas Menelan Obat (PMO) is institutionalized as a strategy to enhance medication adherence. PMOs are tasked with supervising daily medication intake, providing reminders, and acting as intermediaries between patients and health care providers. Several studies conducted in various regions of Indonesia have reported a strong association between effective PMO involvement and higher levels of medication adherence (Yunitasari et al., 2023; Hartina et al., 2025; Astuti et al., 2025).

Effective PMO performance has been shown to reduce missed doses, detect early signs of treatment-related problems, and reinforce patient accountability throughout the treatment process.

Despite extensive evidence on factors influencing medication adherence, fewer studies have explicitly examined how adherence translates into concrete treatment outcomes at the local level. Treatment outcomes, commonly categorized as successful or unsuccessful according to national TB program guidelines, represent the ultimate measure of therapeutic effectiveness. Several studies across different Indonesian regions have demonstrated a significant association between high medication adherence and successful treatment outcomes (Indraswari et al., 2022; Aprilia et al., 2024; Mustaming, 2022). These findings suggest that adherence serves as a critical pathway through which individual, familial, and health system factors exert their influence on clinical outcomes.

In Jember Regency, East Java, tuberculosis remains a persistent public health concern, with community health centers serving as the primary providers of TB diagnosis and treatment. While previous studies in Jember have explored specific determinants of adherence, such as health literacy and peer educator roles, they have not comprehensively examined the direct relationship between medication adherence and treatment outcomes (Isnawati & Ririanty, 2023; Nur Qomariyah & Piyabanditkul, 2023). As a result, there is limited empirical evidence that integrates adherence behavior with documented treatment outcomes within this local context.

Addressing this evidence gap is essential for strengthening TB control strategies at the district level. Understanding how medication adherence relates to treatment outcomes can inform the design of targeted interventions that are both contextually relevant and programmatically feasible. Moreover, evidence derived from local settings is crucial for supporting policy implementation and resource allocation within primary health care systems. By examining adherence behavior alongside treatment outcomes, this study contributes to a more comprehensive understanding of TB treatment dynamics in Jember Regency.

Therefore, this study aims to analyze medication adherence and its relationship with treatment outcomes among tuberculosis patients in Jember Regency, East Java, Indonesia. By integrating individual factors such as health literacy, social factors including family support, and health system elements represented by PMO involvement, this research seeks to provide empirical evidence to support adherence-focused interventions. The findings are expected to contribute to the strengthening of TB control programs by emphasizing medication adherence as a central determinant of treatment success within primary health care settings.

Materials and Methods

Study Design and Setting

This study employed a cross-sectional analytical design to examine medication adherence and its relationship with treatment outcomes among tuberculosis patients. The research was conducted in Jember Regency, East Java, Indonesia, an area where community health centers (Puskesmas) function as the primary facilities for tuberculosis diagnosis, treatment, and monitoring. Data collection was carried out from January to June 2024, aligning with the routine implementation of the national tuberculosis control program at the primary health care level. The cross-sectional approach was considered appropriate to capture adherence behavior and treatment outcomes within the same observation period without altering routine clinical practices.

Study Population and Sample

The study population consisted of pulmonary tuberculosis patients who were registered and actively undergoing treatment at selected Puskesmas in Jember Regency during the study period. Eligible participants included adult patients diagnosed with pulmonary tuberculosis and receiving standard anti-tuberculosis therapy according to national guidelines. Patients with incomplete

medical records or those who were unwilling to participate were excluded from the study. A total of 150 patients were recruited using proportional sampling based on the number of registered TB patients at each participating health center. This sampling strategy was applied to ensure adequate representation across facilities and to reflect the actual distribution of TB cases within the regency.

Data Collection Instruments

Data were collected using structured questionnaires that had been adapted from instruments used in previous tuberculosis adherence studies. The questionnaire captured several domains, including socio-demographic characteristics, health literacy, family support, the role of the Drug Swallowing Supervisor or Pengawas Menelan Obat (PMO), and self-reported medication adherence. Health literacy items assessed patients' understanding of tuberculosis, treatment duration, medication schedules, and potential consequences of non-adherence. Family support was measured through questions addressing emotional encouragement, informational support, and practical assistance related to treatment. PMO involvement was assessed based on supervision frequency, reminder practices, and communication with health care providers.

Medication adherence was measured using a validated self-report instrument commonly applied in tuberculosis research. Responses were categorized into levels of adherence based on predefined scoring criteria, allowing classification of patients into high and low adherence groups. Treatment outcome data were obtained from medical records and categorized as successful or unsuccessful in accordance with national tuberculosis program definitions.

Study Variables

The primary independent variable in this study was medication adherence. The dependent variable was treatment outcome, classified into successful and unsuccessful categories. Supporting variables included health literacy, family support, and PMO involvement, which were analyzed as contextual factors related to adherence behavior. All variables were operationalized based on established definitions and measurement approaches reported in the existing literature cited in this study.

Data Analysis

Data analysis was conducted using descriptive and inferential statistical methods. Descriptive analysis was performed to summarize respondent characteristics, levels of medication adherence, and distribution of treatment outcomes. Frequencies and percentages were used to present categorical variables. Inferential analysis was conducted using the chi-square test to examine the association between medication adherence and treatment outcomes. The same analytical approach was applied to explore relationships between adherence and contextual factors, including health literacy, family support, and PMO involvement. Statistical significance was determined based on conventional probability thresholds.

Ethical Considerations

Ethical principles were applied throughout the research process. Participation in the study was voluntary, and informed consent was obtained from all respondents prior to data collection. Confidentiality of patient information was maintained by anonymizing questionnaire responses and medical record data. The study procedures were conducted in accordance with ethical standards for health research involving human participants and aligned with regulations governing research within primary health care settings.

Results and Discussion

Overview of Medication Adherence and Treatment Outcomes

The findings indicate that most tuberculosis patients in Jember Regency demonstrated a high level of medication adherence during the treatment period. This pattern suggests that the implementation of the tuberculosis treatment program at the primary health care level has generally succeeded in promoting consistent medication-taking behavior among patients. High adherence was predominantly observed among patients who reported regular supervision by PMOs and received ongoing support from family members. These findings are consistent with previous studies conducted in various regions of Indonesia, which reported similar adherence patterns among patients receiving structured supervision and social support (Nafisah et al., 2021; Florentina et al., 2023).

In terms of treatment outcomes, patients with high medication adherence were more likely to achieve successful treatment completion. This result reinforces the established understanding that adherence is a critical determinant of tuberculosis treatment success. Comparable findings have been reported in studies from Karangasem, Lamongan, and other districts, where adherence was identified as a strong predictor of favorable treatment outcomes (Indraswari et al., 2022; Mustaming, 2022).

Table 1 presents a descriptive overview of the relationship between medication adherence levels and treatment outcomes based on the study findings.

Medication Adherence Level	Observed Treatment Outcome Trend
High adherence	Predominantly successful outcome
Low adherence	Higher risk of unsuccessful outcome

Health Literacy and Medication Adherence

Health literacy emerged as an important contextual factor associated with medication adherence. Patients with adequate understanding of tuberculosis, treatment duration, and medication schedules demonstrated more consistent adherence behavior. Adequate health literacy enabled patients to anticipate treatment-related challenges and maintain adherence despite experiencing side effects or symptom improvement. This finding aligns with previous research conducted in Jember Regency, which emphasized the role of health literacy as a key determinant of adherence among tuberculosis patients (Nur Qomariyah & Piyabanditkul, 2023).

These results support the conceptual framework that health literacy influences treatment outcomes indirectly through adherence behavior. Patients who clearly understand the consequences of treatment interruption are more likely to remain committed to completing therapy. Similar conclusions have been reported in other Indonesian studies, underscoring health literacy as a modifiable factor that can be strengthened through targeted patient education interventions.

Family Support and Adherence Behavior

Family support was found to play a substantial role in sustaining medication adherence among tuberculosis patients. Patients who received consistent encouragement, reminders, and assistance from family members showed stronger commitment to daily medication intake. Emotional and instrumental support provided by family members contributed to patients' motivation to complete treatment, particularly during periods of treatment fatigue. These findings are consistent with evidence from studies conducted in Bandung and other regions, which highlighted the importance of family involvement in tuberculosis management (Supriadi et al., 2023; Andriani et al., 2023).

Table 2 summarizes the conceptual relationship between family support and adherence behavior observed in this study.

Level of Family Support	**Adherence Behavior Trend**
Strong support	Consistently high adherence
Limited support	Increased risk of non-adherence

Role of PMO in Supporting Treatment Adherence

The involvement of PMOs was identified as a key health system factor associated with medication adherence. Patients who reported active PMO supervision tended to maintain regular medication intake and demonstrated higher adherence levels. PMOs contributed by providing reminders, monitoring daily medication consumption, and facilitating communication between patients and health care providers. This finding corroborates previous studies that documented the positive impact of PMO performance on adherence and treatment success (Yunitasari et al., 2023; Hartina et al., 2025; Astuti et al., 2025).

The presence of PMOs strengthened patient accountability and reduced the likelihood of missed doses. This result highlights the importance of maintaining PMO capacity and supervision quality within the tuberculosis control program.

Integrated Interpretation of Findings

Overall, the findings demonstrate that medication adherence functions as a central mechanism linking individual, social, and health system factors to tuberculosis treatment outcomes. Health literacy, family support, and PMO involvement do not operate independently but interact to shape adherence behavior. Strengthening these factors simultaneously may therefore enhance treatment success and reduce the risk of unfavorable outcomes. These results are consistent with broader evidence emphasizing adherence-focused strategies as essential components of effective tuberculosis control programs (Hongprasit & Sonthisombat, 2023; Law et al., 2025).

Conclusion

This study confirms a significant relationship between medication adherence and treatment outcomes among tuberculosis patients in Jember Regency, East Java. Patients who demonstrated consistent adherence to anti-tuberculosis therapy were more likely to achieve successful treatment outcomes, highlighting adherence as a central determinant of therapeutic effectiveness within primary health care settings. These findings reinforce the role of adherence as a critical pathway through which tuberculosis control programs can achieve optimal clinical results.

Medication adherence in this study was closely linked to individual, social, and health system factors. Adequate health literacy enabled patients to understand the importance of completing treatment and to manage long-term therapy more effectively. Strong family support provided both practical assistance and emotional motivation, helping patients maintain consistent medication intake throughout the treatment period. In addition, active involvement of Pengawas Menelan Obat (PMO) strengthened supervision and accountability, thereby supporting sustained adherence behavior.

Overall, the findings suggest that tuberculosis treatment success cannot be separated from adherence-focused strategies. Strengthening patient education, enhancing family engagement, and optimizing PMO performance should be prioritized as integrated components of tuberculosis control programs at the primary health care level. These efforts are expected to improve treatment completion rates and reduce the risk of unfavorable outcomes. The results of this study provide empirical support for adherence-oriented interventions and may serve as a reference for local health authorities in designing evidence-based strategies to improve tuberculosis treatment outcomes.

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