

Original Article

Analysis of factors affecting tuberculosis treatment adherence at Lesung Batu Community Health Center: A cross-sectional study

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Abstract

Background

Tuberculosis (TB) remains a major global health problem with high rates of morbidity and mortality, particularly in developing countries like Indonesia. One of the main challenges in TB control is the low treatment adherence among patients undergoing long-term therapy.

Objective

This study aimed to analyze the factors influencing tuberculosis medication adherence among patients at Lesung Batu Community Health Center.

Methods

A quantitative cross-sectional study was conducted from May 8 to 27, 2025, involving 56 TB patients registered at the Lesung Batu Health Center. Total sampling was used. Data were collected using a structured questionnaire based on the Morisky Medication Adherence Scale (MMAS-8) and analyzed using Chi-square and multivariate logistic regression.

Results

Only 51.8% of respondents were adherent to TB medication. Bivariate analysis showed that gender ($p=0.01$), distance to health facilities ($p=0.01$), and family support ($p=0.00$) had significant associations with adherence. Multivariate analysis revealed family support as the most dominant factor ($OR=0.16$, 95% $CI=0.05-0.51$), indicating that patients without family support were 6.25 times more likely to be non-adherent.

Conclusion

Family support, proximity to health services, and male gender significantly influenced TB medication adherence. Interventions should focus on increasing family involvement and improving access to care for patients in remote areas. Primary healthcare providers are advised to implement community-based strategies that include home visits, family counseling, and cross-sectoral collaboration to enhance adherence and improve treatment outcomes.

Background

Tuberculosis (TB) remains a major global health challenge, contributing significantly to high rates of morbidity and mortality (WHO, 2024). According to the WHO (2024), there were 10.8 million new TB cases and approximately 1.25 million deaths globally. Most cases occurred in Southeast Asia, Africa, and the Western Pacific, with nearly 50% of cases originating from Southeast Asia (Nyamathi et al., 2021; WHO, 2024). Indonesia ranks among the top three countries with the highest TB burden worldwide. This indicates that TB control efforts still require serious attention, particularly in improving the effectiveness of treatment programs across all levels of healthcare services (Ministry of Health RI, 2024).

At the national level, TB control faces numerous challenges. In Indonesia, approximately 15 people die from TB every hour. Although the government aims for 100% treatment coverage

for TB patients, the actual rate has only reached 88%, with a treatment success rate of 73% (Ministry of Health RI, 2024). Moreover, many TB cases remain undocumented, resulting in patients being unmonitored and not receiving adequate therapy (Olawade et al., 2024). These facts highlight the low level of treatment adherence among TB patients and the weakness of the reporting and monitoring systems. Adherence to treatment is essential for reducing transmission, preventing drug resistance, and achieving TB elimination targets (Dilas et al., 2023).

Treatment adherence is also a serious concern at the regional level, including in South Sumatra Province. Data from the South Sumatra Provincial Health Office (2024) reported a pulmonary TB prevalence rate of 3.2%, with Empat Lawang Regency contributing around 280 cases. Furthermore, according to the South Sumatra Provincial Bureau of Statistics (2024), TB cases in Empat Lawang sharply increased

from 233 in 2022 to 23,256 in 2023. This surge suggests that challenges in treatment implementation—particularly related to patient adherence—remain unaddressed. Poor adherence has also been linked to an increased risk of multi-drug-resistant TB (MDR-TB), which is more difficult and expensive to manage (Adima & Arini, 2025; Siregar, Yusuf, & Fernaldy, 2022).

Adherence to TB treatment is influenced by a variety of complex individual and environmental factors (Arisandi & Novitry, 2024; Ramayanti et al., 2024). Previous studies have identified demographic characteristics such as age, gender, and education level as contributors to adherence behavior (Kk et al., 2025). Additionally, patients' attitudes and knowledge play a role in shaping motivation to complete treatment (Nyamathi et al., 2021; Sinha, Shenoi, & Friedland, 2020). However, social support from family members and accessibility to healthcare facilities are critical factors that are often overlooked in intervention planning. In fact, active family involvement can enhance patients' emotional and practical engagement in their treatment (Adima & Arini, 2025; Potty et al., 2021).

Geographical barriers, such as long distances to healthcare facilities, pose another obstacle to treatment continuity. Patients living far from health centers often experience delays in medication retrieval or miss scheduled follow-ups (Dam et al., 2022). Such issues are common in remote areas like Lesung Batu, where infrastructure is inadequate (Fuady et al., 2024). Discomfort and high transportation costs are common reasons for treatment discontinuation. These conditions require specific attention from TB program managers at the primary care level to ensure that services are more inclusive and responsive to the needs of patients in hard-to-reach areas (Chavez-Rimache, Ugarte-Gil, & Brunette, 2023).

In addition to access and environmental factors, the role of healthcare providers is crucial in establishing trust and facilitating adherence (Litvinjenko et al., 2023). Clear communication, consistent education, and humanistic approaches can foster trust and increase patient awareness regarding the importance of treatment completion. In practice, however, many healthcare workers lack the time and capacity to provide optimal support to each

patient (Arakelyan et al., 2022). This underscores the need to enhance healthcare workers' capacity and to strengthen treatment monitoring systems that are integrated with family and community support (Cherian et al., 2019).

Although several studies have explored the factors affecting TB treatment adherence, few have examined these factors in geographically and socio-culturally unique settings such as Lesung Batu Health Center. In this area, the community still faces limitations in access to health information, long distances to services, and limited formal social support. Moreover, there is a lack of current and locally specific data on TB treatment adherence. Contextual research is therefore necessary to portray the real situation and to serve as the basis for targeted and effective interventions.

This study aimed to analyze the factors influencing adherence to pulmonary tuberculosis medication among patients at Lesung Batu Community Health Center

Methods

Study Design

This study employed a quantitative cross-sectional design aimed at identifying the factors associated with medication adherence among patients with pulmonary tuberculosis. This approach enabled data collection at a single point in time to examine the relationship between independent and dependent variables. The study was conducted in the working area of Lesung Batu Community Health Center, Empat Lawang Regency, South Sumatra Province, from May 8 to May 27, 2025.

Sampling

The study population comprised all registered pulmonary tuberculosis patients at Lesung Batu Health Center in 2025, totaling 56 individuals. A total sampling technique was used, thus all eligible individuals were included as study participants. Inclusion criteria were patients currently taking anti-tuberculosis medication during the intensive treatment phase and willing to participate. Exclusion criteria included patients with severe comorbidities and those who were uncooperative during questionnaire completion.

Instruments

Data were collected using a structured questionnaire. The dependent variable was medication adherence, measured using the Morisky Medication Adherence Scale (MMAS-8). Independent variables included age, gender, educational level, knowledge, attitude, distance to healthcare facilities, support from healthcare providers, and family support.

Data Collection

Data collection was conducted through the questionnaire by the researcher and trained enumerators. The validity and reliability of the instrument were tested prior to data collection. Data were gathered over a 20-day period from May 8 to May 27, 2025.

Data Analysis

Univariate analysis was used to describe the frequency distribution of each variable.

Bivariate analysis was performed using the Chi-square test to examine the association between independent variables and treatment adherence. Multivariate analysis was then conducted using multiple logistic regression to identify the most dominant factor influencing adherence to TB treatment.

Ethical Consideration

This study received ethical approval from the Health Research Ethics Committee of STIK Bina Husada Palembang. All participants were informed about the study's objectives, benefits, and risks, and were asked to sign a written informed consent form prior to participation.

Results

This section presents the research findings on respondent characteristics and the frequency distribution of both independent and dependent variables (Table 1).

Table 1. Frequency Distribution of Respondents' Characteristics

| Variables | Frequency (n) | Percentage (%) |
|--|----------------------|-----------------------|
| TB Medication Adherence | | |
| Adherent | 29 | 51,8 |
| Non-adherent | 27 | 48,2 |
| Age | | |
| Older | 28 | 50 |
| Younger | 28 | 50 |
| Gender | | |
| Male | 18 | 32,1 |
| Female | 38 | 67,9 |
| Educational Level | | |
| Higher | 45 | 80,4 |
| Lower | 11 | 19,6 |
| Knowledge | | |
| Good | 33 | 58,9 |
| Fair | 23 | 41,1 |
| Attitude | | |
| Positive | 28 | 50 |
| Fair | 28 | 50 |
| Distance to Health Facility | | |
| Near | 29 | 51,8 |
| Far | 27 | 48,2 |
| Support from Healthcare Providers | | |
| Supportive | 29 | 51,8 |
| Unsupportive | 27 | 48,2 |
| Family Support | | |
| Supportive | 29 | 51,8 |
| Unsupportive | 27 | 48,2 |
| Total | 100 | 100 |

The study aimed to analyze the factors influencing medication adherence among pulmonary tuberculosis patients at Lesung Batu Community Health Center. The results include univariate data descriptions for each variable, which then served as the basis for subsequent bivariate and multivariate analyses. The analysis was conducted on variables such as age, gender, education level, knowledge, attitude, distance to health facilities, support from healthcare providers, and family support, with medication adherence serving as the primary outcome variable.

The study findings showed that 29 respondents (51.8%) were adherent to tuberculosis medication, while 27 (48.2%) were non-adherent. Based on age, 28 respondents

(50.0%) were older and 28 (50.0%) were younger. In terms of gender, 18 (32.1%) were male and 38 (67.9%) were female. Regarding educational level, 45 (80.4%) had a higher level of education, and 11 (19.6%) had a lower level. For knowledge, 33 respondents (58.9%) demonstrated good knowledge, while 23 (41.1%) had fair knowledge. Attitude toward treatment was evenly distributed, with 28 (50.0%) having a positive attitude and 28 (50.0%) a fair attitude. As for distance to health facilities, 29 (51.8%) lived near and 27 (48.2%) lived far from the health center. Healthcare provider support was reported as supportive by 29 respondents (51.8%) and unsupportive by 27 (48.2%). Family support was also reported as supportive by 29 respondents (51.8%) and unsupportive by 27 (48.2%).

Table 2. Analysis of Factors Affecting Adherence to Pulmonary Tuberculosis Medication at Lesung Batu Community Health Center

| Variables | TB Medication Adherence | | | | Total | | Pvalue |
|--|-------------------------|------|--------------|------|-------|------|--------|
| | Adherent | | Non-adherent | | | | |
| | n | % | n | % | n | % | |
| Age | | | | | | | |
| Older | 15 | 53,6 | 13 | 46,4 | 28 | 1,00 | 15 |
| Younger | 14 | 50,0 | 14 | 50,0 | 28 | | 14 |
| Gender | | | | | | | |
| Male | 14 | 77,8 | 4 | 22,2 | 18 | 0,01 | 14 |
| Female | 15 | 39,5 | 23 | 60,5 | 38 | | 15 |
| Educational Level | | | | | | | |
| Higher | 22 | 48,0 | 23 | 51,1 | 28 | 0,58 | 22 |
| Lower | 7 | 63,6 | 4 | 36,4 | 28 | | 7 |
| Knowledge | | | | | | | |
| Good | 19 | 57,6 | 14 | 42,4 | 33 | 0,44 | 19 |
| Fair | 10 | 43,5 | 13 | 56,5 | 23 | | 10 |
| Attitude | | | | | | | |
| Positive | 15 | 53,6 | 13 | 46,4 | 28 | 1,00 | 15 |
| Fair | 14 | 50,0 | 14 | 50,0 | 28 | | 14 |
| Distance to Health Facility | | | | | | | |
| Near | 20 | 69,0 | 9 | 31,0 | 29 | 0,01 | 20 |
| Far | 9 | 33,3 | 18 | 66,7 | 27 | | 9 |
| Support from Healthcare Providers | | | | | | | |
| Supportive | 21 | 72,4 | 8 | 27,6 | 29 | 0,00 | 21 |
| Unsupportive | 8 | 29,6 | 19 | 70,4 | 27 | | 8 |
| Family Support | | | | | | | |
| Supportive | 18 | 62,1 | 11 | 37,9 | 29 | 0,18 | 18 |
| Unsupportive | 11 | 40,7 | 16 | 59,3 | 27 | | 11 |

This section also presents the results of the bivariate analysis between independent variables—such as age, gender, education, knowledge, attitude, distance to healthcare facilities, family support, and support from healthcare providers—and the dependent variable, which was adherence to tuberculosis

medication. The Chi-square test was used with a significance level (p-value) of 0.05 to determine whether each independent variable had a statistically significant association with medication adherence (Table 2).

The analysis revealed that variables significantly associated with medication

adherence were gender ($p = 0.01$), distance to healthcare facilities ($p = 0.01$), and family support ($p = 0.00$). Male respondents, those living near the health center, and those receiving family support were more likely to adhere to their medication regimen. In contrast, age, educational level, knowledge, attitude, and healthcare provider support were not

significantly associated with adherence ($p > 0.05$).

Multivariate analysis was conducted to determine the most dominant factor influencing adherence to pulmonary tuberculosis medication. Variables included in the model were those with a p -value < 0.25 in the bivariate analysis.

Table 3. Final Model of Multivariate Analysis on Adherence to Pulmonary Tuberculosis Medication

| Variable | pValue | OR | 95,0% C.I.for EXP(B) | |
|----------------|--------|------|----------------------|-------|
| | | | Lower | Upper |
| Family Support | 0,00 | 0,16 | 0,05 | 0,51 |

The results of the multiple logistic regression analysis indicated that family support was the most dominant factor associated with adherence to pulmonary tuberculosis medication. Family support had a p -value of 0.00 and an odds ratio (OR) of 0.16, with a 95% confidence interval ranging from 0.05 to 0.51. This suggests that patients who did not receive family support were 6.25 times more likely to be non-adherent compared to those who did receive support. These findings highlight the critical role of family involvement in ensuring the success of pulmonary tuberculosis treatment.

Discussion

The study found no significant association between age and adherence to pulmonary tuberculosis medication at Lesung Batu Community Health Center. Although older age biologically tends to decrease immunity and increase the risk of TB infection (Dam et al., 2022), it was not directly related to adherence behavior. This suggests that adherence is more strongly influenced by psychological aspects, such as self-motivation and the desire to recover (Jaiswal, Sharma, Joshi, Agrawal, & Sheohare, 2022; Mgone et al., 2021). The researchers assume that individual willingness to undergo treatment has a greater impact on adherence than age itself. Therefore, strategies that focus on enhancing patient motivation may be more effective in improving adherence, regardless of age category (Manurung, 2024).

Conversely, gender was significantly associated with treatment adherence. In this study, male

patients were more likely to adhere to their medication than females. Gender, as a social construct, influences roles and responsibilities in daily life, including access to healthcare services (Adima & Arini, 2025). The researchers suggest that women may be more vulnerable to non-adherence due to the burden of domestic responsibilities and lack of family support. Therefore, the empowerment of women in TB treatment must be strengthened, including enhancing social support within families and communities (Arakelyan et al., 2022).

Education level was not significantly associated with treatment adherence. Theoretically, education plays a key role in strengthening an individual's ability to understand health information (Dilas et al., 2023). However, in this study, respondents with higher educational backgrounds did not show better adherence levels than those with lower education. This may be due to the equal dissemination of TB education provided by healthcare workers, which reaches all societal levels. Hence, formal education is not the sole determinant of understanding tuberculosis treatment (Huddart et al., 2018; Nyamathi et al., 2021).

Knowledge was also not significantly related to medication adherence. Although knowledge is generally considered a critical factor in shaping healthy behavior (Olawade et al., 2024), having good knowledge does not always lead to appropriate behavior, including adherence to treatment (Nadon, Dmello, & Shetty, 2023; Nyamathi et al., 2021). In this study, even though most respondents had received information

about TB through education and counseling, not all demonstrated adherence. This indicates that other factors such as self-efficacy, environmental influence, and social support also play roles in shaping adherence. Therefore, educational interventions should be accompanied by approaches that address patients' emotional and motivational dimensions (Nadon et al., 2023).

Attitudes toward treatment were likewise not significantly associated with adherence. Attitude, in this context, refers to the readiness to act in accordance with medical advice (Gai, Allwood, & Sun, 2024). A positive attitude does not necessarily translate into adherence behavior (Gai et al., 2024). In this study, respondents with a positive attitude toward treatment did not automatically demonstrate adherence. This indicates that, beyond attitude, external reinforcement such as supervision and support from the surrounding environment is needed. Thus, fostering a positive attitude remains important, but it must be supported by a system of external reinforcement to maintain consistent treatment behavior (Marleni, Syafei, & Saputra, 2020).

One of the factors that showed a significant relationship with adherence was distance to healthcare facilities. Respondents living closer to health services had higher adherence levels compared to those living farther away (Pramono, 2021). The greater the distance, the lower the likelihood of adherence to TB treatment (Pramono, Hendriani, Ardyanti, & Chifdillah, 2023). Poor geographical access creates barriers due to increased transportation costs and travel time. In this study, most respondents lived near the health center, facilitating easier access to healthcare. Therefore, to reach patients in remote areas, home visit programs or mobile healthcare services should be implemented (Pramono et al., 2023; Putri, Thohari, & Sari, 2022).

The most dominant factor in this study was family support. Strong family support was significantly associated with treatment adherence. As stated by Nursalam (2008), family social support can be emotional, functional, or instrumental in nature (Jaiswal et

al., 2022). Patients who feel supported by their families are more motivated to recover and adhere to treatment. Family members also play an essential role in supervising medication intake, especially during long treatment periods (Adima & Arini, 2025). Therefore, involving families in TB control programs should be formalized as part of primary healthcare strategies (Potty et al., 2021).

Meanwhile, support from healthcare providers did not show a significant association with adherence. Healthcare providers are expected to motivate patients through education, counseling, and the provision of accurate information (Dilas et al., 2023). However, in this study, healthcare provider support appeared to be suboptimal in influencing patient adherence (Siregar et al., 2022). The researchers assume that although education was provided, a lack of emotional and personal engagement may have reduced its impact. This highlights the need to improve the interpersonal capacities of healthcare personnel and to involve families in communication strategies. Synergy between healthcare providers and families is key to achieving comprehensive and successful TB treatment (Piovani, Nikolopoulos, & Bonovas, 2022)..

Conclusion and Recommendation

Most pulmonary tuberculosis patients have not fully adhered to their treatment regimen. Among the variables examined, only gender, distance to healthcare facilities, and family support were found to have a significant relationship with adherence to anti-tuberculosis medication. In contrast, age, educational level, knowledge, attitude, and healthcare provider support did not show a significant association with treatment adherence. Multivariate analysis revealed that family support was the most dominant factor influencing patient adherence to therapy. These findings underscore the critical role of the patient's immediate environment in ensuring the success of pulmonary tuberculosis treatment, which requires a high level of discipline and a prolonged treatment duration.

It is recommended that Lesung Batu Community Health Center enhance family involvement in the treatment process of pulmonary tuberculosis patients through direct education, active participation in medication supervision, and regular home visits. A mapping of the service area should be conducted to identify patients living far from the health center so that they can be supported with mobile healthcare services. Furthermore, healthcare workers should strengthen communication approaches that are personal and participatory to foster closer relationships with patients and their families. Efforts to improve adherence should also involve cross-sectoral collaboration, including community leaders and health cadres, to create a supportive social environment for the comprehensive and sustainable success of tuberculosis treatment.

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Declaration of conflict of interest

The authors declare no competing interests.

Declaration on the Use of AI

No AI tools were used in the preparation of this manuscript.

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