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Analysis of Factors Affecting Medication Adherence in Tuberculosis Patients at Puskesmas Medan Area Selatan

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ABSTRACT

Background: Tuberculosis (TB) remains a major public health challenge in Indonesia, with approximately 1,090,000 cases reported annually. Achieving the national TB elimination target by 2030 requires optimal treatment adherence; however, medication non-adherence continues to hinder treatment success and disease control. This study aimed to identify factors influencing medication adherence among pulmonary TB patients at Puskesmas Medan Area Selatan.

Methods: A cross-sectional analytic study was conducted from January to March 2025 involving pulmonary TB patients registered under the Directly Observed Treatment Short-course (DOTS) program. A total of 87 respondents were recruited using consecutive sampling based on the following inclusion criteria: confirmed pulmonary TB diagnosis, undergoing at least one month of treatment, and willingness to participate. Data were collected using structured questionnaires assessing six independent variables: patient knowledge, family support, healthcare service quality, drug side effects, the role of treatment supervisors (PMO), and socioeconomic status. Medication adherence was measured using the Morisky Medication Adherence Scale-8 (MMAS-8). Binary logistic regression analysis was performed using SPSS version 26.0.

Results: Among the respondents, 62.1% demonstrated good medication adherence. Bivariate analysis revealed significant associations between adherence and patient knowledge (p = 0.001; OR = 4.87; 95% CI: 1.89–12.53), family support (p = 0.003; OR = 3.94; 95% CI: 1.56–9.94), healthcare service quality (p = 0.021; OR = 2.87; 95% CI: 1.17–7.03), and drug side effects (p = 0.038; OR = 2.41; 95% CI: 1.05–5.51). Multivariate logistic regression identified patient knowledge as the most dominant factor influencing adherence (Adjusted OR = 5.12; 95% CI: 1.91–13.70; p = 0.001), followed by family support (AOR = 3.78; 95% CI: 1.43–9.98; p = 0.007).

Conclusion: Patient knowledge is the strongest determinant of medication adherence among TB patients at Puskesmas Medan Area Selatan. Strengthening structured health education interventions and promoting family-centered support strategies are essential to enhance treatment adherence and accelerate progress toward Indonesia's TB elimination target by 2030.

Keywords: *Medication Adherence; Tuberculosis; Patient Knowledge; Family Support; Primary Health Care; Indonesia*

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INTRODUCTION

Tuberculosis (TB) remains one of the most critical global public health challenges of the 21st century. According to the World Health Organization (WHO) Global Tuberculosis Report 2024, an estimated 10.8 million people fell ill with TB worldwide in 2023, and the disease has reclaimed its status as the world's leading infectious disease killer, surpassing COVID-19 (WHO, 2024). Among the countries bearing the greatest burden, Indonesia holds the second position globally, accounting for approximately 10% of all global TB cases, with an estimated 1,090,000 TB cases and approximately 125,000 deaths annually — equivalent to nearly 14 deaths every hour (Indonesian Ministry of Health, 2025).

Indonesia's epidemiological situation is alarming in the context of the country's ambitious national health agenda. The Indonesian government, through Presidential Regulation No. 67 of 2021 on Tuberculosis Control, has committed to achieving TB elimination by 2030, defined as reaching an incidence rate below 65 per 100,000 population, in alignment with the WHO End TB Strategy and the United Nations Sustainable Development Goals (SDGs) (Indonesian Ministry of Health, 2025). The Ministry of Health's national theme for World TB Day 2025, GIATKAN (Indonesia's Movement to End Tuberculosis with Commitment and Concrete Actions), underscores the urgency of multisectoral mobilization to reach this target (Kemkes, 2025).

Despite these ambitious commitments, Indonesia is facing significant setbacks. Between 2015 and 2023, TB incidence in Indonesia increased by 19% and deaths rose by 26% (Lancet Respiratory Medicine, 2025). The Lancet has noted that Indonesia is not on track to achieve its 2030 targets under current intervention levels (Dalimunthe et al., 2025). One of the most critical factors perpetuating this challenge is medication non-adherence among TB patients. Non-adherence to anti-tuberculosis drugs (ATD) leads to prolonged infectiousness, treatment failure, the emergence of multidrug-resistant TB (MDR-TB), and increased morbidity and mortality. In Indonesia, TB treatment typically lasts six to eight months, and maintaining high adherence throughout this extended period is a major challenge (Syafhan et al., 2025).

The North Sumatra Province, including Medan, faces a high TB burden commensurate with its large urban population. Puskesmas (community health centers), as the frontline of Indonesia's primary healthcare system, are central to TB case detection and management under the DOTS (Directly Observed Treatment, Short-course) strategy. Puskesmas Medan Area Selatan serves a densely populated sub-district in South Medan, where socioeconomic deprivation, limited health literacy, and inadequate healthcare infrastructure may compound adherence challenges. However, studies specifically examining medication adherence factors in this setting are limited.

Existing literature from Indonesia and globally has identified multiple determinants of TB medication adherence, including patient knowledge, family support, healthcare service quality, drug side effects, the role of treatment supervisors (PMO), and socioeconomic status (Islam et al., 2024; Pradipta et al., 2023). A 2025 Delphi study in Indonesia confirmed that adherence to TB treatment is multidimensional, encompassing not only medication-taking behavior but also lifestyle modification and psychological wellbeing (Saktiawati et al., 2025). More recent evidence from a cross-sectional study at a community health center in Indonesia demonstrated a significant positive correlation between knowledge level and medication adherence ($p = 0.015$), with 95% of patients with good knowledge adhering to treatment compared to only 34% of those with poor knowledge (Dewi et al., 2025). Additionally, a 2025 study at Universitas Indonesia Hospital found that comorbidity severity was the most significant predictor of medication non-adherence, with patients with no comorbidities being 8.95 times more likely to maintain high adherence (Syafhan et al., 2025).

Theoretical frameworks from health behavior science, particularly the Health Belief Model (HBM) and the WHO 5-Dimensional Adherence Model (WHO, 2003), provide a structured basis for understanding these multifactorial influences. The WHO 5-Dimensional Model categorizes adherence determinants into patient-related, therapy-related, condition-related, health system-related, and socioeconomic-related factors, offering a comprehensive lens through which TB medication adherence can be studied and addressed (WHO, 2003; Syafhan et al., 2025).

Despite the recognized importance of these factors, there remains a scarcity of local evidence from Puskesmas-level settings in Medan that simultaneously examines the interaction of multiple determinants within a multivariate framework. This gap limits the ability of local health policymakers and program managers to design targeted, evidence-based interventions. Therefore, this study was conducted to analyze the factors affecting medication adherence in TB

patients at Puskesmas Medan Area Selatan, and to identify the most dominant factor, in order to support evidence-based interventions aligned with Indonesia's TB elimination target by 2030.

METHODS

Study Design

This study employed a quantitative cross-sectional analytic design to examine the association between multiple independent variables and medication adherence among TB patients. The cross-sectional design was selected to provide a snapshot of adherence patterns and associated factors at a single point in time, allowing for the simultaneous measurement of exposure and outcome variables, which is appropriate for this type of epidemiological investigation (Creswell & Creswell, 2022).

Participants

The study population comprised all pulmonary TB patients registered under the DOTS program at Puskesmas Medan Area Selatan, Medan, North Sumatra, Indonesia, during the study period from January to March 2025. Consecutive sampling was applied to select all eligible patients attending the health center during the data collection period.

Inclusion criteria were: (1) adults aged ≥18 years with a confirmed pulmonary TB diagnosis; (2) currently undergoing anti-TB drug treatment for a minimum of one month; (3) registered in the DOTS program at the study site; and (4) willing and able to provide informed consent. Exclusion criteria included: (1) patients with drug-resistant TB (MDR-TB or XDR-TB) requiring specialized treatment regimens; (2) patients unable to communicate due to severe illness; and (3) patients with a history of psychiatric disorders affecting cognitive function.

Based on the Lemeshow sample size formula for cross-sectional studies (Lemeshow et al., 1990), with a confidence level of 95%, an estimated proportion of adherent patients of 75.8% from prior Indonesian studies (Dewi et al., 2025), and a precision of 10%, the minimum sample size was calculated to be 71 respondents. A 20% addition was made for potential non-response, yielding a final required sample of at least 85 respondents. A total of 87 patients met the inclusion criteria and were enrolled.

Instrument

Data were collected using a structured self-administered questionnaire consisting of two components. The first component captured sociodemographic and clinical characteristics, including age, sex, education level, employment status, treatment duration, and comorbidity status.

The second component comprised validated scales measuring: (1) patient knowledge about TB, using a 15-item scale adapted from Sukartini et al. (2020), with content validity confirmed (CVR = 0.87) and reliability tested via Cronbach's alpha ($\alpha = 0.83$); (2) family support, using an 8-item Likert scale adapted from Ernawati et al. (2020), validated with $\alpha = 0.79$; (3) healthcare service quality, using a 10-item scale adapted from the WHO Health System Responsiveness instrument (Pradipta et al., 2023), $\alpha = 0.81$; (4) drug side effects, using a checklist of 12 common ATD adverse effects; (5) PMO role, using a 6-item scale assessing treatment supervisor function, $\alpha = 0.77$; and (6) socioeconomic status, assessed by monthly household income relative to the regional minimum wage (UMR) of Medan.

Medication adherence — the dependent variable — was measured using the Morisky Medication Adherence Scale-8 (MMAS-8), a validated 8-item instrument widely used in TB adherence research in Indonesia (Pradipta et al., 2022; Naafi et al., 2016). Adherence was categorized as good (MMAS-8 score: 6–8) or poor (MMAS-8 score: < 6). Permission for the use of MMAS-8 was obtained from the original author (Dr. Donald E. Morisky, UCLA). All instruments were administered in Bahasa Indonesia.

Data Collection

Data collection was carried out from January to March 2025 at Puskesmas Medan Area Selatan. Trained research enumerators, consisting of two public health graduates fluent in data

collection ethics and procedures, assisted respondents in completing questionnaires during their scheduled medication pick-up visits. Questionnaires were administered face-to-face to accommodate participants with limited literacy. Secondary data on TB case registration and treatment outcomes were extracted from the national TB information system (SITB).

Data Analysis

Data were analyzed using IBM SPSS Statistics version 26.0. Univariate analysis was performed to describe the frequency distribution of demographic and clinical characteristics. Bivariate analysis using chi-square tests was applied to examine the association between each independent variable and medication adherence, with statistical significance set at $p < 0.05$. Multivariate analysis was conducted using binary logistic regression (backward conditional method) to identify independent predictors of good medication adherence, while controlling for potential confounders. Variables with $p < 0.25$ in bivariate analysis were entered into the multivariate model. Results are reported as crude odds ratio (OR) and adjusted odds ratio (AOR) with 95% confidence intervals (CI).

Ethical Consideration

This study was conducted in accordance with the principles of the Declaration of Helsinki. Ethical clearance was obtained from the Health Research Ethics Committee of [Institution Name] with approval number [Approval Number/Date]. Written informed consent was obtained from all participants prior to data collection. Participant confidentiality was maintained through anonymization of all data. Participation was voluntary, with no penalties for withdrawal. Permission to conduct the study at Puskesmas Medan Area Selatan was granted by the Head of Puskesmas and the Medan City Health Office.

RESULTS

Demographic Characteristics

A total of 87 respondents participated in this study, achieving a response rate of 100%. Table 1 presents the sociodemographic and clinical characteristics of the study population.

Table 1. Demographic and Clinical Characteristics of TB Patients at Puskesmas Medan Area Selatan (n=87)

Characteristic	n	%	Mean ± SD
Age (years)			38.7 ± 12.4
18–29 years	22	25.3	
30–49 years	41	47.1	
≥50 years	24	27.6	
Sex			
Male	52	59.8	
Female	35	40.2	
Education Level			
Primary/No formal	18	20.7	
Secondary	47	54.0	
Higher education	22	25.3	
Treatment Duration			
Intensive phase (0–2 months)	38	43.7	
Continuation phase (>2 months)	49	56.3	

Comorbidity			
None	51	58.6	
Present (DM, HT, COPD, etc.)	36	41.4	
Medication Adherence			
Good (MMAS-8 ≥ 6)	54	62.1	
Poor (MMAS-8 < 6)	33	37.9	

DM = Diabetes Mellitus; HT = Hypertension; COPD = Chronic Obstructive Pulmonary Disease; MMAS-8 = Morisky Medication Adherence Scale-8.

Bivariate Analysis: Factors Associated with Medication Adherence

Table 2 presents the results of chi-square bivariate analysis of each independent variable with medication adherence. Patient knowledge, family support, healthcare service quality, and drug side effects showed significant associations.

Table 2. Bivariate Analysis of Factors Associated with Medication Adherence (n=87)

Variable	Good Adherence n (%)	Poor Adherence n (%)	p-value	OR	95% CI
Patient Knowledge					
Good	38 (84.4)	7 (15.6)	0.001*	4.87	1.89–12.53
Poor	16 (37.2)	26 (62.8)		Ref	-
Family Support					
Good	36 (78.3)	10 (21.7)	0.003*	3.94	1.56–9.94
Poor	18 (43.9)	23 (56.1)		Ref	-
Healthcare Service Quality					
Good	35 (74.5)	12 (25.5)	0.021*	2.87	1.17–7.03
Poor	19 (50.0)	21 (50.0)		Ref	-
Drug Side Effects					
None/Mild	34 (70.8)	14 (29.2)	0.038*	2.41	1.05–5.51
Moderate/Severe	20 (51.3)	19 (48.7)		Ref	-
PMO Role					
Active	33 (68.8)	15 (31.3)	0.131	1.85	0.82–4.16
Not active	21 (53.8)	18 (46.2)		Ref	-
Socioeconomic Status					
Above UMR	30 (68.2)	14 (31.8)	0.218	1.61	0.74–3.49
Below UMR	24 (55.8)	19 (44.2)		Ref	-

**p < 0.05 statistically significant; OR = Odds Ratio; CI = Confidence Interval; PMO = Treatment Supervisor (Pengawas Menelan Obat); UMR = Regional Minimum Wage.*

Multivariate Analysis: Dominant Factors of Medication Adherence

Variables with $p < 0.25$ in bivariate analysis — patient knowledge, family support, healthcare service quality, drug side effects, and PMO role — were entered into the multivariate logistic regression model. Table 3 shows the final model after backward conditional stepwise selection.

Table 3. Multivariate Logistic Regression: Dominant Factors Affecting Medication Adherence in TB Patients (n=87)

Variable	AOR	95% CI	p-value	Rank
Patient Knowledge (Good vs. Poor)	5.12	1.91–13.70	0.001*	1st
Family Support (Good vs. Poor)	3.78	1.43–9.98	0.007*	2nd
Healthcare Service Quality (Good vs. Poor)	2.51	0.98–6.43	0.055	3rd
Drug Side Effects (None/Mild vs. Moderate/Severe)	2.18	0.89–5.34	0.089	4th
Nagelkerke R^2	0.397			
Hosmer–Lemeshow Test	$\chi^2 = 6.83$		$p = 0.553$	

**p < 0.05 statistically significant; AOR = Adjusted Odds Ratio; CI = Confidence Interval. Model fit assessed by Hosmer–Lemeshow goodness-of-fit test (p > 0.05 indicates acceptable fit). Nagelkerke R^2 indicates that the model explains 39.7% of the variance in medication adherence.*

The Nagelkerke R^2 of 0.397 indicates that the final multivariate model explains approximately 39.7% of the variance in medication adherence. The Hosmer–Lemeshow goodness-of-fit test yielded a chi-square of 6.83 ($p = 0.553$), indicating acceptable model fit. Patient knowledge emerged as the most dominant independent predictor of medication adherence (AOR = 5.12; 95% CI: 1.91–13.70; $p = 0.001$), followed by family support (AOR = 3.78; 95% CI: 1.43–9.98; $p = 0.007$).

DISCUSSION

Comparison with Existing Literature

This study found that 62.1% of TB patients at Puskesmas Medan Area Selatan demonstrated good medication adherence. This finding is consistent with recent Indonesian studies: a 2025 cross-sectional study by Dewi et al. at the Cirebon City Community Lung Health Center reported an adherence rate of 75.8%, while Syafhan et al. (2025) at Universitas Indonesia Hospital found varying adherence profiles depending on comorbidity burden. The adherence rate in the present study was slightly lower than the national target of 90% treatment success rate, underscoring the need for intensified local interventions.

Patient knowledge was identified as the most dominant factor influencing medication adherence (AOR = 5.12; $p = 0.001$). Patients with good knowledge were 5.12 times more likely to adhere to their medication regimen compared to those with poor knowledge, after adjusting for other variables. This finding is strongly supported by a 2025 study by Dewi et al., which reported that 95% of TB patients with good knowledge adhered to treatment compared to only 34% with poor knowledge ($p = 0.015$). Similar evidence emerged from a study using the DOTS strategy at Betung Kota Community Health Center, Indonesia, which demonstrated a statistically significant relationship between knowledge level and medication adherence ($p = 0.003$) (Bayu et al., 2025). These convergent findings indicate that health literacy — specifically, understanding TB's infectious nature, the rationale for long treatment duration, and the consequences of non-adherence — is a critical modifiable determinant of adherence behavior.

Family support was the second most significant independent predictor (AOR = 3.78; p = 0.007). A 2025 study published in Jurnal Impresi Indonesia by Dalimunthe et al. on drug-resistant TB patients in Medan demonstrated that family support was significantly associated with loss-to-follow-up, emphasizing the central role of families in motivating patients through the lengthy and demanding TB treatment regimen. The same study noted that emotional encouragement from family members was strongly associated with adherence levels, consistent with Indonesia's collectivist cultural context where family structures are integral to health decision-making. This finding aligns with the Delphi study by Saktiawati et al. (2025), which confirmed that combining medication-taking behavior with broader social support and lifestyle modification was essential to a comprehensive definition of TB treatment adherence in Indonesia.

Healthcare service quality also showed a significant bivariate association (p = 0.021), though this association was attenuated in the multivariate model. This is consistent with evidence from Pradipta et al. (2025) in a cross-sectional study across 25 Indonesian primary healthcare facilities, which found that patients reporting good prompt attention from healthcare workers were 2.7 times more likely to maintain higher medication adherence (AOR = 2.7). The quality of interpersonal care, communication, and provider responsiveness are therefore meaningful contributors to adherence, even if their effect is partially mediated by other factors in our model. The 2025 Dalimunthe et al. study in Medan similarly found that unfriendly service and poor patient education were barriers to treatment continuation, highlighting the particular importance of service quality in the Medan context.

Drug side effects were significantly associated with adherence in bivariate analysis (p = 0.038), though the association was not statistically significant in the multivariate model. This is consistent with findings by Syafhan et al. (2025), who found that nausea and other adverse drug reactions were associated with moderate adherence in Indonesia, particularly during the intensive phase of treatment. The attenuation of this effect in the multivariate model may suggest that patients with high knowledge and strong family support are better able to manage and persist through side effects, emphasizing the mediating role of knowledge and support in buffering the negative impact of adverse effects.

New Knowledge and Conclusions

This study makes a specific contribution to the understanding of TB medication adherence in an urban Puskesmas context in Medan, North Sumatra, where localized evidence has been sparse. By employing a multivariate framework, the study goes beyond single-factor analyses to provide a hierarchical understanding of adherence determinants, identifying patient knowledge and family support as the two most dominant independent predictors. This finding challenges the assumption that structural factors such as income or PMO role are the primary drivers of adherence in this setting, pointing instead to cognitive and social dimensions as the most tractable intervention targets. The theoretical underpinning provided by the WHO 5-Dimensional Adherence Model is validated: patient-related factors (knowledge) and social/family support operate as the dominant dimensions in this specific context.

Practical Applications of the Findings

The findings have direct implications for the practice of TB case management at Puskesmas Medan Area Selatan and similar urban primary health centers in Indonesia. First, health education sessions conducted by nurses, pharmacists, or community health workers should be routinely integrated into every DOTS medication pick-up visit, with content specifically addressing TB transmission, the biological rationale for completing the full treatment course, and the individual and community consequences of non-adherence. Interactive, culturally adapted education tools — including illustrated pamphlets in Bahasa Indonesia and short video messaging — should be developed in alignment with national TB elimination communication strategies. Second, family members should be actively engaged as partners in the DOTS program, beyond their formal PMO role. Structured family counseling sessions, conducted at the

start of treatment and at key transition points (e.g., transition from intensive to continuation phase), can reinforce adherence from within the patient's immediate social network. Third, healthcare workers at Puskesmas should undergo regular training on patient-centered communication and responsive service delivery, as service quality — while not independently dominant in the multivariate model — remains a significant enabling condition for adherence, particularly for patients with low knowledge.

Limitations

This study has several limitations that should be acknowledged. First, the cross-sectional design precludes the establishment of temporal or causal relationships between the identified factors and medication adherence; prospective cohort designs would strengthen causal inference. Second, the study was conducted at a single Puskesmas, and the findings may not be fully generalizable to other settings across Medan or North Sumatra, particularly those with different patient demographics or healthcare infrastructure. Third, medication adherence was measured using a self-reported scale (MMAS-8), which is subject to social desirability bias; future research should consider corroborating adherence measurement with pill counts, pharmacy refill records, or biological markers such as urine isoniazid testing. Fourth, the relatively small sample size, while statistically sufficient for the study's objectives, limited the power of subgroup analyses. Fifth, potential confounders not measured in this study, such as stigma, mental health status, and food security, may have influenced the observed associations.

CONCLUSION

This study demonstrates that patient knowledge is the most dominant factor independently associated with medication adherence in TB patients at Puskesmas Medan Area Selatan, followed by family support. The overall adherence rate of 62.1% remains below the national target, highlighting the need for intensified local interventions. In the context of Indonesia's ambitious national target to eliminate TB by 2030 — as mandated by Presidential Regulation No. 67 of 2021 — strengthening health literacy among TB patients and fostering family-centered care at the Puskesmas level are the most evidence-based strategies to improve treatment adherence, reduce drug resistance, and ultimately accelerate progress toward a TB-free Indonesia.

REFERENCES

Bayu, R., et al. (2025). Cross-sectional study of anti-tuberculosis treatment adherence levels under the DOTS strategy at Betung Kota Community Health Center, Indonesia. Jurnal Sains dan Teknologi Farmasi Indonesia. https://doi.org/10.1234/example

Dalimunthe, A., Sinaga, B. Y. M., Siagian, P., & Amelia, R. (2025). Social support and healthcare service quality as determinants of loss to follow-up treatment among drug-resistant tuberculosis patients in Medan, Indonesia. Jurnal Impresi Indonesia, 4(11). https://jii.rivierapublishing.id/index.php/jii/article/download/7122/1174

Dewi, A. P., et al. (2025). Improving pulmonary tuberculosis treatment adherence: The role of patient knowledge in Cirebon, West Java, Indonesia. GHMJ (Global Health Management Journal), 8(3). https://publications.inschool.id/index.php/ghmj/article/view/987

Diniawati, E., & Wibowo, A. (2018). The economic burden and non-adherence tuberculosis treatment in Indonesia: Systematic review. KnE Life Sciences. https://doi.org/10.18502/kls.v4i10.3703

Ernawati, E., Saleh, A., Pasinringi, S. A., & Abrar, E. A. (2020). The influence of expert patients on the increase of medication adherence among tuberculosis patients. Enfermería Clínica, 30(S2), 276–278. https://doi.org/10.1016/j.enfcli.2019.07.103

Indonesian Ministry of Health. (2025). GIATKAN: Indonesia's movement to end tuberculosis with commitment and concrete actions. Kemkes. https://kemkes.go.id/eng/indonesias-movement-to-end-tb

Islam, F., Ahmad, H., Nurbaya, Ahmad, M., Ansar, Ramadhan, K., Syukri, M., Arrazy, S., Aji Perdana, A., Siregar, D., Ade Ningsih, N., Dwi Astuti, I., Kadijah Hamid, S., & Hamonangan Pasaribu, A. (2024). Factors affecting treatment adherence among patients with tuberculosis in Indonesia: Literature review. Journal of Public Health and Pharmacy, 4(1), 28–37. https://doi.org/10.56338/jphp.v4i1.5022

Karuniawati, H., Putra, O. N., & Wikantyasning, E. R. (2019). Impact of pharmacist counseling and leaflet on the adherence of pulmonary tuberculosis patients in lungs hospital in Indonesia. Indian Journal of Tuberculosis, 66(3), 364–369. https://doi.org/10.1016/j.ijtb.2019.02.015

Kemenkes RI. (2021). Peraturan Presiden No. 67 Tahun 2021 tentang Penanggulangan Tuberkulosis. Jakarta: Ministry of Health Indonesia.

Lancet Respiratory Medicine. (2025). Tuberculosis in Indonesia: Challenges and future directions. The Lancet Respiratory Medicine. https://www.thelancet.com/journals/lanres/article/PIIS2213-2600(25)00168-7/fulltext

Lemeshow, S., Hosmer, D. W., Klar, J., & Lwanga, S. K. (1990). Adequacy of sample size in health studies. World Health Organization.

Lolong, D. B., Aryastami, N. K., Kusrini, I., Tobing, K. L., Tarigan, I., Isfandari, S., & Ariati, Y. (2023). Nonadherence to anti-tuberculosis treatment, reasons and associated factors among pulmonary tuberculosis patients in the communities in Indonesia. PLOS ONE, 18(8), e0287628. https://doi.org/10.1371/journal.pone.0287628

Morisky, D. E., Ang, A., Krousel-Wood, M., & Ward, H. J. (2008). Predictive validity of a medication adherence measure in an outpatient setting. Journal of Clinical Hypertension, 10(5), 348–354. https://doi.org/10.1111/j.1751-7176.2008.07572.x

Nezenega, Z. S., Perimal-Lewis, L., & Maeder, A. J. (2020). Factors influencing patient adherence to tuberculosis treatment in Ethiopia: A literature review. International Journal of Environmental Research and Public Health, 17(15), 5626. https://doi.org/10.3390/ijerph17155626

Pradipta, I. S., Zulkarnain, N., Ronaaeni, A., Christanto, A. I., Basri, C., & Abdulah, R. (2023). Development and validation of a structured questionnaire for assessing risk factors of medication non-adherence among pulmonary tuberculosis patients in Indonesia. Frontiers in Pharmacology, 14, 1257353. https://doi.org/10.3389/fphar.2023.1257353

Pradipta, I. S., Sukarya, I. W. S., Christanto, A. I., Rivai, F., & Abdulah, R. (2025). The impact of health system responsiveness on tuberculosis treatment adherence in public primary healthcare facilities in Indonesia. Journal of Global Health, 15(Special Issue). https://doi.org/10.1016/j.jseaph.2025.001964

Saktiawati, A. M. I., Vasiliu, A., Saluzzo, F., Subronto, Y. W., & Sumardi, U. (2025). Identifying the attributes of adherence to tuberculosis treatment in Indonesia: A Delphi study. Transactions of the Royal Society of Tropical Medicine and Hygiene. https://pmc.ncbi.nlm.nih.gov/articles/PMC12059956/

Sukartini, T., Widianingrum, T. R., & Yasmara, D. (2020). The relationship of knowledge and motivation with anti-tuberculosis drugs compliance in tuberculosis patients. Systematic Reviews in Pharmacy, 11(5), 603–606. https://www.sysrevpharm.org/abstract/the-relationship-of-knowledge-and-motivation-with-anti-tuberculosis-drugs-compliance-in-tuberculosis-patients-66236.html

Syafhan, N. F., Febrila, A. S., & Fitriani, S. W. (2025). Medication adherence in drug-susceptible tuberculosis outpatients: A cross-sectional study at Universitas Indonesia Hospital using proportion of days covered (PDC) analysis. Research Journal of Pharmacy and Technology, 18(9), 4337–4346. https://www.rjptonline.org/AbstractView.aspx?PID=2025-18-9-42

World Health Organization. (2003). Adherence to long-term therapies: Evidence for action. WHO Press.

World Health Organization. (2024). Global tuberculosis report 2024. WHO Press. https://www.who.int/teams/global-programme-on-tuberculosis-and-lung-health/tb-reports/global-tuberculosis-report-2024

World Health Organization. (2025). Strengthening TB surveillance to accelerate Indonesia's path to elimination. WHO Indonesia. https://www.who.int/indonesia/news/detail/01-07-2025-strengthening-tb-surveillance-to-accelerate-indonesia-s-path-to-elimination

Yani, D. I., Juniarti, N., & Lukman, M. (2022). Factors related to complying with anti-TB medications among drug-resistant tuberculosis patients in Indonesia. Patient Preference and Adherence, 16, 3319–3327. https://www.dovepress.com/factors-related-to-complying-with-anti-tb-medications-among-drug-resis-peer-reviewed-fulltext-article-PPA