



Original Article

Anti-Tuberculosis Drug Adherence Among Pulmonary Tuberculosis Patients At Primary Health Center

¹Junnia Aulia Zannah, ¹Yuliawati*, ¹M. Rifqi Efendi, ¹Marizki Pondawinata, ¹Fathnur Sani K

¹Pharmacy Department, Faculty of Medicine and Health Sciences, Universitas Jambi, Jambi, Indonesia

E-mail Corresponding: yuliawati@unja.ac.id

ABSTRACT

Article History:

Submit: April 2026
Accepted: Jan 2026

Keyword:

Adherence; Anti-Tuberculosis Drug; Tuberculosis; Patients; Primary Health Center



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Background: Tuberculosis (TB) is an infectious disease caused by infection with the bacterium *Mycobacterium tuberculosis* (M. tb). This bacterium has characteristics that make it difficult to treat, resulting in prolonged TB therapy. Non-adherence to anti-tuberculosis drugs (ATD) may increase the risk of treatment failure in patients diagnosed with pulmonary TB, which in turn can elevate the risk of multidrug resistance (MDR).

Method: This study is a descriptive observational research with a cross-sectional design and consisted of 45 participants. The research instrument used was the MMAS-8 (Morisky Medication Adherence Scale) questionnaire. Univariate and bivariate analyses were performed using the Chi-Square test.

Result: The results showed that 34 respondents (75.6%) had a high level of adherence, 9 respondents (20%) had a moderate level of adherence, and 2 respondents (4.44%) had a low level of adherence. According to statistical analysis using the Chi-Square test, the significance value for gender and adherence was 0.822, for age and adherence was 0.031, for educational level and adherence was 0.445, and for occupation and adherence was 0.465.

Conclusion: The majority of TB patients at Puskesmas Kenali Besar demonstrated a high level of adherence.

INTRODUCTION

Tuberculosis (TB) is an infectious disease caused by infection with *Mycobacterium tuberculosis* (M. tb).¹ This bacterium possesses characteristics that make it difficult to treat, resulting in prolonged TB therapy.² Most *M. tb* bacteria typically attack the lungs, leading to pulmonary TB.³ The disease is generally transmitted through droplet nuclei released when TB patients

cough or sneeze. TB remains a major public health problem worldwide, particularly in Indonesia.⁴

Tuberculosis is one of the leading causes of death globally. In 2021, an estimated 10.6 million people developed TB, and 1.4 million deaths were attributed to the disease. Indonesia has the second highest TB incidence after India, with an estimated 969,000 cases or 354 per 100,000 population.

TB-related deaths were estimated at 144,000 or 52 per 10,000 population, representing a 55% increase from 2020 to 2021. In 2022, more than 724,000 TB cases were identified in Indonesia, and the number increased to 809,000 in 2023.⁵ Jambi Province ranked fifth among provinces with the highest number of pulmonary TB cases, with 3,682 cases in 2021 and 5,308 cases in 2022. Jambi City contributed 24.38% of TB cases in Jambi Province.⁶ One of the key factors contributing to this burden is patient non-adherence to anti-tuberculosis drugs (ATD) use.

Non-adherence to ATD can lead to serious problems, including an increased risk of treatment failure, prolonged treatment duration due to the persistence of viable bacteria requiring more intensive therapy, and drug resistance such as multidrug resistance (MDR), in which bacteria become resistant to standard drugs.^{7,8} This condition complicates treatment and necessitates more costly regimens.⁹ Moreover, poor adherence to ATD raises the public health burden, as increased TB incidence and drug resistance may spread within the community and worsen the overall epidemiological situation. Therefore, adherence to ATD is crucial to prevent such adverse consequences.^{10,11}

Several studies have reported adherence levels to ATD. For instance, the level of adherence among pulmonary TB patients at Puskesmas Putri Ayu in Jambi City was found to be high, at 76.47%.¹² Another study further demonstrated a significant association between ATD adherence and treatment success in TB therapy. Adherence to ATD contributes to optimal recovery, reduced relapse risk, successful treatment outcomes, and ultimately, a decline in TB cases, particularly pulmonary TB.¹³

Puskesmas Kenali Besar reported the highest TB cases in Jambi City, with 149 cases in 2023, an increase from 103 cases in 2022. This rising trend underscores the need for strict monitoring of adherence and non-adherence to TB treatment. Based on these considerations, the researchers were motivated to conduct this study, which was

driven by the high TB prevalence at Puskesmas Kenali Besar compared to other areas in Jambi City.

METHOD

This study employed a quantitative research design with a cross-sectional approach using a descriptive observational method. The research was conducted at Puskesmas Kenali Besar, Jambi City, Jambi, from February to March 2024.

The study population consisted of all outpatient pulmonary TB patients at the Tuberculosis Directly Observed Treatment Short-course (DOTS) Clinic of Puskesmas Kenali Besar, totaling 45 patients. The sampling technique used was total sampling, in which the sample size was equal to the population, resulting in 45 respondents.

The inclusion criteria for this study were as follows: a) Pulmonary TB patients willing to participate as respondents and who signed informed consent; b) Patients diagnosed with pulmonary TB and receiving anti-tuberculosis drugs (ATD) at Puskesmas Kenali Besar; c) Patients undergoing intensive-phase pulmonary TB treatment for at least two weeks; and d) Pulmonary TB patients aged ≥ 15 years.

The exclusion criteria were as follows: a) Patients with TB complications or multidrug-resistant TB (MDR-TB); and b) Patients who transferred to another treatment facility.

The research instruments consisted of an informed consent form, data collection sheets, questionnaires, and interview guides. The level of adherence was measured using the Morisky Medication Adherence Scale-8 (MMAS-8), a validated questionnaire widely applied to assess patient's adherence to medication. The MMAS-8 consists of eight questions designed to evaluate medication-taking behaviour, including patterns of forgetfulness, discontinuation, and consistency in drug use. Each response is scored according to the standard MMAS-8 scoring system, and the total score is used to categorize adherence levels into high (score

8), moderate (score 6-7), and low (score <6). Structured interviews and documentation were also carried out during data collection.

A structured interview among patients with tuberculosis who have low adherence is conducted using a standardized set of questions that are asked consistently to all respondents. The interview is useful for identifying the reasons why patients forget to take their medication or discontinue their treatment. The interviewer follows a predetermined sequence of questions with minimal variation to ensure the data collected are uniform and comparable across participants.

Data processing involved editing (rechecking collected data), coding (converting patient characteristics and questionnaire responses into numerical values), scoring (assigning values based on obtained scores), tabulating (organizing data into tables), data entry (inputting data into SPSS software), and cleaning (rechecking completeness of entered data). The data were analyzed using IBM SPSS Statistics version 25. Univariate analysis was conducted to describe the frequency distribution and proportions of variables, presented in tables of patient demographics. Bivariate analysis was performed to determine the association between independent variables (gender, age, education, and occupation) and the dependent variable (adherence to ATD use) using the Chi-Square test with a 95% confidence level. A p-value < 0.05 was considered statistically significant.

This study has passed ethical review and received approval from the Research Ethics Committee of the Faculty of Medicine, Universitas Andalas, with ethical clearance number 86/UN.16.2/KEP-FK/2024.

RESULT AND DISCUSSION

Patient Demographics

The majority of respondents were male, totaling 26 individuals (57.8%), as shown in Table 1. This may be explained by the fact that females generally have a stronger

immune system compared to males due to the protective effects of estrogen hormones.¹⁴ In addition, males are more likely to smoke, which is a major risk factor for TB.¹⁵ Cigarette exposure can increase macrophage and pulmonary vascular damage, thereby reducing host protection.¹⁶ Moreover, men are more frequently engaged in occupational sectors with poor hygiene and high exposure risks, such as mining and industry, and have wider social interactions than women, making them more vulnerable to TB exposure.^{17,18}

In terms of age, the largest groups of respondents were those aged 46–55 years and ≥56 years, with 12 and 10 individuals, respectively (Table 1). This may be attributed to the natural decline in both innate and adaptive immunity with increasing age, which makes older individuals more susceptible to infections and diseases.¹⁹ Reduced mobility and physical activity, such as lack of exercise, in these age groups may also increase the risk of active TB, acting synergistically with immunosenescence.²⁰

Most respondents had a high school education, accounting for 28 individuals (62.2%), while the largest occupational category was those who were unemployed (housewives, students, or job seekers), totaling 19 individuals (42.2%) (Table 1). Although these respondents were classified as having completed high school and being unemployed, they often had wide social activities and interactions, which increase repeated exposure in their environments. Poor room ventilation and lack of health awareness further contribute to their susceptibility.²¹

Based on all characteristics tested against adherence to anti-tuberculosis drug (ATD) use as presented in Table 2, age was the only variable found to have a significant association with adherence. The Chi-Square test yielded a p-value of 0.031, which is <0.05, indicating a significant relationship between age and adherence to ATD use among pulmonary TB patients.

Table 1. Characteristics of Pulmonary TB Patients

Characteristics	Frequency n = 45	Percentage (%)
Sex		
Male	26	57.8
Female	19	42.2
Total	45	100
Age		
15 – 25	7	15.6
26 – 35	9	20
36 – 45	7	15.6
46 – 55	12	26.7
≥56	10	22.2
Total	45	100
Educational Attainment		
Elementary school	4	8.9
Junior high school	6	13.3
Senior high school	28	62.2
College	7	15.6
Total	45	100
Occupation		
Entrepreneur	9	20
Private employee	6	13.3
Farmer	2	4.4
Laborer	5	11.1
Contract worker	3	6.7
Retiree	1	2.2
Unemployed (housewife, student, etc.)	19	42.2
Total	45	100

The relationship between age and adherence may be influenced by several factors. As age increases, many individuals experience memory decline or cognitive impairment, making it more difficult to remember ATD intake schedules.^{22,23} In older age, the body also becomes more sensitive to various drug side effects, which may burden

patients and reduce their willingness to take ATD consistently.²⁴ Additionally, the presence of comorbidities or other medical conditions can overwhelm patients and complicate medication management, leading to poor adherence.²⁵

Table 2. Chi-Square Test Results of the Relationship Between Sex, Age, Educational Attainment, and Occupation on Adherence to Anti-Tuberculosis Drugs Use

Characteristics	Degree of adherence						Total		p - value
	High		Moderate		Low		n	%	
	n	%	n	%	n	%			
Sex									
Male	19	73.1	6	23.1	1	3.8	26	100	0.822
Female	15	78.9	3	15.8	1	5.3	19	100	
Total	34	100	9	100	2	100	45	100	

Age									
≤44	17	85	1	5	2	10	20	100	0.031
≥45	17	68	8	32	0	0	25	100	
Total	34	100	9	100	2	100	45	100	
Educational Attainment									
Lower level of education (elementary and junior high school)	6	66.7	3	33.3	0	0	9	100	0.445
Higher level of education (senior high school, college)	28	77.8	6	16.7	2	5.6	36	100	
Total	34	100	9	100	2	0	45	100	
Occupation									
Be employed (entrepreneur, private employee, farmer, labourer, contract worker)	19	73.1	5	19.2	2	7.7	26	100	0.465
Unemployed (housewife, student, etc.)	15	78.9	4	21.1	0	0	19	100	
Total	34	100	9	100	2	100	45	100	

Table 3. Overview of Medication Adherence Questions Using MMAS-8

Number	Question	Yes	%	No	%	
1.	Do you occasionally forget to take your ATD ?	2	4.44	43	95.56	
2.	Aside from forgetting, have there been days in the past two weeks when you did not take your medication ?	2	4.44	43	95.56	
3.	Have you ever cut back or discontinued your medication without informing your doctor because you felt your condition worsened while taking it ?	2	4.44	43	95.56	
4.	When you are away from home or travelling, do you occasionally forget to take your medicine with you ?	2	4.44	43	95.56	
5.	Yesterday, did you take your ATD as prescribed ?	30	100	0	0	
6.	When you start feeling better, do you at times stop taking your ATD ?	2	4.44	43	95.56	
7.	Do you feel burdened by the daily routine of taking your ATD ?	8	17.78	37	82.22	
		Never (1)	Only once (0.75)	Sometimes (0.50)	Normally (0.25)	Always (0)
8.	How often do you have difficulty remembering to take your ATD ?	43	0	2	0	0
	Percentage (%)	95.56	0	4.44	0	0

Based on the first interview question (Table 3), almost all respondents, 43 individuals (95.56%), answered "No," indicating they did not forget to take their ATD. This shows that most patients were aware of the importance of taking medication according to the instructions provided by healthcare workers at the Public Health Center, which contributes positively to preventing both individual and community-level drug resistance. Meanwhile, two respondents (4.44%) answered "Yes." Respondent No. 13 reported occasionally forgetting to take ATD during the continuation phase because the treatment schedule required intake only three times a week, leading to lapses. Respondent No. 22 reported forgetting due to being busy with work, which caused delays in taking medication.

For the second question, the majority of respondents (43 individuals, 95.56%) answered "No," indicating they consistently took ATD regularly even within the past two weeks. This demonstrates that patients were aware of the importance of regular medication and benefited from encouragement provided by healthcare workers and family members, which supported adherence. However, two respondents (4.44%), again patients No. 13 and 22, admitted missing doses in the past two weeks due to side effects such as loss of appetite, red-colored urine, joint pain, nausea, vomiting, and skin itching, which discouraged them from continuing medication.

Regarding the third question, 43 respondents (95.56%) stated that they never reduced or discontinued ATD use without informing healthcare workers. Two respondents (4.44%) admitted to stopping ATD without reporting it to healthcare staff. Both patients (No. 13 and 22) expressed concern about worsening conditions due to drug side effects, leading to reduced confidence and eventual treatment discontinuation.

For the fourth question, most respondents (43 individuals, 95.56%) answered "No," indicating they had never forgotten to bring ATD when traveling. They

stated that forgetting to carry the medication during travel would result in missed doses, potentially requiring treatment to restart. Two respondents (4.44%), patients No. 13 and 18, admitted forgetting to bring ATD during trips, citing concerns about carrying the medication or the fact that they rarely traveled far.

On the fifth question, all respondents (45 individuals, 100%) answered "Yes," confirming that they had taken their medication the day before. This indicates a high level of awareness to adhere to treatment for recovery. Healthcare workers reinforced this behavior by regularly asking patients about their medication intake during drug collection visits, and by reminding them that irregular use could lead to treatment failure and drug resistance, thereby increasing transmission risk.

For the sixth question, most respondents (43 individuals, 95.56%) answered "No," stating that they continued to take ATD even after feeling better, as instructed by healthcare workers. However, two respondents (4.44%), patients No. 13 and 22, admitted stopping ATD when they felt their health had improved, believing that further medication was unnecessary.

On the seventh question, the majority of respondents (37 individuals, 82.22%) answered "No," indicating that they did not feel burdened by their routine ATD schedule. However, 8 respondents (17.78%) answered "Yes," reporting that they felt burdened by daily intake. Interviews revealed that this was due to monotony in daily dosing and the unpleasant side effects of medication, which contributed to non-adherence.

For the eighth question, most respondents (28 individuals, 93.33%) answered "Never," reporting no difficulty remembering to take their medication, supported by high awareness and positive reinforcement from family members who reminded them to take their ATD. Meanwhile, 2 respondents (6.67%) reported "Sometimes" forgetting, primarily due to work-related distractions.

Table 4. Frequency Distribution of Adherence Level in the Use of Anti-Tuberculosis Drugs at Puskesmas Kenali Besar

No	Degree of Adherence	Frequency	Percentage (%)
1	High adherence	34	75.56
2	Moderate adherence	9	20
3	Low adherence	2	4.44
Total		45	100

Based on Table 4, the number of respondents with a high level of adherence to ATD was 34 people (75.56%), while those with moderate adherence were 9 people (20%), and low adherence was found in 2 people (4.44%). Interviews revealed that most pulmonary TB patients at Puskesmas Kenali Besar demonstrated strong motivation and confidence to recover. This awareness was supported by information provided by

healthcare workers as well as positive encouragement from family and close friends. Patients also realized the importance of consistently taking ATD over the long term to achieve complete recovery. Non-adherence to TB treatment may lead to relapse and the need to restart therapy from the beginning. Therefore, adherence to treatment is a key factor in the success of pulmonary TB therapy.

Table 5. Findings from interviews with respondents with low adherence

Number	Question	Respondent	Statement
1.	Do you experience any difficulties in taking your Anti-Tuberculosis drugs ?	Mrs. Nrr	"Yes, Ma'am. When I have to take the medication everyday, it sometimes becomes difficult for me to continue taking it."
		Mr. Tpp	"Yes, certainly, Ma'am. Particularly at the beginning, when I first started taking the medication, it was difficult for me, and I also felt worried."
2.	Is there any dose or amount of medication that you have forgotten to take ?	Mrs. Nrr	"When I take my medication, I take all of the prescribed doses, Ma'am. However, occasionally I forget or postpone taking it."
		Mr. Tpp	"Occasionally, I forget to take the medicine, Ma'am, as I tend to delay it too much."
3.	What is the reason you forgot to take your medication ?	Mrs. Nrr	"Several times it was because I had too much work to do, Madam. I work as a tailor, so there are always many things I need to finish. Sometimes, even when I remember, I postpone it and think, I'll take the medicine later."
		Mr. Tpp	"I take the medicine three times a week, alternating with meals. Sometimes, when it is time to take medicine, I delay it. Since I also leave for work in the morning, I sometimes forget completely."
4.	Have you experienced any symptoms or side	Mrs. Nrr	"Yes, I have, ma'am. I felt several side effects such as joint pain, itching on the

effects while taking Anti-Tuberculosis drugs ?	skin, nausea, vomiting, my urine turning red, and loss of appetite. Sometimes I also feel shortness of breath after taking the medicine. That is what I have experienced since taking Anti-Tuberculosis drugs. At one time, I was even hospitalized because I thought it was due to that medication. I felt afraid because I had shortness of breath and also a high fever with chills. When I was examined, the doctor told me to stop taking the Anti-Tuberculosis drugs for a while until my condition improved."
Mr. Tpp	"Yes, ma'am. Since I started taking the medicine, sometimes I feel body aches when I wake up, nausea, and my appetite has decreased compared to before."

Based on the interview results presented in Table 5, two respondents who were categorized as having low adherence reported that the reason for their non-adherence was the side effects of the medication they experienced, which made it difficult for them to comply with the prescribed treatment. This result is in line with prior research demonstrating that adverse drug reactions following ATD represent one of the most significant contributors to patient non-adherence.²⁶ Therefore, the need for continuous patient education to enhance treatment adherence.

CONCLUSION

Based on the findings of this study, it can be concluded that 34 respondents (75.56%) had a high level of adherence, 9 respondents (20%) had a moderate level of adherence, and 2 respondents (4.44%) had a low level of adherence. This result was predominantly high medication adherence. This suggest that most patients have a good understanding of their treatment regimen. Future studies are recommended to explore factors contributing to low adherence, including psychological, social, and healthcare system-related determinants. Additionally, longitudinal studies are needed to assess adherence over time and its direct impact on clinical outcomes.

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