

The relationship between knowledge and attitudes and adherence to Anti-Tuberculosis medication among Tuberculosis patients at the Manyaran community health center

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Abstract

Background: Tuberculosis remains a serious global health problem, with treatment failure often caused by low patient adherence.

Objective: This study aims to analyze the relationship between knowledge levels and attitudes toward adherence to anti-tuberculosis medication (OAT) among TB patients at the Manyaran Community Health Center (UPTD Puskesmas Manyaran).

Methods: A qualitative study with a correlational approach and a cross-sectional design was used. The study sample consisted of 69 respondents selected based on specific inclusion criteria. Data were collected using a knowledge questionnaire, an attitude questionnaire, and the MMAS-8 adherence scale, which has been validated.

Results: The results showed that the majority of respondents had good knowledge (53.6%), but most held negative attitudes (78.3%). The level of medication adherence was predominantly in the moderate category (42.0%). Data analysis revealed a significant positive correlation between knowledge and adherence ($r = 0.451$; $p = 0.000$) as well as a significant correlation between attitude and adherence ($r = 0.424$; $p = 0.000$).

Conclusion: It is concluded that increasing knowledge and fostering positive attitudes are crucial for achieving the cure rate target for TB patients.

Keywords

anti-tuberculosis medication; attitude; knowledge

1. Introduction

Pulmonary tuberculosis (pulmonary TB) is a chronic infectious disease caused by the bacterium *Mycobacterium tuberculosis*, an acid-fast bacillus transmitted through the air (Sunarmi & Kurniawaty, 2022). To date, TB remains a serious global health problem, affecting millions of people worldwide. This disease primarily affects the respiratory system but can also spread to other organs and cause various symptoms. As a global health issue, TB control requires sustained efforts in prevention, early detection, and treatment to effectively reduce its impact on public health (Fauzi et al., 2024).

Tuberculosis causes more than one million deaths each year. The number of patients undergoing treatment increased from 6 million (2015) to 7.1 million (2019). Approximately 44% of cases occur in Southeast Asia, with 9.2% in Indonesia (Adini et al., 2023). In 2022, tuberculosis remained the second-leading cause of death worldwide after COVID-19, with 10.6 million cases and 1.3 million deaths. In Indonesia, there were approximately 1.06 million cases and 134,000 deaths. The 2030 TB elimination target is to reduce the incidence to 65 per 100,000 population and mortality to 6 per 100,000 population (Diana et al., 2024).

The reduction in TB cases and deaths depends on complete and regular adherence to medication. However, not all patients are compliant. Adherence is influenced by factors such as age, occupation, free time, supervision, type and dosage of medication, as well as the knowledge, attitudes, behaviors, and counseling provided by healthcare workers (Fauzi et al., 2024). The duration of treatment can lead to patient fatigue regarding medication adherence, which is influenced by knowledge, communication, healthcare facilities, as well as perceptions and motivation. Increased knowledge can change perceptions, attitudes, and behaviors (Adini et al., 2023). Treatment is considered successful if the patient recovers and TB bacterial test results are negative, whereas it is considered a failure if sputum remains positive after 5 months. Treatment failure is influenced by low medication adherence (4–35% of doses) and treatment interruption lasting at least 2 months (Marta et al., 2023). Additionally, low educational attainment increases the risk of TB, while higher education makes it easier for individuals to understand information and maintain their health (Fitrianti et al., 2022).

Several studies have shown a relationship between knowledge and attitudes and adherence to anti-tuberculosis medication. A 2019 study at the Teladan Community Health Center in Medan found a significant association ($p=0.03$; $p=0.043$) between knowledge and attitudes and adherence (Fauzi et al., 2024). A study at Budi Lestari Hospital in Bekasi (2023) also showed a moderate, positive correlation ($r = 0.423$; $p = 0.001$), leading to the conclusion that there is a significant relationship between knowledge levels and medication adherence (Marta et al., 2023).

According to data from the Semarang City Health Department as of June 8, 2025, there were 2,266 active TB cases, with the highest numbers in Tambakaji (53) and Tanjungmas (53), and the lowest in Sambiroto (DKK, 2025). Data from the Manyaran Community Health Center (UPTD Puskesmas Manyaran) for the period January–June 2025 recorded 635 suspected TB cases, 579 of whom underwent bacteriological testing, and 23 patients undergoing treatment. In 2024, the number of patients with drug-sensitive TB (SO) receiving treatment was recorded at 56 (Central Java Provincial Health Office, 2025). Meanwhile, according to the 2025 Health Profile of the Semarang City Health Office, there were 128 patients with drug-sensitive TB, with 91 patients (71%) successfully completing treatment. This achievement remains below the 90% treatment success rate (TSR) target, indicating patient non-adherence to treatment. This poses a challenge for healthcare workers, particularly at the Manyaran Community Health Center (UPTD Puskesmas Manyaran), to improve adherence to anti-tuberculosis drug (OAT) regimens so that the cure rate target can be achieved.

A study conducted on June 20, 2025, through brief interviews with 10 TB patients revealed that 8 respondents did not understand that stopping OAT would require them to restart treatment from the beginning; Similarly, regarding attitudes toward OAT adherence, the results showed that

6 respondents tended to be non-compliant with taking OAT, and monitoring of medication adherence revealed that 2 patients were non-compliant.

Based on this description, the researcher intends to investigate the relationship between knowledge and attitudes toward adherence to anti-TB medication among tuberculosis patients at the Manyaran Community Health Center (UPTD Puskesmas Manyaran), with the ultimate goal of increasing the success rate of tuberculosis recovery.

2. Methods

2.1 Research Design

This study employed a quantitative method with a correlational approach to determine the relationship between two variables: knowledge and attitude as independent variables, and adherence to OAT as the dependent variable. A *cross-sectional* design was used as the basis for data collection at a single point in time without providing any treatment or intervention to the respondents. This design was chosen because it allows researchers to describe the actual condition of patients and analyze the relationship between the independent variables (knowledge and attitude) and the dependent variable (adherence) simultaneously. Thus, this study is expected to provide an empirical picture of the relationship between the level of knowledge and attitude toward treatment adherence among TB patients as a basis for policy-making in efforts to improve treatment success at community health centers.

2.2 Setting and Samples

The Manyaran Community Health Center (UPTD Puskesmas Manyaran) was selected as the study site because, based on the results of a preliminary study, cases of tuberculosis (TB) and issues with patient adherence to anti-tuberculosis medication (OAT) were still being identified. According to data from the Manyaran Community Health Center's Tuberculosis Information System (SITB), TB cases continue to be identified year after year. The study location covers the service area of the Manyaran Community Health Center (UPTD), including the Manyaran, Kembangarum, and Krapyak neighborhoods. The study was conducted from December 2025 to January 2026.

The study population consisted of 84 drug-sensitive (DS) TB patients who were currently undergoing or had completed treatment between January 2024 and June 2025. A sample of 69 participants was selected from the total population using the simple random sampling method. Sample selection was based on the following inclusion criteria: 1) TB patients currently undergoing treatment at the Manyaran Community Health Center (UPTD); 2) Classified as adult TB patients (age ≥ 15 years) according to the classification of the Ministry of Health of the Republic of Indonesia; 3) Able to read, write, and complete the questionnaire independently or with minimal assistance from the researcher; 4) Willing to participate as a respondent by signing an *informed consent form*; 5) Able to communicate effectively and understand the research questions. The exclusion criteria are as follows: 1) Patients with severe TB complications or comorbidities (e.g., severe mental disorders) that affect treatment adherence; 2) Patients who have moved, lost contact, or were unable to complete treatment due to medical or non-medical reasons unrelated to knowledge or attitude.

2.3 Measurement and data collection;

The study used questionnaires as research instruments, consisting of three main questionnaires: the TB knowledge questionnaire, comprising 20 questions on a 5-point Likert scale, with a score of 5 for "strongly agree," 4 for "agree," 3 for "neutral," 2 for "disagree," and 1 for "strongly disagree." The second questionnaire, the attitude questionnaire, consists of 20 items on a 5-point Likert scale, with a score of 5 for "strongly agree," 4 for "agree," 3 for "neutral," 2 for "disagree," and 1 for "strongly disagree." The third questionnaire assessed medication adherence

using the Morisky Medication Adherence Scale-8 (MMAS-8). This scale consists of 8 items: 7 dichotomous (yes/no) questions and 1 question using a frequency-based Likert scale.

2.4 Data analysis;

Based on the results of *the instrument pilot test* conducted on 30 participants, the calculated *r* values for the TB knowledge questionnaire ranged from 0.421 to 0.781, while the table *r* value was 0.361 ($n = 30$, $\alpha = 0.05$). Thus, all 20 items of the knowledge instrument were deemed valid. This instrument was adapted from a previous study. Meanwhile, the attitude instrument showed a table *r* value of 0.276 ($n = 30$, $\alpha = 0.05$) and a calculated *r* value range of 0.309–0.416, indicating that the instrument is valid. Furthermore, the validity test for the medication adherence instrument showed a table *r* value of 0.361 ($n = 30$, $\alpha = 0.05$) and a range of calculated *r* values from 0.377 to 0.824.

The data were analyzed using the Spearman rank correlation test to determine the relationship between the independent and dependent variables. The level of statistical significance was set at $p < 0.05$.

3. Results

3.1. Overview of the Study Location

The Manyaran Community Health Center (UPTD Puskesmas Manyaran) is a regional technical implementation unit engaged in public health services in the West Semarang District, Semarang City, Central Java Province. This health center is located at Jalan Abdulrahman Saleh No. 267, Kembangarum Village, West Semarang District, in a strategic area that is easily accessible to the community (Manyaran Community Health Center, 2024). As a primary-level health facility, the Manyaran Community Health Center (UPTD Puskesmas Manyaran) not only provides medical treatment but also conducts community health development through promotive and preventive programs such as immunization, integrated health posts (*posyandu*), disease control, environmental health, and health promotion. Therefore, this community health center serves as a representative site for research in the fields of health services, community health center management, and primary-level epidemiology.

3.2. Respondent Characteristics

Based on Table 1, which shows the frequency distribution of respondent characteristics, out of 69 tuberculosis patients at the Manyaran Community Health Center (UPTD Puskesmas), the majority of respondents—44 people (63.8%)—were over 40 years old, followed by 13 people (18.8%) in the 21–30 age group, 9 people (13.1%) in the 31–40 age group, and the smallest group consisted of 3 people (4.3%) under the age of 21. Meanwhile, by gender, male respondents predominated, with 40 people (58.0%) compared to 29 female respondents (42.0%). In terms of educational level, the majority of respondents had a junior high school education, totaling 39 people (56.5%), followed by 21 people (30.4%) with a high school education, and 9 people (13.1%) with a bachelor's degree. Meanwhile, based on the duration of treatment, the majority of respondents—55 people (79.7%)—had been undergoing treatment for 4–6 months, followed by 9 people (13.1%) for 1–3 months, and 5 people (7.2%) for 7–9 months.

Based on the results of a study of 69 tuberculosis patients at the Manyaran Community Health Center (UPTD Puskesmas) in Semarang City, it was found that the majority of respondents had good knowledge of tuberculosis, namely 37 people (53.6%). Meanwhile, 18 respondents (26.1%) had adequate knowledge, and 14 respondents (20.3%) had insufficient knowledge. This indicates that more than half of the TB patients have a good understanding of the disease and its treatment. An analysis of individual questionnaire items supports this overall distribution of knowledge. The high percentage of correct answers regarding the sources of transmission and symptoms of pulmonary TB (99% each) indicates that basic knowledge has been well internalized.

The results of the study show that the majority of TB patients at the Manyaran Community Health Center (UPTD Puskesmas Manyaran) have a negative attitude toward TB treatment (78.3%), even though their level of knowledge is quite good.

The results of the study indicate that the level of adherence to OAT among TB patients at the Manyaran Community Health Center (UPTD Puskesmas Manyaran) still faces significant challenges, with adherence levels distributed as moderate (42.0%), high (31.9%), and low (26.1%).

3.3. Relationship Between Knowledge and OAT Adherence

The results of the study indicate a significant moderate positive correlation between knowledge and adherence to OAT ($r = 0.451$; $p = 0.000$). The distribution of respondents' knowledge in this study showed that the majority (53.6%) had good knowledge, followed by those with adequate knowledge (26.1%) and insufficient knowledge (20.3%). However, an interesting phenomenon was observed: among the 37 respondents with good knowledge, 40.5% actually had low adherence and 40.5% had moderate adherence.

3.4. Relationship Between Attitude and OAT Compliance

The results of the study indicate that there is a significant moderate positive correlation between attitude and adherence to OAT at the Manyaran Community Health Center (UPTD Puskesmas) in Semarang City ($r=0.424$, $p=0.000$). These findings suggest that the more positive a patient's attitude toward TB treatment, the higher their level of adherence to OAT.

4. Discussion

Regarding respondent characteristics, of the 69 tuberculosis patients at the Manyaran Community Health Center (UPTD Puskesmas), the majority—44 individuals (63.8%)—were over 40 years old. Aging leads to weakened immune function and makes the lungs more prone to inflammation, thereby increasing susceptibility to and reactivation of latent tuberculosis (Li et al., 2021). By gender, male respondents predominated, with 40 men (58.0%) compared to 29 women (42.0%). This aligns with a study conducted by Andayani (2020), which found that the number of TB cases among men is higher than among women each year. Smoking is recognized as a major risk factor for pulmonary TB; smokers are more likely to test positive for sputum smear and experience more severe TB compared to nonsmokers. Exposure to cigarette smoke damages the lungs' defenses (cilia, macrophages, immune response), making the lungs more susceptible to TB infection. Since smoking is far more common among men, this is considered one of the key reasons why more men suffer from TB (Ziqra, 2016).

In terms of educational attainment, the majority of respondents—39 people (56.5%)—had a junior high school education. This is consistent with a study by Pangaribuan (2020) indicating that low educational attainment increases the risk of TB. Low educational attainment is often associated with poverty, overcrowded and damp housing, poor ventilation, exposure to kitchen smoke or cigarette smoke, and limited access to healthcare—all of which increase the risk of TB (Budi, 2024). Individuals with low educational attainment often struggle to understand information about TB, leading to delayed diagnosis, inadequate prevention, and incomplete treatment (Istiqomah, 2023). Meanwhile, based on treatment duration, the majority of respondents—55 people (79.7%)—had undergone treatment for 4–6 months, followed by 9 people (13.1%) for 1–3 months, and 5 people (7.2%) for 7–9 months. A 6-month regimen for drug-sensitive pulmonary TB is chosen to ensure the bacteria are completely eradicated and to reduce recurrence, while remaining short enough to ensure patient adherence to medication (Hissar, 2024).

In terms of knowledge levels, it was found that the majority of respondents—37 people (53.6%)—had good knowledge of TB. This indicates that more than half of TB patients have a good understanding of the disease and its treatment. Analysis of individual questionnaire items supports this overall distribution of knowledge. The high percentage of correct answers on items

regarding sources of transmission and symptoms of pulmonary TB (99% each) indicates that basic knowledge has been well internalized. This aligns with Notoatmodjo (2017), who states that knowledge at the “knowing” and “understanding” stages is a crucial foundation before behavioral application. Such understanding plays a role in early detection and the prevention of TB transmission in the community. Meanwhile, patients’ low levels of knowledge are influenced by education, access to information, family support, and the quality of counseling. Nugroho (2023) demonstrated that higher education levels correlate with better understanding of TB, including transmission, medication adherence, and prevention of complications. Additionally, ineffective delivery methods and limited counseling time also hinder knowledge transfer.

Meanwhile, regarding attitudes toward tuberculosis, the majority of TB patients hold negative attitudes toward TB treatment (78.3%), even though their level of knowledge is quite good. This discrepancy between knowledge and attitude can be explained by the Health Belief Model, in which a person’s attitude toward health behaviors is influenced by perceptions of vulnerability, the severity of the disease, the benefits and barriers to treatment, and self-efficacy (Widayati & Suryani, 2024). High levels of negative attitudes indicate the presence of unresolved psychological or social barriers, even though patients have an adequate understanding of TB. A study (Andriani & Hastuti, 2024) identified several determinants of negative attitudes toward TB treatment, including experiences with medication side effects (OR=2.8), social stigma (OR=3.5), and a lack of therapeutic communication between healthcare providers and patients (OR=2.1). In addition, belief in alternative treatments, the perception that TB is a shameful disease, and fear of discrimination in the workplace or social environment also contribute to the formation of negative attitudes (F. A. Nugroho et al., 2023).

The levels of adherence to anti-tuberculosis drug therapy (OAT) among TB patients were moderate (42.0%), high (31.9%), and low (26.1%). According to the World Health Organization (2023), suboptimal adherence is one of the main factors contributing to treatment failure in TB and contributes to the emergence of drug resistance. Research by Alene (2024) in various developing countries also shows that the average rate of non-adherence to TB treatment ranges from 20–30%, which is consistent with the proportion of low adherence in this study.

The moderate adherence rate of 42.0% indicates that most patients are in a vulnerable state, where they are not yet fully consistent in taking anti-TB drugs but also do not fall into the non-adherent category. This situation requires special attention because patients with moderate adherence are at risk of their adherence dropping to low levels if they do not receive appropriate interventions. A study by Nezenega (2023) emphasizes that patients with moderate adherence often face multifactorial barriers, including medication side effects, long treatment duration, and a lack of social support and understanding of the importance of treatment continuity. Therefore, this group of patients with moderate adherence should be a priority target for more intensive education and support programs.

The results of the study indicate a significant moderate positive correlation between knowledge and adherence to OAT ($r = 0.451$; $p = 0.000$). This finding indicates the existence of a knowledge-practice gap, as described in Lawrence Green’s theory (Notoatmodjo, 2017), which states that health behavior is influenced not only by predisposing factors such as knowledge but also by enabling and motivating factors. A study (Fitriani et al., 2020) reinforces these findings by showing that, in addition to knowledge, patient motivation and family support also significantly influence adherence to OAT. This explains why patients with good knowledge do not always exhibit high adherence, as adherence is a complex behavior influenced by multiple factors.

This paradoxical phenomenon can be explained through several theoretical perspectives. First, the likely role of medication supervisors (MS) and strong family support in this group, as suggested by (Warjiman et al., 2022), who found a significant association between family support and medication adherence among patients with pulmonary TB. Second, a study (Nabila, 2023) through a literature review found that adherence to anti-tuberculosis (OAT) treatment is influenced by various factors, including the role of healthcare workers, which can compensate for patients’

lack of knowledge. Third, patients with limited knowledge may rely more heavily on healthcare workers' instructions and follow directions more obediently without questioning them, whereas patients with good knowledge may feel more confident in making self-adjustments to their treatment.

The results of the study show that there is a significant moderate positive correlation between attitude and adherence to anti-tuberculosis medication at the Manyaran Community Health Center (UPTD Puskesmas) in Semarang ($r=0.424$, $p=0.000$). This finding indicates that the more positive a patient's attitude toward TB treatment, the higher their level of adherence to taking OAT. Patients' attitudes and beliefs regarding medication significantly influence whether or not they take their medication regularly. Many studies on chronic diseases have shown that adherence is not merely a matter of forgetfulness but also depends on how patients perceive the necessity and risks of the medication. A more rigorous monitoring and evaluation system needs to be developed for the implementation of the DOTS program across all community health centers, along with adequate resource allocation for training health workers to provide effective counseling and good therapeutic communication (Tu et al., 2021). Negative beliefs about medication, negative emotions, and a sense of being unable to manage medication significantly affect medication adherence. In addition, patients' experiences with side effects, as well as "compliant" behavior that actually involves frequently adjusting the dosage on their own—often to feel more free or to reduce side effects—play a role. Support and good communication with doctors or therapists enhance trust and reduce anxiety (Nugroho, 2023; Skaare-Fatland et al., 2024).

5. Implications and Limitations

5.1. Implications

- a. For the Manyaran Community Health Center (UPTD Puskesmas Manyaran)
Develop a more comprehensive and structured health education program. This program should not only focus on increasing knowledge about tuberculosis, modes of transmission, and the importance of treatment, but also on fostering positive attitudes through individual counseling that takes into account the psychological and social barriers faced by patients.
- b. For Future Researchers
Conduct follow-up research using a longitudinal or *prospective cohort* design that can explain the causal relationship between knowledge, attitudes, and adherence to anti-tuberculosis medication in greater depth.

5.2. Limitations

This study used a cross-sectional design; therefore, it can only describe the relationship between knowledge, attitudes, and medication adherence at a single point in time and cannot explain the cause-and-effect relationship among the variables.

6. Conclusion

Based on the results of the study on the Relationship Between Knowledge and Attitudes and Adherence to Anti-Tuberculosis Medication Among TB Patients at the Manyaran Community Health Center (UPTD Puskesmas Manyaran), it can be concluded that:

- a. There is a significant relationship between knowledge and adherence to anti-tuberculosis medication among TB patients at the Manyaran Community Health Center (UPTD Puskesmas).
- b. There is a significant relationship between attitude and adherence to anti-tuberculosis medication among TB patients at the Manyaran Community Health Center (UPTD Puskesmas).

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Author contributions

Author 1: Conceptualization, Data Curation, Formal Analysis, Investigation, Methodology, Writing – Original Draft.

Author 2: Conceptualization, Methodology, Supervision, Validation, Writing – Review & Editing.

Conflict of Interest

The authors declare that there are no conflicts of interest related to the research, writing, or publication of this article.

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Table

Table 1. Frequency Distribution of Respondent Characteristics (n=69)

Characteristics	Frequency	Percentage (%)
Age		
<21 years	3	4.3
21–30 years	13	18.8
31–40 years	9	13.1
>40 years	44	63.8
Gender		
Female	29	42.0
Male	40	58.0
Education Level		
Junior High School	39	56.5
High School	21	30.4
Bachelor's Degree	9	13.1
Duration of Treatment		
1–3 months	9	13.1
4–6 months	55	79.7
7–9 months	5	7.2
Total	69	100%

Table 2. Distribution of Knowledge Characteristics of (n=69)

Research Variables	Frequency	Percentage (%)
Low	14	20.3
Fair	18	26.1
Good	37	53.6
Total	69	100

Table 3. Frequency Distribution of Attitudes (n=69)

Research Variables	Frequency	Percentage (%)
Positive	15	21.7
Negative	54	78.3
Total	69	100

Table 4. Frequency Distribution of Adherence (n=69)

Research Variables	Frequency	Percentage (%)
High	22	31.9
Moderate	29	42.0
Low	18	26.1
Total	69	100

Table 5 . Analysis of the Relationship Between Knowledge and OAT Adherence

Knowledge	Compliance						Total		<i>r</i>	<i>P-value</i>
	High		Moderate		Low					
	F	%	F	%	F	%	F	%		
Less	10	71.4	4	28.6	0	0.0	14	100	0.451	0.000
Fair	5	27.8	10	55.6	3	16.7	18	100		
Good	7	18.9	15	40.5	15	40.5	37	100		
Total	22	31.9	29	42.00	18	26.1	69	100		

Table 6. Attitude and OAT Compliance

Attitude	Compliance						Total		<i>r</i>	<i>P-value</i>
	High		Moderate		Low					
	F	%	F	%	F	%	F	%		
Positive	10	66.7	5	33.3	0	0.0	15	100	0.424	0.000
Negative	12	22.2	24	44.4	18	33.3	54	100		
Total	22	31.9	29	42.00	18	26.1	69	100		