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CORRELATION BETWEEN ANTITUBERCULOSIS MEDICATION ADHERENCE AND HEALTH-RELATED QUALITY OF LIFE AMONG TUBERCULOSIS PATIENTS IN KLATEN

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Abstract

Background: Tuberculosis remains a major public health challenge in Indonesia, particularly in high-burden areas such as Klaten. Beyond clinical recovery, improving Health-Related Quality of Life (HRQoL) is an essential goal in tuberculosis management. Medication adherence plays a critical role in achieving successful treatment outcomes, as it contributes to symptom resolution, prevention of complications, and overall improvement in patients' well-being. However, previous studies examining the relationship between adherence and HRQoL have shown inconsistent results, and empirical data in high-case settings remain limited.

This study aimed to analyze the relationship between adherence to antituberculosis medication and HRQoL among tuberculosis patients in Klaten.

Methods: An analytic observational study with a cross-sectional design was conducted among 85 respondents from 16 Community Health Centres in Klaten Regency between August and December 2025. Medication adherence was assessed using the Morisky Medication Adherence Scale (MMAS-8), while HRQoL was measured using the 36-Item Short Form Survey (SF-36). Data were analyzed using Spearman's rank correlation test.

Results: A significant and strong positive correlation was found between medication adherence and HRQoL ($p < 0.001$; $r = 0.625$; 95% CI: 0.451–0.785). Higher adherence was associated with better quality of life.

Conclusion: Strengthening adherence support is essential to improve the overall well-being of tuberculosis patients.

Keywords: tuberculosis; medication adherence; health-related quality of life; MMAS-8; SF-36.

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Introduction

Tuberculosis (TB) is a chronic infectious disease caused by Mycobacterium tuberculosis and transmitted through airborne droplets[1]. TB remains a leading cause of death from infectious diseases, accounting for approximately 1.5 million deaths in 2020, particularly in developing countries[2]. The Global TB Report 2024 reported an increase in new TB cases from 7.1 million in 2021 to 8.2 million in 2023, with India (26%), Indonesia (7.4%), the Philippines (7.2%), China (6.8%), and Pakistan (6.3%) contributing the highest proportions[3,4].

In Indonesia, an estimated 860,100 cases were reported in 2024, with Central Java ranking among the three provinces with the highest TB burden[5]. In 2023, Klaten Regency reported 1,760 cases (2.07%) and ranked 20th out of 35 districts in Central Java[6]. Although the national TB control strategy aims to ensure treatment completion, Klaten's treatment success rate (86.2%) remains below the 90% target[7,8]. Suboptimal outcomes may reflect inadequate medication adherence, which is crucial for preventing relapse and transmission[9].

TB treatment lasts at least 6–9 months and may cause adverse drug effects, contributing to poor adherence and potentially reducing health-related quality of life (HRQoL)[10–13]. HRQoL includes physical and mental well-being, functional capacity, and psychological health[14,15]. Previous studies have reported inconsistent findings regarding the relationship between medication adherence and HRQoL[16]. Moreover, empirical data from high-burden areas such as Klaten remain limited. Therefore, this study aimed to analyze the relationship between adherence to anti-tuberculosis medication and HRQoL among TB patients in Klaten.

Method

This quantitative analytic observational study employed a cross-sectional design[17–20] to examine the relationship between adherence to anti-tuberculosis medication and health-related quality of life (HRQoL). The study was conducted from August to December 2025 in 16 Community Health Centers in Klaten Regency, Central Java, Indonesia, selected based on the highest number of active TB cases reported by the District Health Office[6]. The target population included active pulmonary TB patients registered for outpatient treatment in 2025. Of 93 eligible patients, 85 met the inclusion criteria and agreed to participate using a total sampling technique[21,22]. Inclusion criteria comprised newly diagnosed pulmonary TB patients aged 18–60 years who had received anti-tuberculosis treatment for at least two weeks and provided informed consent, while patients with extrapulmonary TB, drug-resistant TB, relapse cases, significant comorbidities (e.g., diabetes mellitus or immunodeficiency disorders),

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pregnancy, or incomplete medical records were excluded. Medication adherence was measured using the 8-item Morisky Medication Adherence Scale (MMAS-8)[23,24], and HRQoL was assessed using the 36-Item Short Form Survey (SF-36)[25,26]. Data were analyzed using SPSS with descriptive statistics and Spearman's rank correlation test, with $p < 0.05$ considered statistically significant[27–29]. Ethical approval was obtained from the Health Research Ethics Committee of the Faculty of Medicine, Universitas Sultan Agung (No. 416/VIII/2025/Komisi Bioetik) and conducted in accordance with the Declaration of Helsinki[30].

Result

Respondent Characteristics

Table 1. Respondent Characteristics

Respondent Characteristics	***n***	***%***
Sex		
Male	*48*	*56,5*
Female	*37*	*43,5*
Age		
Late Adolescence (18–25 years)	*10*	*11,8*
Early Adulthood (26–35 years)	*12*	*14,1*
Late Adulthood (36–45 years)	*15*	*17,6*
Early Elderly (46–55 years)	*29*	*34,1*
Late Elderly (56–60 years)	*19*	*22,4*
Occupation		
Student	*1*	*1,2*
Housewife	*11*	*12,9*
Security Guard	*1*	*1,2*
Laborer	*38*	*44,7*
Trader	*4*	*4,7*
Construction Worker	*2*	*2,4*
Private Employee	*19*	*22,4*

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Respondent Characteristics	***n***	***%***
Entrepreneur	*5*	*5,9*
Teacher	*4*	*4,7*
Educational Level		
Primary School	*17*	*20,0*
Junior High School	*11*	*12,9*
Senior High School	*50*	*58,8*
Bachelor's Degree (Undergraduate)	*7*	*8,2*

Based on the study findings, the respondents' characteristics included sex, age, educational level, and occupation. As presented in Table 4.1, the majority of respondents were male, accounting for 48 individuals (56.5%). The most prevalent age group was early elderly (46–55 years), representing 34.1% of the sample. Most respondents were employed as laborers (44.7%), and the educational level was predominantly senior high school graduates, totaling 50 respondents (58.8%).

Distribution of Medication Adherence Levels and Health-Related Quality of Life

Tabel 2. Distribution of Anti-Tuberculosis Drug (OAT) Adherence Levels

Adherence	***n = 85***	***%***
Low	*8*	*9,4*
Moderate	*33*	*38,8*
High	*44*	*51,8*

Based on the results presented in Table 2, more than half of the respondents demonstrated high adherence to anti-tuberculosis treatment (44 respondents; 51.8%). A total of 33 respondents (38.8%) had moderate adherence, while 8 respondents (9.4%) were categorized as having low adherence.

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Table 3. Distribution of Health-Related Quality of Life by Domain

Indicator	*n*	*%*		
		Poor	*Moderate*	*Good*
Fungsi Physical Functioning	*85*	*11,8*	*21,2*	*67,1*
Role Limitations due to Physical Problems	*85*	*7,1*	*10,6*	*82,4*
Role Limitations due to Emotional Problems	*85*	*9,4*	*12,9*	*77,6*
Energy	*85*	*10,6*	*42,4*	*47,1*
Mental Health	*85*	*8,2*	*40*	*51,8*
Social Functioning	*85*	*5,9*	*25,9*	*68,2*
Bodily Pain	*85*	*7,1*	*30,6*	*62,4*
General Health	*85*	*12,9*	*23,5*	*63,5*

Based on the results presented in Table 3, the distribution of Health-Related Quality of Life (HRQoL) across the eight health domains indicated that the majority of respondents were categorized as having high quality of life in nearly all domains. The highest proportion in the high category was observed in the role limitations due to physical problems domain (82.4%). In contrast, the energy domain showed the lowest proportion in the high category (47.1%) and demonstrated a relatively dominant proportion in the moderate category (42.4%) compared to the other domains.

Tabel 4. Distribution Health-Related Quality of Life

Health-Related Quality Of Life	*n*	*%*
Poor	*4*	*4,7*
Moderate	*35*	*41,2*
Good	*46*	*54,1*
Total HRQoL Score	*85*	*100*

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Based on the results presented in Table 4, the majority of respondents had a Good Health-Related Quality of Life (HRQoL), totaling 46 individuals (54.1%). A total of 35 respondents (41.2%) were categorized as having moderate quality of life, while 4 respondents (4.7%) were classified as having poor quality of life.

Medication Adherence and Health-Related Quality of Life among Tuberculosis Patients

Table 5. Correlation between Medication Adherence and Health-Related Quality of Life among Tuberculosis Patients

Variable	***n***	***Correlation Coefficient (r)***	***95% CI***	***P-Value***
Medication Adherence (MMAS-8)	*85*	*0.625*	*0,451 - 0,785*	*<0,001*
Health-Related Quality Of Life (SF-36)	*85*			

Based on the results of the study and data analysis conducted across 16 primary healthcare centers in Klaten Regency, the Spearman correlation coefficient was 0.625, with a 95% confidence interval ranging from 0.451 to 0.785. The level of significance was $p < 0.001$. As the confidence interval did not cross zero and all values were positive, and the p-value was well below 0.05, the null hypothesis was rejected and the alternative hypothesis was accepted. These findings indicate a statistically significant, strong, and positive correlation between medication adherence and Health-Related Quality of Life (HRQoL). This suggests that higher adherence to anti-tuberculosis treatment is significantly associated with improved quality of life among tuberculosis patients.

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Table 6. Cross-tabulation of Medication Adherence and Health-Related Quality of Life among Tuberculosis Patients

		Health-Related Quality Of Life			*P-Value*	*R*
		Poor	***Moderate***	***Good***		
Medication Adherence	*Low*	*3*	*4*	*1*	*<0,001*	*0.625*
	Moderate	*0*	*25*	*8*		
	High	*1*	*6*	*37*		
	Total Score	*4*	*35*	*46*		

Based on the data analysis presented in Table 6, the majority of respondents with high medication adherence had a Good Health-Related Quality of Life (37 respondents). In contrast, respondents with low medication adherence were more frequently categorized as having poor or moderate Health-Related Quality of Life.

Discussion

The findings of this study indicate that pulmonary tuberculosis (TB) was more prevalent among male respondents than females. This result is consistent with Lestari et al.[31], who reported that 54.4% of TB patients were male and 45.6% were female in primary healthcare centers in Kupang City. Similarly, the Global Tuberculosis Report 2024 documented 10.8 million TB cases worldwide, with 55% occurring in men, 33% in women, and 12% in children[4]. The higher prevalence among men may be associated with risk factors such as smoking and frequent exposure to crowded environments with inadequate ventilation, both of which increase susceptibility to TB infection.

By age, the largest proportion of respondents was in the early elderly group (46–55 years), at 34.1%. This finding aligns with Caraux-Paz et al.[32], who reported that the highest TB incidence occurred among individuals aged 25–54 years. The increased incidence in this age group may be related to immune system decline and reactivation of latent TB infection. Moreover, because this age group remains economically productive, TB can have substantial socioeconomic consequences. Sikumbang et al.[33], reported that TB patients may lose

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approximately 3–4 months of work, leading to an estimated annual income reduction of 20–30%.

Regarding occupation, the majority of respondents were laborers (44.7%). Individuals in this occupational group may experience high physical workloads, inadequate rest, and unhealthy lifestyle behaviors, which can weaken the immune system and increase vulnerability to TB. Data from the Indonesian Ministry of Health (2022) indicate that laborers represent one of the most vulnerable occupational groups due to high mobility and prolonged close contact with others, facilitating droplet transmission[34]. Occupational status is also closely associated with socioeconomic conditions, which may influence access to healthcare services and adequate nutrition during treatment.

In terms of education, most respondents had completed senior high school (58.8%), consistent with findings from Prananda et al.[35], who reported that the majority of TB patients had secondary-level education. Higher educational attainment is associated with a better understanding of health information and greater awareness of the importance of adherence to anti-tuberculosis treatment. Conversely, individuals with lower educational levels may have difficulty comprehending medical information from healthcare professionals, potentially affecting treatment adherence and recovery outcomes.

Table 6 shows that the majority of respondents demonstrated high adherence to anti-tuberculosis medication (44 respondents; 51.8%), followed by moderate adherence (33 respondents; 38.8%) and low adherence (8 respondents; 9.4%). The high level of adherence may be attributed to patients' knowledge and motivation to recover. Observational findings indicated that respondents with high adherence generally had strong motivation for recovery, higher educational backgrounds, and broader knowledge regarding tuberculosis. This knowledge was supported by local health cadres and healthcare professionals who provided adequate information and continuous support throughout the treatment process. In line with Berhimpong et al.[36], health education should not only target TB patients but also involve their families and surrounding communities. Adequate knowledge and awareness of the disease form the foundation for preventive behavior and treatment adherence, thereby increasing the likelihood of recovery[36]. From a behavioral perspective, adherence is shaped by both internal and external stimuli. External stimuli may include social support, educational materials, and a supportive environment, which help explain why most respondents demonstrated good adherence levels[37].

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However, as shown in Table 2, 8 respondents (9.4%) were categorized as having low adherence. Based on observational findings, some respondents discontinued treatment after experiencing symptom relief, assuming that they had recovered. This phenomenon is consistent with Gong et al.[38], who reported that limited knowledge about TB and lack of awareness regarding the importance of long-term anti-tuberculosis therapy contributed to treatment discontinuation once symptoms subsided. Non-adherence can result in serious consequences, including the development of anti-tuberculosis drug resistance[38]. In addition to misconceptions about recovery, low adherence was also influenced by medication side effects such as nausea, vomiting, weight loss, and treatment fatigue, which discouraged patients from continuing therapy[36].

The development of healthy behaviors, including the initiative to seek medical care and the presence of self-efficacy, is strongly influenced by individual perceptions of disease threat and the perceived benefits of medical recommendations. Perceived threat arises from beliefs regarding disease severity and personal susceptibility to infection. Individuals often weigh perceived benefits against potential barriers, recognizing that treatment may alleviate symptoms while also considering obstacles such as side effects and financial burden. Therefore, medication adherence can be understood as a behavioral process that begins with awareness of disease seriousness, which motivates individuals to seek professional care and consistently adhere to prescribed treatment despite potential risks or discomfort[39].

Health-Related Quality of Life (HRQoL) is a multidimensional concept encompassing physical, psychological, social, and environmental aspects of an individual's well-being[40]. Based on the findings presented in Table 3 and Table 4, the distribution of HRQoL across eight health domains indicated that the majority of respondents were categorized as having good quality of life, totaling 46 (54.1%) respondents. The high proportion of good HRQoL may be associated with the duration of treatment undertaken by the respondents. Most participants were in the continuation phase of tuberculosis treatment, during which the body's clinical response to anti-tuberculosis therapy tends to stabilize. Severe symptoms such as persistent cough, nausea, vomiting, weight loss, and shortness of breath generally subside, leading patients to perceive their condition as significantly improved compared to the time of initial diagnosis.

Although residual symptoms or drug side effects were occasionally reported, respondents tended not to complain and remained active in fulfilling their social roles, including working and managing household responsibilities. This condition may be driven by

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the perception that adherence to treatment leads to recovery, thereby fostering internal motivation to maintain health stability. Such optimism and independent health-maintenance efforts reflect effective self-care ability. Consistent with the findings of Simatupang et al.[41], the majority of patients (39 respondents; 51.3%) were categorized as having good self-care. This suggests that most patients demonstrated a high level of awareness in managing their condition throughout tuberculosis treatment. Effective self-care facilitates adaptation to illness, symptom reduction, and accelerated recovery, and is influenced by strong motivation to recover as well as positive support from family and the surrounding environment[41].

A domain-specific analysis presented in Table 3 showed that 67.1% of respondents had good quality of life in the physical functioning domain, indicating that most patients were still able to perform daily activities independently, such as walking, climbing stairs, dressing, and engaging in light exercise. However, 12.9% of patients were categorized as having poor quality of life in the general health domain, which reflects an individual's overall perception of their health status beyond physical symptoms. Similar findings were reported by Gangadharan et al.[42] in Karnataka, where the highest HRQoL scores were observed in physical functioning, while the lowest scores were found in general health, followed by bodily pain and role limitations due to emotional problems. The study also found that patients who had undergone tuberculosis treatment for more than two months demonstrated significantly better physical quality of life, likely due to symptom reduction, treatment adaptation, and the positive effects of therapeutic interventions[42].

These findings were further supported by Nurwidia[43] in Yogyakarta, who reported that most pulmonary tuberculosis patients experienced poor quality of life in the general health domain (82%), as well as in emotional role and physical functioning. In contrast, Pavita et al.[44] at the TB-DOTS clinic of RSUD dr. Soedarso Pontianak found that seven HRQoL domains—physical functioning, physical role, emotional role, energy, social functioning, pain, and general health—were predominantly categorized as poor. In the physical functioning domain, tuberculosis patients commonly reported limitations in lifting heavy objects, exercising, walking more than 1.5 kilometers, climbing stairs, and walking through corridors or alleys. A smaller proportion of patients experienced limitations in light activities such as casual walking, carrying small objects, bathing, and dressing independently. These limitations were attributed to persistent tuberculosis symptoms and side effects of anti-tuberculosis drugs, including cough, chest pain, dyspnea, weakness, dizziness, fever, and headache, which interfered with daily activities[44].

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In Table 3, the domain of Role Limitations due to Physical Health demonstrated the highest proportion of good quality of life (82.4%). This high percentage indicates that tuberculosis was no longer a major barrier preventing patients from engaging in physically demanding activities. Field observations revealed that many respondents were able to maintain employment with high mobility and travel long distances to meet family economic needs. This assumption aligns with the findings of Kastien-Hilka et al.[17], who reported that tuberculosis treatment significantly improved HRQoL, particularly in the physical dimension. High treatment adherence was associated with substantial recovery of physical function and enabled patients to return to work productively. Conversely, Darvishpoor et al.[45] in Tehran identified differences in role limitations due to physical health among employed tuberculosis patients. Employment may divert patients' attention from their illness and enhance vitality through work engagement; however, it may also limit the time and energy available for Good role performance due to the negative impact of tuberculosis on physical capacity[45].

The energy (vitality) domain showed the lowest proportion of good quality of life (47.1%), while the moderate category remained relatively dominant (42.4%). This finding indicates that many respondents continued to experience fatigue and reduced vitality despite improvements in other physical aspects. Similar results were reported by Thedthong[46], who found an 88% incidence of fatigue and decreased energy, with most cases classified as moderate (52%). Fatigue in tuberculosis patients can be attributed to increased metabolic demands for oxygen utilization, impaired lung function due to chronic inflammation, and immune responses to infection. Additionally, loss of appetite associated with pro-inflammatory cytokines, particularly tumor necrosis factor-alpha (TNF-α), may reduce energy intake and exacerbate fatigue[46]. These findings were reinforced by Aytac et al.[47], who emphasized that reduced vitality affects not only physical well-being but also social and economic aspects. Post-medication fatigue was reported to significantly reduce work productivity, potentially leading to financial losses and becoming a critical factor influencing treatment discontinuation[47].

Based on the study conducted in 16 primary health centres in Klaten Regency, a strong, significant positive relationship was found between anti-TB adherence and HRQoL, indicating that higher adherence is associated with better quality of life.

The enhancement in quality of life among adherent patients may be attributed to the good effectiveness of anti-TB therapy in suppressing Mycobacterium tuberculosis, thereby reducing clinical symptoms such as cough and dyspnea. This clinical improvement positively affects physical functioning and other domains measured by the SF-36. Furthermore, adherent patients

generally demonstrate stronger motivation to recover and a better understanding of the importance of completing treatment. These findings are consistent with Muflihatin et al.[48] and Rittasi et al.[49], who reported that higher adherence leads to better clinical outcomes, prevents transmission and drug resistance, and ultimately improves patients' quality of life in line with national TB treatment goals.

However, this result contrasts with Octavia et al.[50], who found no significant relationship between adherence and quality of life, despite high adherence rates among participants. This suggests that factors such as socioeconomic status, psychological condition, and social support may also influence HRQoL.

Conclusion

Based on the findings, most tuberculosis patients in Klaten were male, aged 46–55 years, with high medication adherence (51.8%). A significant, strong, and positive correlation was found between adherence and HRQoL ($p < 0.001$; $r = 0.625$; 95% CI: 0.451–0.785), indicating that higher adherence improves physical and mental recovery. However, the vitality domain remained the lowest, highlighting persistent fatigue among patients.

Ethical Clearance

This study received ethical approval (No. 416/VIII/2025/Komisi Bioetik) and followed the principles of the Declaration of Helsinki.

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