

Treatment Compliance for Pulmonary Tuberculosis Patients: Analysis of Internal and External Factors at Mandai Health Center, Maros Regency, Indonesia

Cumplimiento del tratamiento en pacientes con tuberculosis pulmonar:
análisis de factores internos y externos en el Centro de Salud Mandai,
Maros Regency, Indonesia

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SUMMARY

Background: Tuberculosis is still a public health problem both in Indonesia and worldwide, making it one of the goals of sustainable health development (SDGs). Lack of treatment adherence is a major obstacle to efficient TB control, so innovative strategies are needed to improve treatment adherence. **Objective:** To analyze factors related to adherence to treating pulmonary TB patients in the Mandai Health Center Working Area, Maros Regency. **Method:** Using an observational study with a Cross-Sectional design. The sampling technique used was purposive sampling

with a sample of 102 respondents. **Results:** Bivariate statistical analysis showed that there was a relationship between adherence to treatment with knowledge ($p = 0.001$), access to health services ($p = 0.0001$), and support from health workers ($p = 0.014$). There was no relationship between motivation ($p = 0.051$), family support ($p = 0.593$), and drug side effects ($p = 0.460$). The logistic regression analysis found that the most influential factors on medication adherence were knowledge ($p=0.038$) and access to health services ($p=0.0001$). **Conclusion:** Knowledge and access to health services are the most significant variables on medication adherence in patients with pulmonary tuberculosis.

Keywords: Medication adherence, pulmonary tuberculosis, TB patients.

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RESUMEN

Antecedentes: La tuberculosis sigue siendo un problema de salud pública tanto en Indonesia como a nivel mundial, lo que la convierte en uno de los objetivos del desarrollo sostenible de la salud (ODS). La falta de adherencia al tratamiento es un obstáculo importante para el control eficaz de la tuberculosis, por lo que se necesitan estrategias innovadoras para mejorarla. **Objetivo:** Analizar los factores relacionados con la adherencia al tratamiento de pacientes con tuberculosis pulmonar en el área de trabajo del Centro de Salud de Mandai, Regencia de Maros. **Método:** Estudio observacional con diseño transversal. La técnica de muestreo empleada fue un muestreo intencional con una muestra de 102 participantes. **Resultados:** Las pruebas estadísticas bivariadas mostraron una relación entre la adherencia al tratamiento y el conocimiento ($p = 0,001$), el acceso a los servicios de salud ($p = 0,0001$) y el apoyo del personal sanitario ($p = 0,014$). No se observó relación entre la motivación ($p = 0,051$), el apoyo familiar ($p = 0,593$) y los efectos secundarios de los medicamentos ($p = 0,460$). Mediante un análisis de regresión logística, se determinó que los factores más influyentes en la adherencia a la medicación fueron el conocimiento ($p = 0,038$) y el acceso a los servicios de salud ($p = 0,0001$). **Conclusión:** El conocimiento y el acceso a los servicios de salud son las variables más significativas en la adherencia a la medicación en pacientes con tuberculosis pulmonar.

Palabras clave: Adherencia a la medicación, tuberculosis pulmonar, pacientes con tuberculosis.

INTRODUCTION

Tuberculosis (TB) is still a public health problem both in Indonesia and worldwide. In 2021, TB became the second most deadly infectious disease in the world after COVID-19 and was ranked thirteenth as the leading cause of death worldwide. Based on the 2022 Global Tuberculosis Report, in 2021, the estimated incidence rate of TB in Indonesia was 354 per 100 000 population, with a TB mortality rate in 2021 of 52 per 100 000 population. In 2022, the total number of TB cases found was 677 464 cases, a significant increase compared to all TB cases in 2021, which were 397 377 cases (1). Meanwhile, in the Global Tuberculosis Report 2023, Indonesia is in second place with the largest

number of TB cases in the world after India, with a total of 820 789 TB cases and 134 000 deaths due to TB per year in Indonesia (17 people die from TB every hour) (2). Lack of compliance with treatment is a major obstacle to efficient TB control, so innovative strategies are needed that can increase compliance with treatment (3). Since 2016, the success rate of tuberculosis patient treatment has decreased, with the highest rate in a period of 10 years, namely 89.2 %, achieved in 2010. Still, in 2020 the success rate of treatment decreased by 82.7 % and in 2021 it was 83 %, based on the Global Tuberculosis Report in 2023, it turns out that the success rate of tuberculosis treatment globally is around 86 % in 2022, this can be said that there is still a need for an increase in TB treatment because it has not reached the target of the Ministry of Health regarding the success standard Tuberculosis treatment by 90 % in 2024 (4).

Drug adherence factors are the patient's motivation to recover, Project Management Office (PMO) maintenance, education level that affects knowledge, and family support (5). Kadek Ayu stated that there is a significant relationship between knowledge and motivation on drug adherence, so the higher the knowledge, the higher the compliance, and the higher the respondent's motivation with their treatment (6,7).

Based on data from the South Sulawesi Provincial Health Office, the Makassar Regency/City area was ranked first in 2023 with the number of TB cases of 0.46 %, while Maros Regency was 0.19 %. Based on data from the South Sulawesi Provincial Health Office, Maros Regency is a regency that has experienced an increase in TB every year for the past three years, where in 2021 it was 0.13 %, in 2022 it was 0.17 %, and in 2023 it was 0.19 %.

The tuberculosis eradication program has existed since 1995 in the states in health centers with the implementation of the Directly Observed Treatment Short course (DOTS) strategy recommended by the World Health Organization (WHO) (8). Then, it was developed and changed into a pulmonary TB control program. Handling tuberculosis cases is one of the DOTS strategies that can control tuberculosis because it can break the disease's transmission chain (9). Based on the evidence, this study aimed to examine

factors related to compliance with treatment for Pulmonary TB patients in the Mandai Health Center work area, Maros Regency.

METHODOLOGY

This research is quantitative. It used an observational study with a cross-sectional design. The sampling technique used was purposive sampling, which is carried out with certain considerations according to the researcher's wishes (10). The respondents were 102 people who were interviewed in the Mandai Health Center work area.

The sampling formula in this study is as follows:

$$n = \frac{(N \cdot Z^2 \cdot p \cdot q)}{(d^2 (N-1) + Z^2 \cdot p \cdot q)}$$

Note:

n= Sample size

N= Population size

Z= Standard deviation = 1.96

p= Maximum estimate 0.5

q= 1-p= 0.5

d= Error rate/degree of accuracy = 0.05

Based on this formula, the sample in this study is:

$$n = \frac{(N \cdot Z^2 \cdot p \cdot q)}{(d^2 (N-1) + Z^2 \cdot p \cdot q)}$$

$$n = \frac{(138 \cdot [(1.96)]^2 \cdot 0.5 \cdot 0.5)}{([0.05]^2 (138-1) + [(1.96)]^2 \cdot 0.5 \cdot 0.5)}$$

$$n = \frac{(138 \cdot 3.84 \cdot 0.5 \cdot 0.5)}{(0.0025 \cdot 137 + 3.84 \cdot 0.5 \cdot 0.5)}$$

$$n = 132.48 / (0.34 + 0.96)$$

$$n = 132.48 / (1.3)$$

$$n = 101.9$$

$$n = 102$$

Therefore, this study took a sample of 102 respondents who suffered from Respiratory TB in the Mandai Health Center, Maros Regency.

Ethics Approval

The data was collected after obtaining ethical approval from the Ethics Commission of the Faculty of Public Health, Hasanuddin University, with reference number 1860/UN4.14.1/TP.01.02/2024 and obtaining consent from respondents to be involved in this study.

Data Analysis

The data was processed using the Stata program version 14, and the relationship between the dependent and independent variables was analyzed using the Chi-Square test. The multivariate analysis used was the logistic regression test with a confidence level of 95 % ($\alpha = 0.05$).

RESULTS

Univariate Analysis

Table 1 shows the individual characteristics of Pulmonary TB patients at the Mandai Health Center, Maros Regency. It is shown that the largest proportion of respondents is female, namely 56 respondents (54.9 %). The respondents were mostly in the 26-35-year age group, with as many as 26 people (25.49 %). Most respondents' education level was at the Senior High School (SMA) level, namely 50 people (49.02 %). Most respondents' work type was Housewives (IRT), namely 37 people (36.27 %).

Bivariate Analysis

Table 2 shows three significant variables related to medication adherence: knowledge (p-value = 0.001), health service access (p-value = 0.0001), and health worker support (p-value = 0.014). In contrast, the variables that are not related to medication adherence are motivation (p-value=0.510), family support (p-value=0.593),

Table 1. Frequency Distribution of General Characteristics of Respondents at the Mandai Health Center, Maros Regency in 2024

General Characteristics of Respondents	n	%
Gender		
Male	46	45.1
Female	56	54.9
Age		
12-16	5	4.9
17-25	15	14.71
26-35	26	25.49
36-45	17	16.67
46-55	18	17.65
56-65	20	19.61
>65	1	0.98
Education		
No School	1	0.98
Elementary School	23	22.55
Junior High School	15	14.71
Senior High School	50	49.02
S1	13	12.75
Occupation		
Not Working	10	9.8
Housewife	37	36.27
Student	18	17.65
Private Employee	15	14.71
ASN/Polri/TNI	4	3.92
Farmer	6	5.88
Other	12	11.76
Total	102	100.00

Source: Primary Data, 2024

and drug side effects (p-value=0.460). There are three variables with a p-value<0.25: knowledge, health service access, and health worker support. These variables are continued in multivariate analysis.

Multivariate Analysis

Table 3 shows the results of multivariate analysis using logistic regression analysis, indicating two variables with p-value <0.05, namely knowledge (p-value=0.038) with a 95 % CI value of LL 0.1770101 and UL 2.435278, and access to health services (p-value=0.0001) with a 95 % CI value of LL 1.789429 and UL 4.110804. This means that both variables are related to medication adherence.

Based on the results of the logistic regression analysis. The following equation is obtained:

$$y = \text{constant} + \text{coefficient} (x1) + \text{coefficient} (x2)$$

$$y = -2.820308 + 1.306144 + 2.950116$$

$$y = 1.435952$$

After obtaining the y value, the next step is to calculate the probability of the subject with the formula:

$$P = 1 / (1 + \exp (-y))$$

$$P = 1 / (1 + \exp (-1.435953))$$

$$P = 1 / (1 + 0.238496)$$

$$P = 0.80743 \times 100 \%$$

$$P = 80.7 \%$$

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Table 2. Bivariate Analysis of Factors Related to Medication Adherence of Pulmonary TB Patients at the Mandai Health Center, Maros Regency

Variable	Treatment Compliance				Total		p-Value
	Compliant		Non-Compliant		f	%	
	f	%	f	%	f	%	
Knowledge							
Good	50	78.12	14	21.88	64	62.75	0.001
Poor	17	44.74	21	55.26	38	37.25	
Motivation							
Good	44	68.75	20	31.25	64	62.75	0.51
Poor	23	60.53	15	39.47	38	37.25	
Health Service Access							
Easy	58	85.29	10	34.31	68	66.67	0.0001
Difficult	9	26.47	25	73.53	34	33.33	
Family Support							
Good	53	63.86	30	36.14	83	81.37	0.593
Poor	14	73.68	5	26.32	19	18.63	
Health Worker Support							
Good	56	72.73	21	27.27	77	75.49	0.014
Poor	11	16.42	14	40.0	25	24.51	
Drug Side Effects							
Yes	54	67.5	26	32.50	80	78.43	0.460
No	13	59.09	9	40.91	22	21.57	

Source: Primary Data, 2024

Table 3. Multivariate Logistic Regression Modeling Analysis of Factors Related to Medication Adherence of Pulmonary TB Patients at the Mandai Health Center, Maros Regency

Variable	OR	Coefficien	Sig.	CI 95 %	
				LL	UL
Knowledge	4.649456	1.306144	0.023	0.1770101	2.435278
Access to Health Services	16.63603	2.950116	0.0001	1.789429	4.110804
_cons	0.145035	-2.820308	0.0001	-4.333182	-1.307434

DISCUSSION

Thus, if TB patients have good knowledge and access to health services, they will be able to comply with treatment well, which is 80.7 % at the Mandai Health Center, Maros Regency.

Compliance with tuberculosis (TB) treatment for pulmonary TB patients is influenced by

both internal and external factors. Internal factors include patient characteristics like age, gender, and comorbidities, while external factors encompass aspects like healthcare access, family support, and social stigma. Effective treatment requires addressing these factors to improve patient adherence and outcomes. Regarding knowledge, the present results show that out of 67 respondents (65.69 %) who are compliant with treatment, 50 respondents (78.12 %) have good knowledge, and 17 respondents (44.74 %) have poor knowledge. Of 35 respondents (34.31 %) who are not compliant, 14 respondents (21.88 %) have good knowledge, and 21 respondents (55.26 %) have poor knowledge. Chi-Square statistical test indicated a significant relationship between knowledge and compliance with treatment in patients with Pulmonary TB at the Mandai Health Center, Maros Regency.

The results are in line with the study of Annida Rifai Nur, who demonstrated that there is a significant relationship between knowledge, access to health services, the role of family as PMO, and the role of health workers with adherence to taking Anti-Tuberculosis Drugs (OAT) in patients with tuberculosis (11). In a family-centered healthcare approach, families act as a Project Management Office (PMO), supporting the care process by facilitating self-management, reminding and motivating patients, and providing emotional support. Health workers, in turn, guide and support families, provide clear information and training to enhance their ability to participate effectively in their loved ones' care. In addition, they agree with another study that showed that the variable of knowledge is related to compliance in taking anti-tuberculosis drugs; this study also revealed that the higher the patient's knowledge, the higher the level of compliance in taking anti-tuberculosis drugs (12). Meanwhile, motivating factors include support from family, friends, and society, as well as the attitudes of health workers and the Drug Management Program (PMO) (13).

Overall, efforts to improve compliance in taking medication for patients with pulmonary TB, in addition to knowledge, which is the most important factor, need to include other factors that influence behavior (14). According to Notoatmodjo (15), although knowledge is a very important factor, it alone is not enough to bring

about changes in health behavior. Although a person's knowledge of health may be needed before behavioral change occurs, the expected action will not be achieved unless the individual has the motivation to act based on the knowledge they have.

Our evaluation of motivation showed that 67 respondents (65.69 %) who were compliant with treatment, 44 respondents (68.75 %) had good motivation, and 23 respondents (60.53 %) had poor motivation. Of the 35 respondents (34.31 %) who were not compliant, 20 respondents (31.25 %) had good motivation, and 15 respondents (39.47 %) had poor motivation. The results of the Chi-Square statistical test showed that H_0 was accepted, and H_a was rejected, so there was no relationship between motivation and compliance with treatment in pulmonary TB patients at the Mandai Health Center, Maros Regency. These results agree with research that stated that there was no relationship between patient motivation and compliance with treatment in pulmonary TB patients in the Gamping II Health Center work area (16,17). This is because motivation is influenced by various factors such as social support, perception, and disease severity (18). In this study, some respondents had less motivation, which was influenced by the lack of social support obtained by the respondents because the respondents did not tell their family or close friends about the disease they were suffering from, so that motivation, especially from social support, was lacking. This is supported by a study that states that social support increases patient motivation, providing additional strength for TB patients facing the challenges of treatment (19).

When evaluating access to Health services, the results of the analysis showed that of the 67 respondents (65.69 %) who were compliant with treatment, 58 respondents (85.29 %) had easy access to health services, and nine respondents (26.47 %) had difficult access to health services. Meanwhile, of the 35 respondents (34.31 %) who were not compliant, 10 respondents (34.31 %) had easy access to health services, and 25 respondents (73.53 %) had difficult access to health services. Chi-Square statistical test indicated that H_0 is rejected, and H_a is accepted, so there is a relationship between access to health services and compliance with treatment in pulmonary TB patients at the Mandai Health Center, Maros

Regency in 2024. This data agrees with Abdullah et al. (20) on access to health services; the study's results state that the distance to health services is related to patient compliance in taking TB medication. Access to health services includes various aspects that allow individuals or groups to get the health services they need (20). Some of the main components of access to health services include geographic reach, financial ability, accessibility of information, availability of drugs and medical equipment, and administrative procedures that are not too complicated. By fulfilling all these aspects, access to health services can be more equitable and ensure all individuals get the care they need.

Our data on Family Support showed that out of 67 respondents (65.69 %) who were compliant with treatment, 53 respondents (63.86 %) had good family support, and 14 respondents (73.68 %) had poor family support. Meanwhile, out of 35 respondents (34.31 %) who were not compliant, 30 respondents (36.14 %) had good family support, and five respondents (26.32 %) had poor family support. The Chi-Square statistical test results showed no relationship between family support and compliance with treatment in pulmonary TB patients at the Mandai Health Center, Maros Regency in 2024.

The absence of a relationship between family support and compliance with treatment in pulmonary TB patients is because there are still respondents who feel less close to their families or they are afraid to bother their families, so that when they need something they feel embarrassed to ask for help which ultimately has an impact on patient non-compliance in treatment. Berliana et al. (21), stated that respondents are not compliant with treatment because they do not want to tell their families about their illness. Hence, the respondents are not compliant with undergoing treatment.

Health Worker Support data indicate that of the 67 respondents (65.69 %) who are compliant with treatment, 56 respondents (72.73 %) have good health worker support, and 11 respondents (16.42 %) have poor health worker support. Meanwhile, of the 35 respondents (34.31 %) who are not compliant, 21 respondents (27.27 %) have good health worker support, and 14 respondents (40 %) have poor health worker support. The results of the Chi-Square statistical

test showed a significant relationship between the support of health workers and compliance with treatment in pulmonary TB patients at the Mandai Health Center, Maros Regency in 2024. This is in accordance with the study indicating a relationship between the support of health workers and compliance with treatment in pulmonary TB patients at Bunturaja Health Center (22); and the study (23) where the Chi-Square statistical test obtained family support (p -value = 0.0001) and support from health workers (p -value = 0.004) with compliance with taking medication.

The role of health workers at the Health Center is very crucial in providing health services and conveying information about the importance of taking medication regularly and completely. They also explain the correct way to take medication, possible side effects, and solutions that can be provided. As communicators, health workers can convey information clearly to patients. Providing this information is very important because good communication can help improve understanding and reduce misperceptions about health and Pulmonary TB disease. Communication is considered effective if health workers can convey information clearly to patients (24).

Finally, the influence of Drug Side Effects revealed that 67 respondents (65.69 %) who were compliant with treatment, 54 respondents (67.5 %) had side effects, and 13 respondents (59.09 %) had no side effects. Of the 35 respondents (34.31 %) who were not compliant, 26 respondents (32.5 %) had side effects, and 9 respondents (40.91 %) had no side effects. The Chi-Square statistical test results indicated no relationship between drug side effects and compliance with treatment in Pulmonary TB patients at the Mandai Health Center, Maros Regency. Almost the same research results were shown by the results of Siti Maesaroh's research, who conducted research at the Jakarta Respiratory Center (JRC)/PPTI Clinic, where they showed that there is no significant relationship between drug side effects and compliance with treatment for pulmonary TB patients (25). The results of different studies (26) state that the presence of drug side effects is one of the causes of failure in the treatment of pulmonary TB. Most of the patients in this study underwent treatment with side effects, and some also without side effects; therefore, monitoring the possibility of side

effects is very important during treatment. This monitoring can be done by explaining the signs of side effects when the patient takes the drug.

CONCLUSION

Knowledge and access to health services are the most significant variables for compliance with treatment in patients with pulmonary tuberculosis in the Mandai Health Center Working Area, Maros Regency, in 2024. It is recommended that health workers at the health center pay more attention to efforts to control infectious diseases, especially pulmonary TB, to reduce the number of new cases of pulmonary TB. Implementing efforts to overcome patients who have dropped out of treatment optimally, such as looking for patients, home visits, and so on, that have been planned in advance by health workers, so that they can positively impact increasing compliance with treatment in patients with pulmonary TB.

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Conflict of interest

We have no conflict of interest.

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