Relationship between knowledge and medication adherence among patients with tuberculosis: a cross-sectional survey

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ABSTRACT

Background: The World Health Organization (WHO) stated that treatment adherence is one determinant of the successful management of pulmonary tuberculosis therapy. Non-adherence can result in recurrence or treatment failure. Knowledge of tuberculosis is crucial for a patient’s adherence to treatment, and the level is proportional to the information obtained. This study aimed to determine the relationship between the knowledge level of pulmonary tuberculosis and adherence to anti-tuberculosis drugs (ATD).

Methods: This study is a non-experimental quantitative study with analytic correlation and a cross-sectional approach. Sampling was done at the Umbulharjo 1 Public Health Center, Yogyakarta, Indonesia, in November-December 2021, using purposive sampling with 43 respondents. The knowledge level and adherence were measured using a questionnaire and the Morisky Medication Adherence Scale (MMAS-8). Meanwhile, the relationship between the variables was analyzed using the Pearson Product Moment correlation test with a significance level of 95%.

Results: The results showed that respondents with high, moderate, and low knowledge levels were 88.37%, 11.63%, and 0%, respectively. Respondents with high, moderate, and low adherence to ATD were 95.34%, 4.7%, and 0%, respectively. Furthermore, analysis of the relationship to taking ATD obtained a p-value of 0.001 (<0.05) and a correlation value (r) of 0.609.

Conclusion: Most patients had high knowledge and adherence to medication, and the correlation showed a strong relationship between the variables and taking ATD.

Keywords: adherence, knowledge, medication, tuberculosis.


INTRODUCTION

Tuberculosis can be defined as a direct bacterial infection caused by Mycobacterium tuberculosis and transmitted through cough and inhaled saliva.1 About 3,000 spuha can be expelled in one cough, and the incubation period is between 3 to 6 months. The treatment can be carried out in two stages: an active and a follow-up period of 2 and 4-6 months.2 Regular treatment can achieve complete cure results, and when stopped, the bacteria multiply. It means that the patient should be treated again from the beginning.3 In addition, 50% of people with tuberculosis are liable to die within 5 years, 25% may recover with a strong immune system, and 25% will become chronic cases and remain infectious when left untreated.2 The death rate from pulmonary tuberculosis can be reduced when the patient is given proper care and treatment.4

According to the World Health Organization (WHO), one determinant of the successful management of pulmonary tuberculosis therapy is adherence to treatment, and non-adherence can result in recurrence or treatment failure.5 It can cause resistance to germs and long-term disease transmission from individual to individual. The consequences in the long term can worsen health conditions and increase medical costs. Moreover, it impacts low cure rates, the resistance of tuberculosis bacteria to anti-tuberculosis drugs (ATD), increased recurrence, and high mortality rates, making disease cure difficult to achieve.6

The incidence in 2016 was equivalent to 10.4 million or 120 cases per 100,000 population. The countries with the highest case are India, Indonesia, China, the Philippines, and Pakistan.7 Most of the estimated incidence at 45% occurred in Southeast Asia, including Indonesia, while 25% occurred in Africa.8 According to several reports, in 2017, the number of cases in Indonesia was 420,994 (data as of May 17, 2018).9 In Yogyakarta as the study site, the number increased in 2019 to 1048 cases.10 Furthermore, about 604 new cases were found, while 564 occurred in 2018. The data were obtained from 18 Public Health Centers and 12 Hospitals in Yogyakarta City as referral health facilities for patients.11

Many individuals with tuberculosis believe they are healed and discontinue therapy due to a lack of knowledge about this disease. Several studies stated that education affects the patient’s rules in taking medication. Therefore, the patient’s education level is directly proportional to the information obtained about the treatment. Furthermore, several factors influencing adherence include...
communication, knowledge, health service facilities, individual perceptions, and motivations. The knowledge level influences a person’s adherence to tuberculosis treatment; hence, patients need to understand the information well. Moreover, another factor influencing medication adherence is the knowledge of family members and health workers. Some of these factors necessitate an investigation of the association between patient understanding and adherence to anti-tuberculosis medications (ATD). Therefore, this study aimed to determine the relationship between the knowledge level of pulmonary tuberculosis with adherence to taking ATD using a non-experimental quantitative design with analytic correlation and a cross-sectional approach.

METHODS

This study used a non-experimental quantitative model with a cross-sectional design in November-December 2021. Direct data collection used a questionnaire distributed to tuberculosis patients subjected to active treatment at the Umbulharjo 1 Public Health Center, Yogyakarta.

The sample was taken using a purposive sampling method. The inclusion criteria were: (a) Patients diagnosed with tuberculosis and currently subjected to treatment at the Umbulharjo 1 Public Health Center, Yogyakarta; (b) aged 17-50 years; (c) volunteered to be respondents; and (d) ability to read and write. Meanwhile, the exclusion criteria included (a) Patients who could not communicate well; (b) Patients who did not fill out the questionnaire completely; and (c) Patients who were unwilling to cooperate.

Study Instrument

The instrument used was the questionnaire contained in the respondent data sheet and informed consent. The questionnaires used in this study are as follows:

Questionnaire about the knowledge level

The instrument used was a questionnaire to determine the knowledge level about pulmonary tuberculosis. The questionnaire consisted of one and four questions about the definition and transmission of pulmonary tuberculosis. Furthermore, it includes one, three, and four questions about the causes, signs and symptoms, treatment, and prevention. Detail of the question items regarding the patient's knowledge level is shown in Table 1.

<table>
<thead>
<tr>
<th>Question</th>
<th>True</th>
<th>False</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Mycobacterium tuberculosis infection always causes people to suffer from pulmonary tuberculosis.</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Pulmonary tuberculosis can only attack the lungs.</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>The duration of treatment for pulmonary tuberculosis is 6 months.</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>The eradication of pulmonary tuberculosis is only the responsibility of the Ministry of Health.</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Environmental hygiene can reduce the risk of transmission.</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>The improvement of community nutrition has no effect on disease prevention.</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Pulmonary tuberculosis is an incurable disease.</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Pulmonary tuberculosis patients do not need to adhere to treatment and take medication.</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Pulmonary tuberculosis can be transmitted through the patient's droplets inhaled by other people.</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>The type of treatment I am currently on is a long-term treatment.</td>
<td></td>
</tr>
</tbody>
</table>

Table 1. A list of question items of knowledge on tuberculosis.

Data Analysis

Knowledge Level

The form of the questionnaire used is True (T) and False (F) statements with 16 question items. Questions are made in 2 types, namely favorable and unfavorable to the object. For quantitative analysis, each answer is given a score where the favorable item with the answers T (True) and F (False) has a score of 1 and 0. Meanwhile, the unfavorable item with the answers T (True) and F (False) scores 0 and 1.

Adherence to taking ATD

This questionnaire comprises 8 questions, and the response category consists of yes or no answers and 5 Likert scales for one last question. In the MMAS-8 measurement, questions 1 - 7 with the answer YES and NO have a score of 0 and 1, except for question number 5. It has a score of 1 and 0. Question number 8 with the answer never/rarely has a score of 4, occasionally with 3, 2, 1, and always/every time with 0. The adherence level is obtained from the total score in the overall assessment, namely the high, moderate, and low categories, with a total score of 8, 6-7, and <6.

Univariate test

The univariate test was conducted using SPSS 26.0 for windows computing.
Table 2. A list of question items of knowledge on tuberculosis.

<table>
<thead>
<tr>
<th>No</th>
<th>Question Items</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Do you sometimes forget to take your medication for tuberculosis?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>People sometimes do not have time to take medication, not because they forget.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Have you ever cut back or stopped taking the medication without telling your</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>When you go on a trip or leave the house, do you sometimes forget to bring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Did you take your medication yesterday?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Taking medication daily is an unpleasant thing for some people. Have you ever</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>How often do you have trouble taking your medication?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>a. Never/rarely</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Several times</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>c. Sometimes</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>d. Often</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>e. Always</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Write: Yes (if selected: b/c/d/e); No (if selected: a)

• Bivariate test
Pearson Product Moment correlation statistical test was conducted to examine the relationship between the variables at a significance level of 95% or α=0.05. This test analyzed the independent (knowledge about pulmonary tuberculosis) and the dependent variable (adherence to taking ATD). Furthermore, conclusions can be drawn based on the analysis results.

RESULTS

Characteristics of respondents
Respondents were patients with pulmonary tuberculosis subjected to active treatment at the Umbulharjo 1 Public Health Center, Yogyakarta, consisting of 43 people. From all existing respondents, a demographic description regarding the characteristics was obtained. In this study, the characteristics discussed include age, education, gender, and occupation, as shown in Table 3.

Based on the demographic data, most respondents (17 people or 39.53%) were 17-25 years old. The education level was Senior High School with a percentage of 37.2%. The data above showed that most respondents (26 people or 60.5%) were female, while 17 (39.5%) were male. Among respondents with pulmonary tuberculosis, 12 (27.9%) worked, and 31 (72.1%) did not. A detail of the respondent’s characteristics is shown in Table 3.

Knowledge level
The patients’ knowledge level about pulmonary tuberculosis was classified into three categories, namely high (≥75%), moderate (55-75%), and low (≤55%). The results showed that 38 (88.37%), 5 (11.63%), and 0% respondents had high, moderate, and low knowledge. Patients must be educated and knowledgeable about their disease and treatment method. The results of descriptive statistics of knowledge level are shown in Table 4.

Adherence
The medication adherence was classified into 3 categories, namely high (≥75%), moderate (55-75%), and low (≤55%). Meanwhile, 37 (86.05%), 6 (13.95%), and 0% had high, moderate, and low adherence at the Umbulharjo 1 Public Health Center, Yogyakarta. The results of descriptive statistics of medication adherence are shown in Table 5.

Relationship between patients’ knowledge and medication adherence
The following results are obtained from data analysis using Pearson Moment Product with SPSS for windows version 15.0 program and 95% confidence level or α: 0.05. The results show a p-value of 0.001 (<0.05) and a correlation value (r) of 0.609, shown in Table 6, which means that the knowledge level has a strong correlation with adherence to taking ATD. Based on the hypothesis, 38 (88.37%) and 37 respondents (86.05%) had high knowledge and medication adherence.

DISCUSSION
This study aimed to describe the knowledge level and adherence to anti-tuberculosis drugs and analyze the relationship between the two variables. The population was patients subjected to active treatment at the Umbulharjo 1 Public Health Center, Yogyakarta. The sample was taken using the purposive sampling method, and the data was taken through a questionnaire directly. From the data collection, the results obtained were 43 respondents.

Most respondents diagnosed with pulmonary tuberculosis (17 people or 40.5%) were aged 17-25 (productive). According to the National Population and Family Planning Agency (2013), residents of productive age are between 15 and 59 years. Residents of productive age tend to have more interactions outside the home and have a higher rate of contracting tuberculosis. There is a strong suspicion that age is associated with the development of cases. It is in line with Kanmani et al. (2021) that tuberculosis, on average, occurs at a productive age due to the many activities outside the home and work environment.

The analysis results showed that respondents with an education level of Elementary School, Junior High School, Senior High School, and Undergraduate were 5 (11.6%), 13 (30.2%), 16 (37.2%), and 9 (20.9%), respectively. The highest...
percentage is in respondents with a Senior High School education level. Kaafah et al. (2021) stated that people with higher levels of education have 1.185 times more adherence relationships. According to Ayllón (2019), higher education levels are more informative and knowledgeable. A lack of education will hinder the development of one’s attitude toward newly introduced values. The relationship between education and knowledge about tuberculosis and its impact on medication adherence varies.

Women are more susceptible to tuberculosis than men because they are mostly passive smokers. In theory, passive smoking is more dangerous than active, and most women seek treatment at the Umbulharjo 1 Public Health Center in the surrounding area smoke. According to Tahseen et al. in 2020, gender differences affect tuberculosis incidence in the detection, diagnosis, and treatment process. It is consistent with Moyo (2022) in South Africa, which stated that 55% of patients with pulmonary tuberculosis were women, mostly homemakers.

Among respondents with pulmonary tuberculosis, 12 people worked (27.9%), and 31 did not work (72.1%). These results indicate that the percentage of respondents who do not work is high. Adults are susceptible to tuberculosis, and one of the causes is the factor of their work activities, which expose them to many tuberculosis sufferers. Moreover, workers are prone to fatigue, which can cause decreased immunity, and are susceptible to infection. According to Rathnayake et al. (2021), patients who do not work have a higher knowledge level and more time to get information from health workers and neighbors.

Adherence to the ATD treatment regimen plays a very important role in the healing process of pulmonary tuberculosis for complete recovery. It is strongly influenced by knowledge and attitude to adapt to change by managing and taking the time and opportunity needed. It occurs when the rules for the use and administration of prescribed drugs are followed correctly. Some of the reasons that make patients stop taking medication are (1) boredom from taking long treatment, (2) patients feel healthy after receiving treatment for some time and then stop, (3) lack of knowledge about pulmonary tuberculosis, (4) far distance between the patients’ house and the Public Health Center. This study found a statistically significant relationship between knowledge level and adherence to ATD. The knowledge about pulmonary tuberculosis is directly proportional to the awareness of treatment. In this case, pulmonary tuberculosis patients with good knowledge have awareness and a positive perspective about the importance of undergoing regular treatment to completion, which will result in optimal recovery.

Knowledge of pulmonary tuberculosis plays an important role in the patient’s recovery process. Non-adherence to the treatment regimen for six months causes resistance to anti-tuberculosis drugs and increases the source of pulmonary tuberculosis transmission. Furthermore, Orok et al. (2022) found a relationship between knowledge and medication adherence. Respondents with good knowledge were 5,833 times more likely to adhere to taking medication compared to those with poor or less knowledge.

One factor determining the success of treatment is the patients’ knowledge and attitude about the mode of transmission and treatment of pulmonary tuberculosis. Therefore, patients have awareness and adherence to take ATD in the pulmonary tuberculosis treatment program.

Further studies are suggested to analyze other factors influencing medication adherence in pulmonary tuberculosis patients to optimize therapy, such as respondent characteristics, including age, education level, occupation, and gender. In addition, professional healthcare practitioners must provide information about the importance of knowing the patients’ medication adherence to obtain optimal results.

### Limitations of the study

During the implementation, scientific procedures were conducted, but they still had limitations. Therefore, further studies are expected to improve and develop the results, and the limitations are:

<table>
<thead>
<tr>
<th>Variable</th>
<th>P-Value</th>
<th>Correlation Value ($r$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge Level Adherence to taking ATD</td>
<td>0.001</td>
<td>0.609</td>
</tr>
</tbody>
</table>
Some patients asked to be represented by their family members in filling out the questionnaire. Therefore, obtaining real patient results regarding their knowledge level and adherence took much work; and (2) It was not easy to communicate freely due to the crowded waiting room at the Public Health Center where the study was conducted.

CONCLUSION
The knowledge level of pulmonary tuberculosis patients strongly and significantly correlates with medication adherence.

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AUTHOR CONTRIBUTION
All authors contributed to this study’s conception and design, data analysis and interpretation, article drafting, critical revision, final approval, and data collection.

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CONFLICT OF INTEREST
All authors declare no conflicts of interest.

ETHICAL CONSIDERATION
This study was officially approved by the Research Ethics Committee (KEPK) of the Faculty of Medicine and Health Sciences, Universitas Muhammadiyah Yogyakarta (Number 026/EC-KEPK FKIK UMY/I/2022).

REFERENCES
