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Improving Pulmonary Tuberculosis Treatment Adherence:
The role of patient knowledge in Cirebon, West Java, Indonesia

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ABSTRACT

Background: With 10 million cases around the world, pulmonary tuberculosis (TB) has been classified as a highly contagious disease and mostly affecting low and middle countries. Having the second highest incident cases in West Java of Indonesia, Cirebon becomes a challenging city in order to reduce the number of TB cases in the country.

Aims: This study aims to identify the patients' knowledge and treatment phases, and how the two factors encourage patients to comply with their medication.

Methods : This cross-sectional observational study was conducted among 91 new pulmonary tuberculosis patients at the Cirebon City Community Lung Health Centre, selected using random sampling. Not only respondent characteristics, but also data on the patients' knowledge levels, treatment phases, and medication adherence were collected using a questionnaire and medical records. To assess the relationship between these variables, the collected data was then analyzed using the Spearman Correlation test. Ethical clearance was obtained from the Health Research Ethics Commission, and informed consent was gathered from all participants.

Results: This study reveals the most updated characteristics of the Tuberculosis patients at the Cirebon City Community Lung Health Center aged 15-64 years old with treatment duration ranged 1-6 months. The majority have insufficient knowledge about tuberculosis (45.1%), and 75.8% of patients adhered to their prescribed medication regimen, regardless of their knowledge level. The data indicates a significant positive correlation between knowledge level and medication adherence ($p = 0.015$), with 95% of patients with good knowledge adhering to treatment compared to only 34% with poor knowledge. Furthermore, there is a significant relationship between adherence and treatment duration ($p = 0.002$), as 85% of patients who adhered to treatment did so for more than two months.

Conclusion: The study shows that patients with better knowledge of tuberculosis are more likely to stick to their medication, which also leads to longer treatment durations. Given the high incidence of TB in the region, these findings suggest the need for targeted educational programs to enhance patients' understanding of TB, thereby improving adherence to treatment protocols.

1. Introduction

Recorded with more than 10 million cases in global, pulmonary tuberculosis (TB) has been raised as major global issue which causes 1.5 million deaths per year (World Health Organization, 2023). Caused by *Mycobacterium tuberculosis*, Tuberculosis is highly contagious, affecting the lungs, and impacting low and middle countries (Global Tuberculosis Report, 2023). As per GTR report in 2023, recorded with approximately 808,000 drug-sensitive tuberculosis (TB) cases, World Health Organization (WHO) places Indonesia as having the second highest number of TB cases in the world.

While the country continues facing significant challenges, enhancing treatment adherence is crucial in order to reduce the risks associated with TB, such as health deterioration, complications, relapse, treatment failure, drug resistance, and ongoing community transmission. Vandauli and Bachtiar (2019) noted that not only stigma, but also lack of knowledge in TB patients relates to the medical compliance regarding to how vulnerable them to other high risk infection such as TB-HIV co-infection.

This study will find out the relationship of knowledge level and phase of pulmonary tuberculosis treatment with medication compliance in TB patients at the Cirebon City Community Lung Health Center, the only hospital in Cirebon City that treats Lung Tuberculosis patients. Ranking as the second highest incident in West Java, Cirebon City has been known with 94.01% of detection rate, and 84% of treatment success rate. Comprehensive knowledge plays a critical role in the success of Tuberculosis treatment by informing patients about transmission methods, treatment stages, goals, drug side effects, and disease complications, thereby shaping their behaviors, plans, and decisions; emphasizing the utmost priority on patient compliance due to its significant impact on treatment outcomes (Dwiningrum et al., 2021; Rizki et al., 2022).

2. Methods

Study Design

This research includes observational analysis using cross sectional, to determine the relationship between level of knowledge and phase of treatment for pulmonary tuberculosis and adherence to taking medication, data collected at the same time.

Populations and Samples

The population of this study was all pulmonary tuberculosis patients in Cirebon City and the sample for this study was taken from all new cases of TB sufferers who met the criteria at the Cirebon City Community Lung Health Centre with a sample size of 91 people. Data information was provided by several treatment centre officers who were selected based on a minimum work period of 3 years. This study employed a random sampling involving patients with age ranged 15-64 years, and currently being treated for tuberculosis (1-6 months). The patients will be excluded if more than 75% of the questions on the questionnaire were not answered.

Measurements

The independent variable in this study is the level of knowledge and phase of treatment for pulmonary tuberculosis and the dependent variable is adherence to taking medication. The data was taken using a secondary data from a set of questionnaires and the patient's medical records at the hospital.

Data Collection

Research data was collected directly by researchers at the hospital, by first providing information to respondents regarding an explanation of the research to be carried out, objectives, benefits, research procedures and guaranteeing the confidentiality of all information and personal data of respondents. Ethical clearance has been obtained by the researcher, reviewed by the Health Research Ethics Commission (KEPK) Faculty of Medicine, Swadaya University, Gunung Jati with ethical number No.156/EC/FKUGJ/VI/2022.

Instruments and Analysis

The respondents who were willing to voluntarily take part in this research were asked for written consent by filling out an informed consent letter. The questionnaire was adopted from the MMAS-8 Score Questionnaire. Observations were carried out by researchers, Lecturers at the Faculty of Medicine, UGJ, the respondent's level of knowledge category refers to a good percentage if the overall score is >30, sufficient if the overall score is (16-30), and poor if the overall score is <16. The Spearman Correlation test was used to determine between knowledge and stages of treatment for pulmonary TB sufferers and compliance with the treatment program for pulmonary TB sufferers at the Cirebon City Community Lung Health Center.

3. Results

Respondents' Characteristics

Table 1 summarizes the respondent characteristics in this recent study including sex, age, and patients' knowledge to the TB disease, and also the duration of treatment and their obedience to the given medication. The survey indicates that more male suffer tuberculosis at the subjected area. The data at the Cirebon City Community Lung Health Center counts that there were 52 male patients with TB case (57.1%), compares to women with 39 cases (42.9%). The majority of patients were 15-29 years (43.9%), and only 8 patients (8.8%) with age more than 60 years old. Looking to the data, more respondents involved in this study have bad knowledge even the majority are obeying the medication given to them during the observation. Our survey noted that of 91 patients, only 20 patients are accompanied with good knowledge to Tuberculosis. While 30 patients have adequate knowledge (33%), the majority of new cases of tuberculosis patients at the Cirebon City Community Lung Health Center had a level of insufficient knowledge (45.1%). By the data, it can be said the patients' knowledge does not affect their obedience and duration to follow the medication. The data shows that 61% of patients receive treatment for more than 2 months and still counting.

Table 1. Respondents' characteristics

	Characteristics	Frequency	Percentage
Sex	Male	52	57.1
	Female	39	42.9
Age	15 – 29	40	43.9
	30 – 44	23	25.3
	45 – 59	20	21.9
	60 – over	8	8.8
Knowledge	Bad	41	45.1
	Adequate	30	33.0
	Good	20	22.0
Treatment Duration	≤ 2Months	30	33.0
	> 2 Months	61	67.0
Obedience	Not Obey	22	24.2
	Obey	69	75.8

Table 2 shows the distributions of the patients based on their level knowledge to Tuberculosis. The statistical analysis shows that the level of knowledge significantly contribute to the obedience level to comply the TB medication (p value = 0.015). If compared to the treatment phase, it can be said that the level knowledge deliver more positive correlation (r = 0.314). The data indicates that the highest the knowledge level, the more comply the patients with the TB treatment). Among 20 patients with good knowledge, it is noted that 19 patients are following the medication, while out of 41 patients with bad level of knowledge, the percentage of patients obeying the medication are decreasing to only 14 patients.

Table 2. Relationship between Level of Knowledge and Compliance with Medication

	Obedience					Total	r	P value
		Not Obey	N	Obey	N			
Level Knowledge	Bad	14	63.6%	27	39.1%	41	0.254	0.015
	Adequate	7	31.8%	23	33.3%	30		
	Good	1	4.5%	19	27.5%	20		
	Total	22	100%	69	100%	91		
Treatment Phase	≤ 2 Months	13	59.1%	17	24.6%	30	0.314	0.002
	> 2 Months	9	40.9%	52	75.4%	61		
	Total	22	100%	69	100%	91		

The results of this recent study not only show how knowledge is affecting the obedience level among the new TB cases patients at the Cirebon City Community Lung Health Center, but also how long the patients willing the participate the treatments (counting as duration). The statistical analysis shows positive relationship where the more the patients obeying the medication, the more durations the TB patients complying the treatment (p value = 0.002). Observed from table above, of 61 patients with more than 2 months treatment duration, 52 patients have been noted obeying the medication compliance. On the other hand, of 22 patients observed not obeying the medication from the total respondents, more than half patients (59.17%) have been surveyed with less than 2 months treatment phase.

4. Discussion

Knowledge Level

The level of knowledge about tuberculosis of respondents in this study was 41 (45.1%) at a poor level of knowledge. While 30 patients (33%) were measured with a sufficient level of knowledge the other 20 (22%) had good level of knowledge. This is similar to previous research conducted by Miranda & Ridwan (2019) explaining that there is a relationship between the level of knowledge and efforts to prevent the spread of TB. The higher the level of knowledge, the greater the community's efforts are needed to prevent the transmission of tuberculosis. This means that knowledge is very important, because high knowledge can create good behavior. In the elderly group, the level of knowledge is lower than the age range in early and middle adulthood. Women's knowledge level is higher (Miranda & Ridwan, 2019) than men, because women prefer to read or discuss with other people, so they have a better understanding of tuberculosis. Women are more diligent and thorough when given a task or doing something. Another factor that influences knowledge is education, the higher the level of education, the easier it is to obtain information.

Treatment Phase

It is noted that there were 30 respondents (33%) underwent treatment for ≤ 2 months and there were 61 respondents (67%) underwent treatment > 2 month. This research explains that if you do not undergo treatment for 6 months it will cause resistance to pulmonary tuberculosis drugs and will increase the source of transmission of pulmonary tuberculosis, therefore the majority of respondents adhere to taking medication regularly, the level of awareness and knowledge of respondents about pulmonary tuberculosis plays a role in the process. his recovery (Seniantara et al., 2018). Ita Azizah's research shows that compliance with taking medication in this study was seen from information on compliance with taking medication and compliance with taking medication (Azizah, 2020). Adherence to taking medication in the intensive phase for two months at the start of treatment is done every 2 weeks, while in the advanced phase, patients take the medication every month. This is in line with research by Masyudi et al (2019. Compliance can be interpreted as patient behavior that complies with all advice and recommendations from medical personnel. Compliance with taking medication is measured according to the guidelines that have been implemented, namely by complete treatment.

Medication Adherence

The number of respondents at the compliant level was 69 people (75.8%) while those included at the less compliant level were 22 people (24.2%). The results obtained in this study according to the level of compliance of smear positive pulmonary tuberculosis patients in carrying out the treatment program were quite good. The Spearman test shows a correlation value of 0.254 with a p value of 0.015, which means there is a positive correlation with weak strength in the variables tested. This means that the higher the patient's level of knowledge, the higher the patient's level of compliance with taking medication. The results of this study are in accordance with research conducted by Mellyana et. al. (2022) showing the results obtained using the Spearman p-value test were 0.028 < α (0.05), means relationship between knowledge and the level of compliance of pulmonary tuberculosis patients. The positive correlation coefficient value of τ 0.389 shows a unidirectional relationship, which means that the higher the knowledge possessed by tuberculosis sufferers, the higher the patient's medication adherence and better compliance is determined by the patient's behavior in complying with instructions given by medical personnel. Non-compliance with pulmonary tuberculosis sufferers is due to the patient not taking medication on time according to the predetermined schedule (Rojali & Noviatuzzahrah, 2018). ATD must be taken regularly according to schedule, during the intensive and continuation phases to avoid treatment failure and relapse. Patient noncompliance with tuberculosis treatment is common and an important cause of treatment failure. Failure to comply with treatment can also lead to the emergence of tuberculosis treatment requiring longer treatment.

Correlation between Knowledge Level and Compliance with Medication

This research shows Relationship between Knowledge Level and Treatment Adherence. The level of knowledge has a significant relationship with compliance where the Spearman test shows a correlation value of 0.254 with a p value of 0.015, which means there is a correlation in the variables tested has a positive direction with weak strength, the high level of patient knowledge causes , the higher the level of compliance with taking medication. As per research conducted by Mellyana et. al. (2022), Knowledge influences TB patients' adherence to medication and the more compliant the patient, the higher the cure rate and the impact on reducing resistance to anti-tuberculosis drugs. The patient's recovery rate is measured by regular treatment. Compliance is also one of the factors that increases recovery from tuberculosis (Mellyana et al., 2022).

Correlation between Treatment Phase and Medication Adherence

The results of the research show that a correlation value of 0.314 with a p value of 0.002 is obtained, which means that there is a correlation in the variables tested in a positive direction with weak strength. This shows that if the respondent goes through a phase of more than 2 months of treatment, the patient will be more compliant in taking the medication. The OR value was 4.418 (1.608-12.143), which means that respondents who underwent treatment for ≤ 2 months were 4.418 times more likely to be non-compliant with taking medication than those who underwent treatment for > 2 months. This finding is similar to previous research conducted by Ita Azizah showing that compliance with taking medication in this study was seen from information on compliance with taking medication and compliance with taking medication (Azizah, 2020). Adherence to taking medication in the intensive phase for two months at the start of treatment is done every 2 weeks, while in the advanced phase, patients take the medication every month. A research by Masyudi et al. (2019) explains that compliance can be interpreted as patient behavior that complies with all advice and recommendations from medical personnel. Compliance with taking medication is measured according to the guidelines that have been implemented, namely by complete treatment. This research explains that the results of data collection showed that those who were compliant in taking OAT were those who received supervision from their families at home (Azizah, 2020; Masyudi et al., 2019).

5. Conclusion

This recent study shows that patients with better knowledge of tuberculosis are more likely to follow their medication regimen, which helps them stay on treatment longer. Patients who go through the treatment phase for more than 2 months will be more compliant in taking medication. Although the connection between knowledge, adherence, and treatment length is not very strong (r = 0.254 – 0.314), improving patient education can make a significant difference. Policy implications include the needs for targeted educational programs and sustained community engagements to improve knowledge and adherence, ultimately reducing Tuberculosis incidence and resistance in high-burden areas like Cirebon of Indonesia.

Conflict of Interest

The authors declare no conflict of interest for the results.

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