Journal of Advanced Zoology

ISSN: 0253-7214

*Volume **44** Special Issue-**2 Year 2023** Page **2132:2145***

The Effect of Individual Characteristics and Role of Social Environment on Drug Resistant Tuberculosis Patient's Adherence Treatment during Pandemic COVID-19 Era.

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Article History

Received: 08July2023

Revised: 29 Aug 2023

Accepted: 02 Oct 2023

Abstract

Background: Drug Resistant Tuberculosis (DR TB) continues to be a threat to society. The increasing number of treatments drop out will lead to high mortality and Lost To Follow Up (LTFU). Therefore, it is necessary to analyze more deeply about treatment adherence influencing factors, starting from individual internal and external factors to social environment factors.

Method: This quantitative study used a cross-sectional design toward 156 both on patients and ex-patients who had recovered from DR TB in Special Region of Yogyakarta and Central Java.

The sampling technique used was purposive sampling. The data was collected through a valid and reliable questionnaire valued > 0.444 per questions (r count > r table) in 20 patients. The data was analyzed in bivariate using *Chi Square* and multivariate using Logistic Regression through Stata application.

Result: The result of bivariate test showed the influencing factors are age, knowledge, motivation, socioeconomic, occupation, family support, social support and stigmatization with value $p > 0.05$. While factors that are not influencing the treatment adherence are education ($p=0.153$) and sociodemographic ($p=0.782$). The result of multivariate analysis stated family support provided the highest chance of treatment adherence (OR 27.9)

Conclusion: Individual internal factors (age, knowledge, and motivation), individual external factors (socioeconomic and occupation), and social environment factors (family support, social support, and stigmatization) are affecting the medical adherence in DR TB patients that and lead to high recovery chance.

Keywords: Drug Resistant Tuberculosis (DR TB), Individual Characteristics, Treatment Adherence, Social Environment.

1. Introduction

Tuberculosis (TB) is the highest cause of death in Indonesia after ischemic heart disease and cerebrovascular disease[1]. Therefore, TB is one of the biggest challenges

Indonesia must face, which also become one of the main priorities in the Sustainable Development Goals (SDGs)[2]. According to Global Tuberculosis Report, currently Drug Resistant Tuberculosis (DR TB) continues to be a threat to public health. DR TB appears as the result of inadequate treatment, patient non-adherence in taking first-line drugs until the end, and through the transmission from other DR TB patients [3].

Every year the estimated cases of DR TB in Indonesia are 24,000 cases [4]. There are 3,770 cases of TB in Special Region of Yogyakarta (DIY) in 2018[5]. While in 2017, there were 82 cases of DR TB confirmed in DIY which 29.51% of the cases occurred happen in the City of Yogyakarta and most of the cases had received previous TB treatment[6]. The Case Notification Rate (CNR) of DIY is the second lowest provincial figure in Indonesia, which is 99 cases per 100,000 population while the Case Detection rate (CDR) of DIY is 33.9% which makes the CDR rate of DIY is lower than Indonesia's average CDR (67,2%). Meanwhile, the Central Java's CNR is 197 cases per 100,000 population. The provinces of DIY and Central Java have not met the target for the treatment success with success rates of 82.7% and 85.1% (target > 90%).

One of the government's challenges in the Integrated Management of Drug Resistant Tuberculosis Control (MTPTRO) is the increasing dropout rate in DR TB patients since 2011 starting from 25% to 27%, 29%, 28%, and 30% in 2012 – 2015[7]. This will lead to high mortality and Lost To Follow Up (LTFU) because the treatment dropout patients will tend to have increased risk for more severe drug resistance[8]. Therefore, there are various efforts have been conducted to control LTFU in many countries. It was found that the patient's psychological emotion had a major influence on the treatment adherence**9**. Emotional support in form of a family support can increase the patient's motivation in finding solutions to their own problems caused by DR TB. Problems such as poverty, depression, stigmatization, and isolation due to the DR TB transmission will also be felt not only by the patients but their families also. In summarize, a support from families becomes very important for the patients [9–11]. The patient's perception towards the disease also contributes greatly to the treatment process. It is also influenced by occupation, the amount of TB treatment received in the past, and the physical condition of the treatment center they used[12].

Some mental health problems such as job loss, comfort of residence, and other social discrimination also affect a patient's motivation to take the treatment. Hence, a DR TB patient with good mental health will have a greater change for healing[13]. The DR TB patients' quality of life is also influenced by socioeconomic conditions considering that patients need to pay for accommodation even though the medicines have been provided free of charge by the government [14]

Aside from that, individual factors can also influencing the patient's treatment adherence. Patients with aged less than 45 years have a greater chance for healing than the elderly patients. [15–18] In order to motivate the patients to continue the treatment, it is also required a good level of knowledge about TB disease and anti-TB therapy. In their study Mekonnen and Azegaw stated that patients with less knowledge were 4 times more likely to drop out from the TB treatment[19].

Based on that reason this research was conducted. Especially in this COVID-19 pandemic situation. Research about DR TB treatment assistance based on treatment

problems and seen from the experiences of both recovered patients and failed patients is very rarely done. Therefore, this research is expected to be able to raise new problems that may have not been reviewed before and open the opportunity to develop a new model based on the patient's opinion.

2. Methods

2.1. Aim

This study was conducted with the aim of examining various DR TB treatment adherence influencing factors as seen from individual internal factors (age, education, knowledge, and motivation), individual external factors (occupation and socioeconomic), sociodemographic (history of risky behavior), and social environmental factors (family support, social support, and stigmatization).

2.2. Study Design

This study quantitative study used cross-sectional design with the independent variables were age, education, knowledge, motivation, socioeconomic, occupation, history of risky behavior, family support, social support, and stigmatization while the dependent variable was treatment adherence.

2.3. Sample

The sampling process was taken using this formula [20]:

$$n' = \frac{nN}{\mathrm{N} + n - 1}$$

Therefore, total sample obtained in this study was 150 patients with inclusion criteria were patients who have experienced in DR TB treatment according to MTPTRO protocol and declared cured from DR TB by the hospital but still undergoing the treatment process according to the MTPTRO protocol, and also were willing to be this research subjects by signed the informed consent. The exclusion criteria of this research were the XDR TB patients, DR TB patients with mental disorders, and DR TB patients with HIV. All of the samples were from Special Region of Yogyakarta (DIY) and Central Java.

3. Result

3.1. Main Result

The results of the data from the respondents showed that, the number of respondents who were successfully tracked was 156 TBRO patients who were distributed as follows:

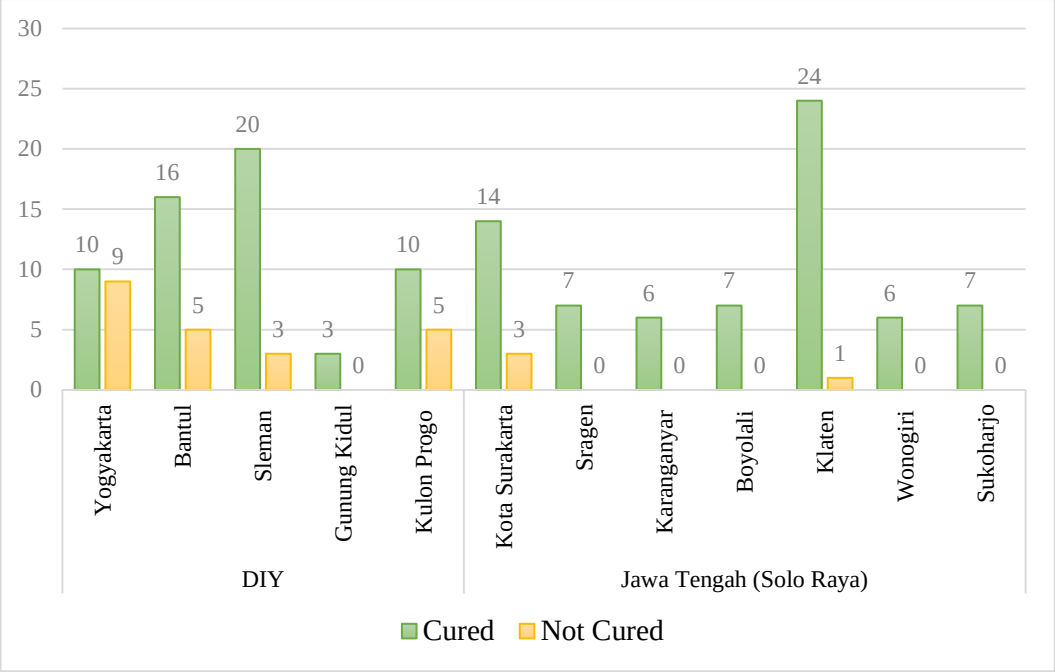
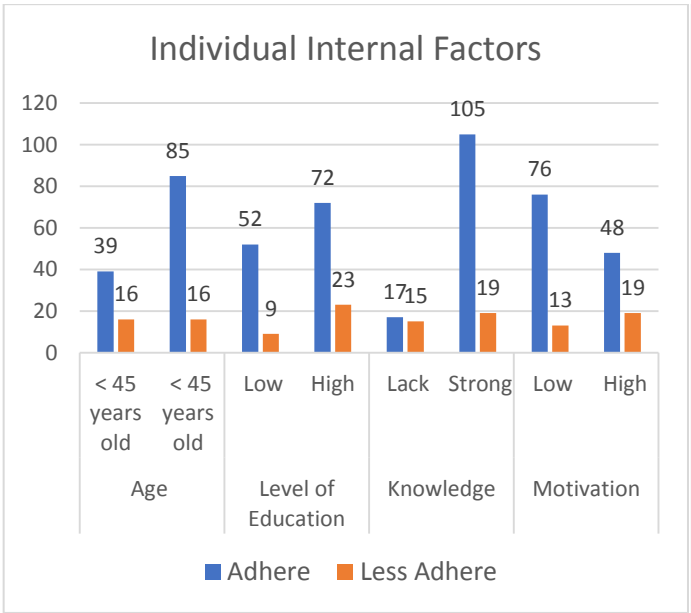


Diagram 1. Distribution of Drug Resistant Tuberculosis (DR TB) Patients by District of Residence in DIY and Central Java Regions (n=156).

Based on diagram1, it is known that mostly the DR TB respondents who lived in Central Java regions is mostly lived in Klaten with the total of 25 respondents (16.03%) while in DIY region in Sleman with the total of 23 people (14.37%). While the region with the least population in Central Java is in Sukoharjo with the total 7 people (4.49%) and in DIY is in Gunung Kidul with the total 3 people (1.91%).

Furthermore, the data were analyzed using Pearson Chi-Square with the following result:



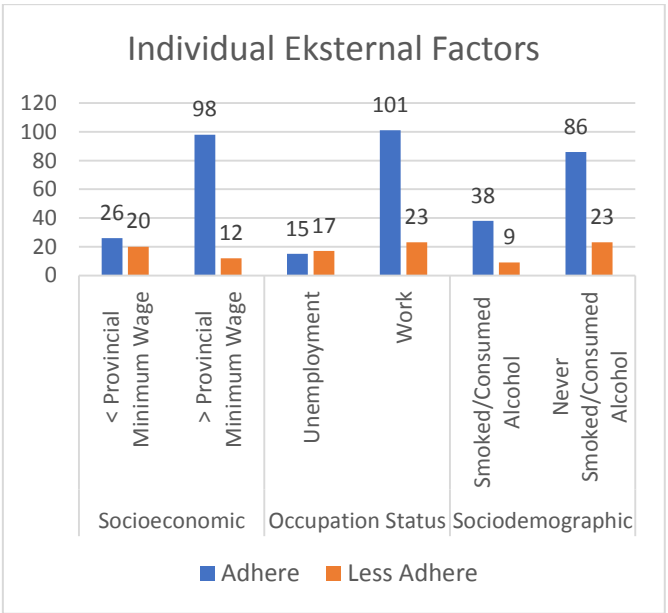


Table 2. Variables Affecting Treatment Adherence Based on Individual Factors and Social Environment Factors in DIY and Central Java Regions (n=156).

Variables	Adherence				p value
	Less Adhere		Adhere		
	f	%	f	%	
Individual Internal Factors					
Age					
1. < 45 years old	16	50,0	39	31,5	0.050
2. ≤ 45 years old	16	50,0	85	68,5	
Level of Education					
1. Low	9	28,1	52	41,9	0.153
2. High	23	71,9	72	58,1	
Knowledge					
1. Lack	15	46,9	17	53,1	0.000
2. Strong	19	53,1	105	84,7	
Motivation					
1. Low	13	40,6	76	61,3	0,035
2. High	19	59,4	48	38,7	
Individual External factors					
Socioeconomic					
1. < Provincial Minimum Wage	20	62,5	26	21,0	0,000
2. ≥ Provincial Minimum Wage	12	37,5	98	79,0	
Occupation Status					
1. Unemployment	17	53,1	15	46,9	0,000
2. Work	23	46,9	101	81,5%	
Sociodemographic (Risky Behaviour)	9	28,1	38	30,7	0,782
1. Ever Smoked/Consumed Alcohol	23	71,9	86	69,3	
2. Never Smoked/Consumed Alcohol					
Social Environment Factors					
Family Support					
1. Negative Support	19	59,4%	15	12,1%	0,000
2. Positive Support	12	40,6%	109	87,9%	
Social Support					
1. Not Feeling Supported	13	40,6%	21	17,0%	0,004
2. Feeling Supported	19	59,4%	103	83,0%	
Stigmatization					
1. Feeling accepted	14	43,8%	27	21,8%	0,012
2. Not Feeling Accepted	18	56,3%	97	78,2%	

The Results of Pearson Chi-Square test (Table 2) showed the variables were found to be influential if the significance value (p value) ≤ 0.05. In summarize, the indicator of age, knowledge, motivation, socioeconomic, occupation, family support, social support, and stigmatization affect the treatment adherence of DR TB patients with the significance value (p value) ≤ 0.05. The variables that were not influential to the treatment adherence were education and history of risky behavior because the significance value was > 0.05.

After being analyzed with Pearson Chi-Square, the data were analyzed using Logistics Regression to determine the most influential adherence treatment factor.

Table 3. Results of Logistic Regression Test.

Adherence	Odds ratio	Std. Err.	z	P> |z|	95% Conf.	Interval
Age	1.44173	.9062626	0.58	0.561	.4205561	4.942469
Knowledge	2.84308	1.842558	1.61	0.107	.7982481	10.12605
Socioeconomic	5.662137	3.328481	2.95	0.003	1.788967	17.92084
Occupation	4.767207	2.380089	2.10	0.036	1.092037	12.99575
Family Support	27.86199	20.57102	4.51	0.000	6.554723	118.4322
Social Support	3.021662	1.965433	1.70	0.089	.8444692	10.81205
Stigmatization	2.628895	1.891575	1.34	0.179	.641662	10.77061
_cons	.0136575	.0169221	-3.46	0.001	.0012012	.1550571

Variables included in the model those who had significance value ≤ 0.25, there are age, knowledge, socioeconomic, work, family support, social support, and stigmatization. The result of the Logistics Regression analysis (Table 3) show that the most dominant variable influencing treatment in DR TB patients is family support with an OR 27.9.

4. Discussion

a. The Effect of Individual Factors (Age, Knowledge, and Motivation) on DR TB Patient's Treatment Adherence.

Table 2 shows that age, (0.050), knowledge (0.000), and motivation (0.035) have a significance value (*p value)* ≤ 0.05. In summarize, those variables are affecting the treatment adherence of DR TB patients. This because the younger-productive patients have a high motivation to fight the disease, therefore they have greater chance for healing from the disease [21,22] than the elder patients. Patients aged < 45 years also have a higher cure rate [23].

The level of knowledge also determines motivation in DR TB treatment adherence. The higher level of knowledge a patient about TB, the easier for a patient to implement clean and healthy living behaviors which will also support to reach the Pulmonary Tuberculosis Treatment Success Rate [24,25]. Someone who can motivate themselves to take preventive action tends to accept the condition of their disease. Therefore, they will start to live healthier to control their disease rather than deny it [26]. Hence, it is necessary to encourage them to take a preventive and controlling action instead of still denying the disease, by providing them any kind of emotional support like motivating the patient's social environment to be more caring and supporting the patients it will improve their health status [27].

b. The Effect of External Factors (Occupation and Socioeconomic) on DR TB Patient's Treatment Adherence.

Table 2 shows the result of Pearson Chi-Square, it stated occupation *(p=0.000)* and socioeconomic *(p=0.000)* affect the DR TB patient's treatment adherence with the significance value *(p value)* < 0.05. While the result of Logistic Regression test shows socioeconomic has the highest Odd Ratio (OR) of 5.7 in the group of external factors, which mean patient with more stable and better socioeconomic condition will be more obedient 5.7 times in continuing their treatment than those who do not.

This is because the condition of socioeconomic status also affect the recovery of DR TB patient [18]. The DR TB patient's occupation has a major influence on their health level and/or the severity level of certain disease [28]. Patient with high source of income will make it easier to get adequate health facilities and infrastructure [29], fulfill better nutritional needs, adequate education, and adequate consolation to reduce their stress levels. While in low socioeconomic condition it tend to increase physical and psychosocial risks [28].

Besides that, the employment status of DR TB's patients whether they were working or unemployed will determine the degree of their treatment adherence due to the patient's recovery is more effective when the patient is stay at home and focus during their treatment to minimize the transmission of DR TB itself [30].

c. The Effect of Social Environment Factors (Family Support, Social Support, and Stigmatization) on DR TB Patient's Treatment Adherence.

Social Environment factors including family support, social support, and stigmatization also affect the DR TB patient's treatment adherence [31]. Family support consisting of the support of emotional, instrumental, informational, and reward has a very a very important role in DR TB treatment adherence because good family support will make the patient to be more motivated to recover for their family who always support them [32]. The existence of family itself can be a support system for the family member who still undergoing the chronic disease treatment [33] which DR TB is also one of the chronic disease. Therefore, the patient's family is considered as the most suitable support to help patients in their self-management system**.** In general, family support must be fulfilled to make the patient's always comply their treatment [34]

Social support can also influence the DR TB treatment adherence due it can increase defenses against stress, change affective states, increase self-efficacy, and influence changes the negative behavior [35]. Good defense against stress can improve adaptive coping towards DR TB treatment adherence [36]. The affective management of DR TB patients become more stable when their environment support their treatment [37]. The more positive the DR TB patient's perception about their benefits of medication adherence, the more self-efficacy and confidence to recover develop which can change their negative behavior [38].

Stigmatization of DR TB patients can affect the treatment adherence because stigmatized DR TB patients are no longer have attributes and characteristics of social identity in their environment. Therefore, it is necessary to

suppress the stigmatization toward DR TB patients in order to improving the level of DR TB patient's treatment adherence [39].

4.1. Research Findings

a. The recovery of DR TB patients is influenced by the level of adherence and medication.

Factors that directly affect the recovery of DR TB patients is the level of adherence. The recommendations from World Health Organization (WHO) stated that the main key in curing DR TB is patient compliance [37]. Then, the efforts to optimize patient treatment compliance need to be conducted. The treatment that carried out continuously (without dropping out the treatment) will increase the chances of recover in DR TB patients [40]**.** This can be support directly with family support that provides a great opportunity for adherence. Family support itself in this study has the highest OR among any variables which is 27.9. In summarize patients, with a family support will tend to adhere their treatment 27.9 times more than those who do not receive any family support.

b. Treatment Adherence Influenced by Knowledge, Social Support, Family Support, and Stigmatizations.

Knowledge has been extensively studied in various literatures [39,41,42] and has been shown that knowledge can influence a person's behavior, including behavior of DR TB patients during their treatments [43,44]. Good and strong knowledge will make the patients easier to build a good attitude[45] to achieve their recovery, this including adhering to the treatment [46] and controlling painful side effects[47] without having to drop out the treatment. Informational support from the family[48] will be needed to increase and maintain patient knowledge about their disease other studies also stated that increasing knowledge is important for increasing self-control behavior and increasing self-efficacy to form good disease control behavior[49].

The results of the analysis also showed social support will affect patient compliance. Nirmala et al., (2021) stated patients who received food social support would have a better prognosis than patients with high social burdens[50]. Social support needed can be in the form of economic support[51], supportive environmental support for patient's recovery[50], not creating negative stigma for the patient[52,53], and not isolating the patients until they feel alienated.

Besides of social support, family support also affects patient compliance[53]. Patients need several types of family support such as informational support, appreciation support, affective support, and instrumental support. Informational support can be provided through treatment advice for patients, information on how to control painful side effects, and seeking health information for patients through the health care facilities[48]. Emotional support is needed to make the patient feel they get enough attention and affection. While instrumental support is needed to meet the patient's need during the treatment, including nutrition needs and other material needs.

In optimizing patient compliance, increasing knowledge and support needs to be balanced by eliminating the negative stigma that burdens the patient's emotions. Many studies have reported various forms of negative stigma in DR TB patients were being ostracized and alienated from their social environment[54–58]. Negative stigmas like this will make the patients feel left out and reluctant to meet many people, including health workers. This will make difficult for health workers to reach good treatment for patients, and reduce the enthusiasm of patients in seeking their recover. Mohr et al., (2015) created an information access media in the form of a counseling tool kit to increase patient knowledge through the patient support component while doing the decentralized DR TB care to the primary care level [59].

c. The DR TB's Socioeconomic Conditions Affecting Family Support.

Patients with higher income levels increase the opportunity to get stronger family support which family support were greatly influences treatment adherence. The costs that need to be incurred by DR TB patients during the treatment are quite high[60], even though the established regimen is free of charge[61]. Florence[62] analyzed the total costs required for the management of DR TB for patients and the burden on patient is quite high to cover to fulfilling the need for their transportation, nutrition, and other expenses. Patients with a high level of income can covered the burden cost during the DR TB treatment properly without the need for any extra effort from the family in seeking additional income [51,63–65]. Thus families can have sufficient time and energy to meet other support needs for patients besides that, such as affectional support and informational support[48,66]. While patients with low income will make their families have to spend extra efforts to meet their material needs. This will make the other support needs can be neglected.

4.2. Research Limitation

This study has limitations that needs further investigation. Our study was limited to the patients in the Special Region of Yogyakarta and Central Java only, which in another condition some patients could not be found or had changed their addresses. This can affect the data collection process in the field. Some participants also distanced themselves from the researches due to the feeling of rejection and shame because of the disease. Therefore, in order to get more representative results, a qualitative study may be needed to complete the results of this study to find out the situations that occurs in patients in a concrete way.

5. Conclusion

The DR TB treatment adherence is influenced by internal individual factors (age, knowledge, and motivation), individual external factors (occupation and socioeconomic), and social environmental factors (family support, social support, and stigmatization). During their treatment period, a high level of TB knowledge determines patient motivation in continuing their treatment, implementing clean and healthy living behaviours, and preventing the transmission of DR TB itself. The

existence of support from their family and surrounding environment which followed by good socioeconomic conditions also influence the quality of the DR TB patients during their treatment. Therefore, in this study family support determine as the most influential factor in adhering the DR TB treatment with the OR of 27.9.

The recovery during the DR TB treatment is also influenced by the level of adherence and medication. Patients with high level of adherence more likely to recover than patients with low level of adherence.

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FUNGDING STATEMENTS

This research did not receive any special grant from any public, social, and non-profit sectors funding agency.

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AUTHORS CONTRIBUTIONS

All researchers in this study contribute the same role, including as follows:

1. Substantial contribution for concept or protocol design, acquisition, analysis, and interpretation of data in this research.
2. Draft critical improvements for important intellectual content.
3. Final approval of the published version.
4. Agreement to be responsible for all aspects of work in ensuring every questions related to accuracy or integrity in this study are investigated and properly resolved.