An Evaluation of Medication Adherence in Tuberculosis Patients Based on Theory of Planned Behavior

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Abstract: Medication adherence in TB (tuberculosis) becomes a crucial factor in achieving success of treatment. The aim of this study was to assess the medication adherence of TB patients and to identify the predictors based on TPB (Theory of Planned Behavior). Cross-sectional studies were conducted in patients of TB with positive AFB (Acid-Fast Bacilli) test at a hospital in Pacitan District (N = 113), (n = 104) patient agreed to participate this study. Recruitment of the respondent was used total sampling method. Data collection was conducted from November 2017 to February 2018. The instrument in this study was developed in accordance with standard guideline of TPB, medication adherence was measured using MMAS-8. Multiple linear regression used to identify predictors. Mean score of medication adherence was 4.09 (SD = 0.936) (range of possible score = 1-8). ATB (Attitude Toward Behavioral) (p = 0,02), SN (Subjective Norm) (p = 0.00), and PBC (Perceived Behavior Control) (p = 0.00) significantly predicted intention (R Square = 0965), then intention may affect medication adherence (p = 0.00). The constructs of TPB, namely ATB, SN, PBC, and Intention significantly predicted medication adherence of TB patients. This study supports an investigation about the factors underlying medication adherence on a larger scale, as well as the identification of targets in designing future interventions.

1 BACKGROUND

Tuberculosis is an infectious disease that becomes a major health concern (Pang *et al.*, 2018). Tuberculosis control with the DOTS strategy has been implemented in many countries since 1995, but still remains global problem which is difficult to be solved (WHO, 2015).

Indonesia is one of the world largest tuberculosis contributors, ranks second after India which is 10% of all patients in the world (WHO, 2015). This becomes very serious problem because of its long treatment period and requires high adherence of the patients.

Drug resistance is one result of poor medication adherence, either due to dose problems or failure in completing treatment program (Guix-Comellas *et al.*, 2017). The average of patient adherence in long-term treatment program in developed countries is only 50%, while lower numbers are found in developing countries (WHO, 2015). Adherence of treatment program has an important role to prevent transmission, death from TB, recurrence and drug resistance (Addisu *et al.*, 2014). The measurement of adherence is important in order to achieve the success of treatment (Browne *et al.*, 2018).

TB patients are required to have high adherence in treatment program as an effort to reduce the burden of TB. Therefore, this study is intended to measure TB treatment adherence and identify factors that may affect adherence itself.

This study was used Theory of Planned Behavior (TPB) as the conceptual framework. TPB explains that intention is a direct predictor of behavior, which in this case is behavior of TB patient in completing their treatment programs. While the intention itself comes from the main factors of TPB, namely ATB, SN, and PBC (Ajzen, 2005). The main factors of TBP are shown to have a close relationship with the intention(Miller *et al.*, 2015). The constructs of TBP can predict a person's intentions until behavior is formed (Peleg *et al.*, 2017).

Thus, the idea in this study is Theory of Planned Behavior can also explain how medication adherence in TB patients. In this study, we explore factors associated with medication adherence in TB

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patients based on the construct of TPB. The aim of this study was to assess the medication adherence of TB patients and to identify the predictors based on TPB (Theory of Planned Behavior).

2 METHODS

2.1 Respondent and Procedure

Cross-sectional studies were conducted in patients of TB with positive AFB (Acid-Fast Bacilli) test at a hospital in Pacitan District (N = 113). Recruitment of the respondent was used total sampling method. Data collection was conducted from November 2017 to February 2018. Respondents consisted of all TB patients with positive AFB and were over 15 years of age. Patients with co-morbid conditions (such as, psychiatric illness, neoplasia) and patients who did not complete the questionnaire were excluded from the study. A total of (n = 104) from 113 eligible respondents agreed to participate this study (recruitment rate 92.03%). The informed consent was obtained from all respondents before they participate in this study. This study protocol has been approved by the Indonesian Commission of Health Research Ethics.

2.2 Instrument

Questionnaire was used in data collection process. The medication adherence was measured using MMAS-8(Morrisky Medication Adherence Scale-8), while ATB, SN, PBC, and Intention were measured using instruments developed from standard instruments of TPB.

2.2.1 Medication Adherence

The medication adherence was measured using MMAS-8 (Morisky *et al.*, 2008) that has been modified as needed. The instrument was written in Indonesian, and there was 8 items of questions with a range of scores each question (0-1). The score were summed, and the higher score showed the higher adherence level. This questionnaire has been tested for its validity and reliability. Validity test used pearson product moment with 5% significance level, and the result showed that all item of the questionnaire are valid. Reliability test used alpha cronbach with 5% significance level, and the result showed reliable.

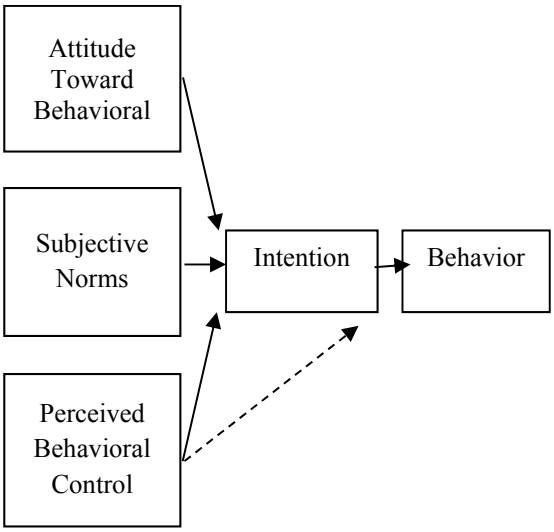


Figure 1: Construct of theory of planned behavior.

2.2.2 Attitude Toward Behavioral

The measurement of this variable was used the instrument which consist of 10 questions, and it is divided into 2 paired sections. The first section was the questions about outcome evaluation as many as 5 items of questions, and the second section was about strenght beliefs as many as 5 items of questions.

Range of scores each question (1-7) (Semantic Differential). ATB scores were calculated using the following formula (Ajzen, 1991):

$AB = \sum b_i e_i$

Keterangan:

- AB: Attitude Toward Behavioral
- b_i : Strengt beliefs
- e_i : Outcome evaluation

2.2.3 Subjective Norm

The measurement of this variable was used the instrument which consist of 10 questions, and it is divided into 2 paired sections. The first section was the questions about motivation to comply as many as 5 items of questions, and the second section was about normative beliefs as many as 5 items of questions.

Range of scores each question (1-7) (Semantic Differential). SN scores were calculated using the following formula(Ajzen, 1991):

$SN = \sum n_i \, . \, m_i$

Keterangan:

- SN : Subjective norm

- n_i : normative beliefs
- m_i : motivation to comply

2.2.4 Perceived Behavior Control

The measurement of this variable was used the instrument which consist of 10 questions, and it is divided into 2 paired sections. The first section was the questions about beliefs control as many as 5 items of questions, and the second section was about power beliefs as many as 5 items of questions.

Range of scores each question (1-7) (Semantic Differential). PBC scores were calculated using the following formula(Ajzen, 1991):

$PBC = \sum c_i \, . \, p_i$

Keterangan:

- SN : Subjective norm
- c_i : control beliefs
- p_i : Power beliefs

2.2.5 Intention

The Intention questionnaires which modified from TPB Quissionariewas used as the measurement of intention (Ajzen, 1991). Modifications were made to the question form as well as the content of the questions to match the theme of the study, so the researchers tested the validity and reliability of the questionnaire, and the results showed that the questionnaire was valid and reliable.

This variable measurement questionnaire consists of 10 question items. Range of scores for each question (1-7) (Sisctematic Differential). The score were summed, and the higher the score showed the higher the intention level.

2.3 Statistical Analysis

Data were analyzed using SPSS version 22. Multiple linear regression was used to identify the ATB, SN, PBC variables contribution to Iintention. Simple linear regression was used to determine the effect of intention on medication adherence, and the direct effect of PBC on medication adherence. Confounding variables in this study were gender, education, occupation, and age. The specified significance level was $p < 0.05$.

3 RESULTS

Socio demographic characteristics in table 1 showed a total of 104 respondents in this study gave a response of 100%. The average age of respondents was 43.65 years. More than half of respondents (54.8%) were male. A total of 63.3% of respondents had graduated from elementary school, 29.8% graduated from high school, and 1.9% graduated from college. Most respondents (71.2%) work as private employees, 3.8% of civil servants, 1.9% police/military, and 23.1% were not employed.

Table 1: Predicting medication adherence from demographic characteristics (n = 104).

	Frequency	(%)	Mean	SD	Sig.
Age			43.65	14.47	.011
Gender:					.989
Male	57	54.8			
Female	47	45.2			
Education					.000
Elementary school	71	68.3			
High school	31	29.8			
College	2	1.9			
Occupation					.004
Civil servants	4	3.8			
Private employees	74	71.2			
Police/military	2	1.9			
Not employed	24	23.1			

Table 2: Medication adherence of TB patiens (n = 104).

Item	No (f)	(%)	Yes (f)	(%)
1. Do you sometimes forget to take your pills?	100	96.2	4	3.8
2. Over the past 2 weeks, were there any days when you did not take your medicine?	102	98.1	2	1.9
3. Have you ever cut back or stopped taking your medication without telling your doctor because you felt worse when you took it?	83	79.8	21	20.2
4. When you travel or leave home, do you sometimes forget to bring along your medications?	7	6.7	97	93.3
5. Taking medication everyday is a real inconvenience for some people. Do you ever feel hassled about sticking to your treatment plan?	6	5.8	98	94.2
6. When you feel better, do you sometimes stop taking your medicine?	5	4.8	99	95.2
7. Did you take your medicine yesterday?	0	0	104	100
8. How often do you have difficulty remembering to take all your medication?	18	17.3	86	82.7

Table 3: Frequency distribution of TPB construct.

TPB Construct	Mean	Median	SD	Range of Possible Score
Attitude toward behavioral.	98.65	93	31.11	5 – 245
Subjective norm.	103.05	100	28.74	5 – 245
Perceived behavior control.	137.42	135	21.18	5 – 245
Intention.	44.65	44	5.77	7 – 70
Behavior (medication adherence of TB patients).	4.09	4	.93	0 – 8

Table 4: Predicting intention from ATB, SN, and PBC.

	R Square	B	Sig.
Attitude toward behavioral, subjective norm, and percieved behavior control (simultaneously).	.965		.000
Attitude toward behavioral.		.041	.020
Subjective norm.		.074	.000
Perceived behavior control.		.110	.000

*Dependent variable: Intention.

Pearson correlation analysis showed that there was no significant relationship between gender with medication adherence (p = 0.989), while age, education status, and occupation were closely related to medication adherence: age (p = 0.011), education status (p = 0.00), occupation (p = 0.004).

Table 5: Predicting medication adherence from intention and direct from PBC.

	R Square	B	Sig.
Intention.	.975	.160	.000
Perceived behavior control.	.977	.044	.000

*Dependent variable: Medication adherence of TB patients.

The mean score of medication adherence as showed in table 2 was 4.09 (SD = 0.93) (range of possible score = 0-8). According to the results of the questionnaire analysis, 4 respondents (3.8%) sometimes had forgotten to take their medicine. 2 respondents (1.9%) sometimes had not taken the drug in the last 2 weeks.

Twenty one respondents (20.2%) had not taken the medicine without telling the doctor because their condition became worse after taking the medicine. 97 respondents (93.3%) sometimes forgot to bring medicine while traveling. 98 respondents (94.2%) feel disturbed or uncomfortable having to take medicine every day for a long time. 99 respondents (95.2%) had the desire to stop taking the medication

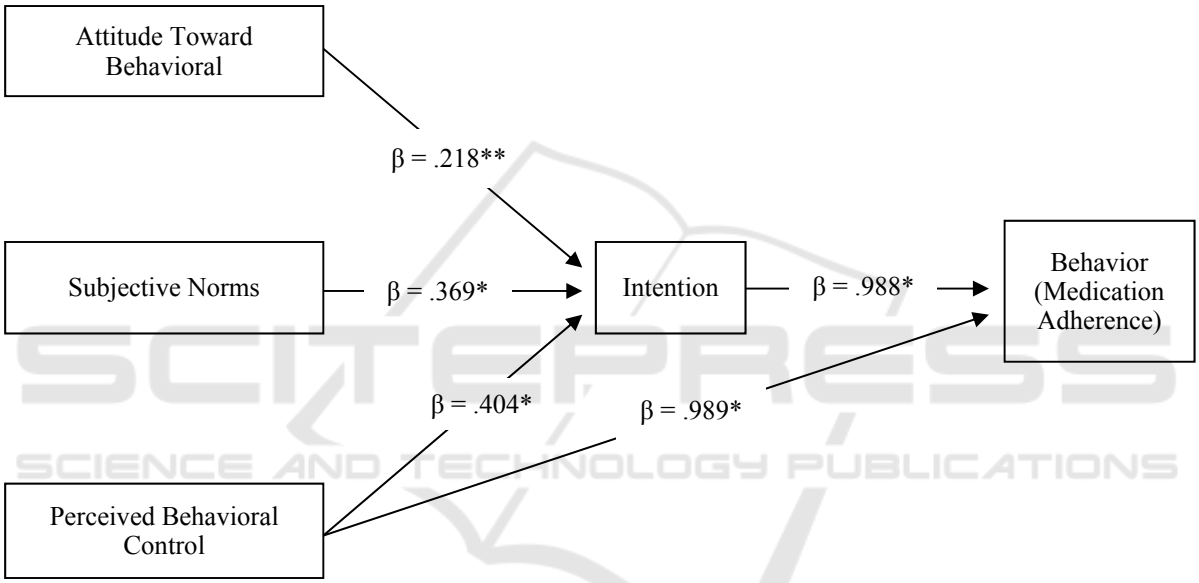
if they was already healed. The day before filling out the questionnaire, all the respondents (100%) took their medicine. 86 respondents (82.7%) had difficulties in remembering that they should take all TB medication.

The effect of ATB, SN, and PBC on intention: The mean of each variable was 98.65 (SD = 31.11) for ATB variables (range of possible score = 5-245), 103.05 (SD = 28.74) for SN variable (range of possible score = 5-245), 137.42 (SD = 21.18) for PBC variable (rang of possible score = 5-245), 44.65 (SD = 5.77) for intention variables (range of possible score = 7-70).

Multiple linear regression analysis showed that ATB, SN, and PBC were simultaneously significant in predicting intention (p = 0.00) (R Square = 0.96), when viewed from the significance level separately were (p = 0.02) for ATB, (p = 0.00) for SN, and (p = 0.00) for PBC.

The effect of intention on medication adherence: **S**imple linear regression analysis showed that intention significantly affected medication adherence (p = 0.00) with (R Square = 0.97).

The direct relationship between PBC with medication adherence: **S**imple linear regression analysis showed that PBC significantly affected medication adherence (p = 0.00) with (R Square = 0.98).



Notes: Statistics reported next to arrows are standardized regression coefficients
*ρ < 0.001 ; **ρ < 0.05

Figure 2. Extended TPB construct to predict medication adherence

4 DISCUSSION

Based on this study result, the mean score was 4.09 in the medication adherence of TB patients (range of possible score 0 - 8), it has been known that medication adherence has an important role to prevent transmission, death from TB, recurrence and drug resistance (Addisu *et al.*, 2014). The analysis of questionnaire in this study showed that 94.2% of respondents feel disturbed and uncomfortable with treatment program of TB that requires them to take their medication every day for a long time, perhaps because of the lack of social and psychological support from their family and their nearest person as documented in some previous research.A study in South Africa showed that good social support can improve adherence in TB patients (Akeju, Wright and Maja, 2017). Social and psychological interventions should be optimized to improve medication adherence in TB patients (Yan *et al.*, 2017). Good medication adherence can be achieved by utilizing social influences through education in family members about how to support medication adherence to their family (Kopelowicz *et al.*, 2015).

In this study, socio-demographic factors (such as age, education, and occupation) were correlated with medication adherence, but not by gender. It is also reported in a study that the social situation of each individual can affect medication adherence in TB patients (Akeju, Wright and Maja, 2017). In addition to adequate treatment, treatment of TB patients should pay attention to specific mental and social needs (Kastien-Hilka *et al.*, 2017). Psychosocial treatment and other interventions need to be done in difficult patients (Priwitzer, 2018), and also the interventions should focus on improving social and family function (Yin *et al.*, 2018).

The aim of this study was to identify factors that affect the medication adherence of TB patients based on Theory of Planned Behavior. The results of the study showed that the main factors of TPB (such as ATB, SN, and PBC) explain more than 96% of the other studies have also suggested that TPB became positive determinant factor related to adherence (Wu and Liu, 2016), TPB was also helpful to investigate factors underlying medication adherence (Bérubé *et al.*, 2017), so that TPB can be used as powerful tool to predict intention and medication adherence (Zomahoun *et al.*, 2016).

This study has limitations because it only measures medication adherence and does not measure prevention of transmission and nutritional compliance, for the further research it is advisable to measure these variables because considering the importance of prevention of transmission and nutritional compliance in the case of tuberculosis.

5 CONCLUSIONS

Based on the discussion above, it can be concluded that medication adherence of TB patients in respondents was at low level. Socio-demographic and constructive factors of TPB can affect the medication adherence of TB patients, there was also a direct relationship of PBC with medication adherence without intention. This study helps health professionals and researchers in understanding the medication adherence of TB patients using TPB. This study supports an investigation about the factors underlying medication adherence on a larger scale, as well as the identification of targets in designing future interventions.

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