

The Influence of the Adherence Improvement Model Based on King's Interaction System Theory towards Pulmonary Tuberculosis Patients

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Abstract-Background: Indonesia is one of country with the largest incidence of tuberculosis (TB) in the world. Adherence to treatment is a significant problem to be managed. Therefore, there needs to be an intervention model that focuses on the interaction between the nurse and the patient.

Purpose: The purpose of this study was to analyze the influence of an Adherence Improvement Model (AIM) on pulmonary TB patients in Indonesia.

Methods: The study used pre-test, post-test quasi-experimental design to compared several factors related to treatment adherence over a six month period in 2013. The intervention group (n=50) consisted of pulmonary TB patients from one hospital in Surabaya, while the comparison group (n=50) consisted of pulmonary TB patients from a regional public hospital in East Java.

Results: Results showed that in the intervention group, there were significant improvements in knowledge about the disease and its treatment, motivation to continue with the medications, and treatment adherence when compared to the comparison group.

Conclusion: In conclusion an improvement in treatment adherence in patients with pulmonary TB can be achieved by implementing the Adherence Improvement Model (AIM).

Keyword: adherence improvement model, pulmonary tuberculosis, king's interaction system theory

approximately 80% of the new TB cases in the world each year [2].

In Indonesia, it is estimated that the prevalence of TB is 600,000, or equivalent to 281 per 100.000 people. In addition, it as also been estimated that the incidence of new cases each year is 450,000, or equivalent to 187 new cases per 100,000 people. The overall, the annual death rate from TB approaches 65,000. Given the large numbers of people who contract and die of TB each year, those who are successfully treated is now more than 90%^[2]. The challenge however is to reach 100% and although Indonesia has reached the target goals set by WHO, treatment adherence is still below average. The tendency is for patients to stop their treatment once their symptoms lessen within 2-4 weeks of commencing treatment. Consequently, further deterioration of their condition is likely if not supported by comprehensive care involving stakeholders and an effective care model for pulmonary TB patients.

Nurses have an important role in facilitating continued therapy and shaping constructive behaviors in patients with TB so that these patients are motivated to adhere to treatment. However, research has found that health education conducted by nurses was less optimal in improving patients' adherence to treatment. Therefore, a new approach that focuses on nurse-patient interaction system is needed. The Adherence Improvement Model (AIM) can be used to improve nurse-patient interaction thus patients' adherence to improved treatment.

I. INTRODUCTION

Globally, Tuberculosis (TB) is one of priorities in disease control because it broadly affects a person's quality of life, their ability to work, the county's economy and it also causes death. According to the Indonesian Ministry of Health (2010), the prevalence of pulmonary TB in 2009/2010 was 725 people per100,000, with the highest number of cases occurring in men, with the average aged of 54 years who; live in rural areas, are uneducated and belong to a farmer/fisherman/laborer group ^[1].

In 2011, the World Health Organization (WHO) estimated that there were 8.7 million new cases of TB globally; equivalent to be 125 cases per 100,000 populations. Most of these cases occurred in Asia (59%) and Africa (26%). WHO declared 22 countries in the world as high TB burden countries. Countries such as Chine, India and South Africa, have 63% of the world's population and they contribute to

II. METHODS

The study used a quasi-experimental design with pre-post test control group design. The intervention group was pulmonary TB patients in a Surabaya Hospital and the comparison group was pulmonary TB patients in a regional public hospital in East Java Both the intervention group and the comparison group contained 50 people. A Consecutive sampling method was used. The intervention group was given information on an AIM. This model contains an intervention guide for nursing procedures based on the personal system, interpersonal system, and patients' social system.

The intervention group received one booklet containing information on TB to be used over the duration of the study. In addition, the researcher (TS) was used the AIM as a guide in her interactions with patients. The researcher met with the patients eight times at baseline when the patient was newly diagnosed with pulmonary TB, and again at week two,

four, six, eight, 12, 16 and finally in week 20. These meeting coincided with the scheduled appointment at the hospital outpatient department.

Measurements were taken at the baseline (pre test), at end of the second month of TB treatment (post test 1) and finally at end of fifth month the treatment (post test 2) to determine differences in disease knowledge, motivation and treatment adherence. The Questionnaire was developed by the researchers and has been tested for validity and reliability. The Questionnaire consisted of Yes. No responses and several Likert scales.

The statistical tests used Chi square, independent t-test and general linear model-repeated measured (GLM-RM).

III. RESULTS

Table 1 Knowledge of Pulmonary TB Patients before and after Intervention of Adherence Improvement Model based on King’s Interaction System Theory (n=97)

Variable	Intervention (n=50)			Control (n=47)			T test	R2
	Mean	Median	95%CI	Mean	Median	95%CI		
Knowledge								
Pre test	51.75	50	47.91-53.8	48.80	50	46.34-54.27	P=.607	
Post test 1	88.25	87.5	84.28-92.21	65.42	62.5	61.33-69.51	P<.001***	.400
Post test 2	94.00	100	90.37-97.63	67.28	75	63.54-71.03	P<.001***	.521

Table 1 showed that there was knowledge difference among measurements (before, after 2 months, and after 5 months intervention) between intervention and control group (p<.001).

Table 2 Self efficacy of pulmonary TB patients before and after intervention of adherence improvement model based on King’s interaction system theory (n=97)

Variable	Intervention (n=50)			Control (n=47)			T test	R2
	Mean	Median	95%CI	Mean	Median	95%CI		
Self efficacy								
Pre test	29.78	30.5	28.92-30.63	30	30	29.20-30.96	P=.623	
Post test 1	44.46	44	43.71-45.20	38	38	36.61-38.15	P<.001**	.646
Post test 2	49.06	50	48.63-49.48	46	46	46.35-47.28	P<.001**	.364

Table 2 showed that there was difference in self efficacy among measurements (before, after 2 months, and after 5 months intervention) between intervention and control group (p<.001).

Table 3 Motivation of pulmonary TB patients before and after intervention of adherence improvement model based on King’s interaction system theory (n=97)

Variable	Intervention (n=50)			Control (n=47)			T test	R2
	Mean	Median	95%CI	Mean	Median	95%CI		
Motivation								
Pre test	32.08	33	31.21-32.95	32.04	32	31.20-33.00	P=.976	
Post test 1	45.26	45	44.54-45.97	37.98	38	37.24-38.71	P<.001***	.675
Post test 2	47.28	47	46.61-47.94	36.13	35	35.44-36.81	P<.001***	.860

Table 3 showed that there was significant difference in motivation among measurements (before, after 2 months, and after 5 months intervention) between intervention and comparison group (p<.001) with 52.4% of power.

Table 4 Prevention of transmission of pulmonary TB patients before and after intervention of adherence improvement model based on King’s interaction system theory (n=97)

Variable	Intervention (n=50)			Control (n=47)			T test	R2
	Mean	Median	95%CI	Mean	Median	95%CI		
Prevention of transmission								
Pre test	24.80	25	24.30-25.29	24.16	24	23.68-24.70	P=.093	
Post test 1	45.28	45	44.58-45.98	37.74	38	37.02-38.47	P<.001***	.699
Post test 2	49.12	50	48.38-49.85	41.60	40	40.84-42.35	P<.001***	.679

Table 4 showed that there was difference in prevention of transmission among measurements (before, after 2 months, and after 5 months intervention) between intervention and control group (p<.001).

Table 5 Treatment adherence of intervention and control group (n=97)

No	Variable	Intervention (n=50)		Control (n=47)		X ²
		n	%	n	%	
1	Method					P=.001***
	One time	0	0	36	76.6	
	Several time	50	100	11	23.4	
	Dosage					P=1
2	Appropriate	50	100	47	100	
	Inappropriate	0	0	0	0	
3	Time					P=.005***
	Before meal	50	100	40	85.1	
	After meal	0	0	7	14.9	
	Adherence					P=.242
4	Adhere	50	100	44	94	
	Drop out	0	0	3	6	

Table 5 showed significant difference in anti-TB drugs consumption at each group after 2 months intervention (p=.001). In the intervention group, all respondents (100%) were taking anti-TB drugs in one time, whereas the other group shows 11 respondents (23.4%) were taking anti-TB drugs in several times (morning, noon, and night). There was no significant difference in dosage in the intervention and control group which means all respondents were taking drugs as prescribed. Despite, there was time difference in taking drugs between two groups after 2 months intervention (p=.005). After 2 months intervention, all respondents in the intervention group were taking anti-TB drugs 1 hour before meal. On the contrary, 7 respondents (14.9%) in the control group taking anti-TB drugs after meal. At the end of the intervention (after 5 months), there was no significant difference in treatment adherence at each group. It was reported that there was no dropped out respondents from the intervention group while 3 respondents (6%) from control group were dropped out the treatment.

IV. DISCUSSION

Influence of adherence improvement model based on King's interaction system theory toward knowledge of pulmonary TB patients

The results of this study showed more significant increase inter-measurements before intervention and at end of 2nd month interventions (58.1%) compared to at end of 2nd month toward 5th month intervention (1.3%). The influence could be achieved by improving patients' personal system and growing correct pulmonary TB perception through appropriate learning about pulmonary TB. By first 2 months regular intervention, patients could acquire knowledge, discussed, and shared experiences about pulmonary TB all at once. The intervention could be implemented by nurse-patients interaction when patients visited polyclinic's pulmonary for routine control one time per 2 weeks. Finally, patients found new perspectives about pulmonary TB.

This present study is in accordance with Aini, Fatmaningrum, and Yusuf (2011) and Sekarsari (2013) that reported patients' knowledge tended to increase when they received education [3][4]. Knowledge is defined as behaviors, information and skills gained by a person through observation, education or experience. Therefore, knowledge is influenced by learning. In this study, pulmonary TB patients who underwent treatment received education which resulted in improvement in learning about pulmonary TB concepts.

According to Rogers (1974) as written at Notoatmodjo (2003), behavior based on knowledge will be more lasting than behavior not based on knowledge [5]. In this model, knowledge improvement is needed as a foundation to improve patients' behavior towards treatment adherence.

Influence of adherence improvement model based on King's interaction system theory toward self efficacy of pulmonary TB patients

The results of the present study showed that in the intervention group there were significant increases inter-measurements before intervention toward end of 2nd month intervention (47.5%) and between measurements at end of 2nd month and 5th month interventions (52.6 %). Measurements at end of 2nd month toward 5th month intervention had more power than measurements before intervention toward end of 2nd month intervention. Such results might have probability related to patients' belief that fluctuated during intervention; therefore continuous intervention was needed until the end of month 5 intervention.

Focused on self awareness improvement to heal, pulmonary TB patients were given patients' role model that adhere to treatment and recovered from pulmonary TB. It aims to grow patients' belief that they are able to adhere to treatment in order to heal. By doing that, in accordance with Bandura's opinion (1994) that mentioned above, one of the factor that influence self efficacy of person is vicarious experience, means somebody learns from experience of somebody else and imitates their behavior to gain what others

gained [6]. Self efficacy will improve if somebody observes the success of somebody else. On the contrary, self efficacy will decrease if person observes failure from somebody else that has same capability.

This study supports Muhtar (2013) which explained that patients with family empowerment have higher self efficacy [7]. In adherence improvement model based on King's interaction system theory, patients received intervention to improve communication with family. Patients with good communication and support from family will improve self efficacy, thus they feel convinced to adhere to treatment until get recovered.

Hendiani, Sakti, and Widayanti (2012) explained that patients with positive perception about family support as drugs consumption controller (PMO), have higher self efficacy [8]. On the other hand, Hidayati (2012) explained that patients with good self management, their self efficacy improved [9].

Influence of adherence improvement model based on King's interaction system theory toward motivation of pulmonary TB patients

The results of this study indicated more significance increase between before intervention toward end of 2nd month interventions (54.4%) than between end of 2nd month and 5th month interventions (24.3 %). An influence toward motivation can be reached by improving personal and interpersonal system, as good as toward self efficacy. Interventions that need to be given to patients were improving self awareness to heal, optimizing patients' developmental task, growing positive self image, optimizing role during ill, improving communication among patients, family, and health care personnel, helping patients balance stress, and improving coping ability of patients.

The model was equipped with 1 booklet to facilitate patients understanding what and how pulmonary TB was, and also what they must do to motivate them adhere to treatment. The result of this study was in accordance with Kamil, Ibnu, and Rachman (2013) which found that printed media for communication, information, and education (CIE) has positive effect in motivating patients adhere to treatments [10].

Sutarno and Utama (2012) discovered that social support from family and health care personnel about knowledge and perception of pulmonary TB, gave positive effect toward patients' motivation to adhere to treatment [11]. Nurse always involves patients' family during intervention particularly to improve interpersonal system of patients by improving communication among patients, family, nurses, and doctors.

Influence of adherence improvement model based on King's interaction system theory toward prevention of transmission of pulmonary TB patients

This study showed there was significant difference in prevention of transmission at each group at end of 2nd month and 5th month after the intervention of adherence improvement model based on King's interaction system theory. The

influence toward prevention of transmission could be attained by improving patients' personal system through learning about healthy environment and how to prevent the transmission of pulmonary TB.

This study supports Asih, Suryanto, and Munir (2014) that focused on description of pulmonary TB patients' behavior toward the prevention effort of pulmonary TB disease transmission to patients who medically treated in polyclinic's pulmonary. The results of their study were 43.5% of patients had good knowledge, 70.4% had good attitude, and 46.1% had good behavior in effort to prevent the transmission [12]. Intervention of King's model provides appropriate learning model to improve behavior about prevention of transmission.

Another supporting study was Fatimah (2008) that discovered relationship among incidents of pulmonary TB with lighting, ventilation, opened window, humidity, temperature, variation of wall, and nutrition status [13]. Poor environment increases transmission risk that leads to increasing of incident rate of pulmonary TB. At the intervention of adherence improvement model based on King's interaction system theory, patients were provided by learning and were stimulated to discuss about healthy environment to prevent the transmission. Patients were asked to widely open the windows everyday that enabling sun light and fresh air coming inside to the house and were asked to make glass roofs. Lasts, nurses also taught patients to keep the house clean.

Influence of adherence improvement model based on King's interaction system theory toward treatment adherence of pulmonary TB patients

The results at end of 2nd month intervention of adherence improvement based on King's interaction system theory reveal there was significant difference in method (one and several times) and time (before and after meal) of daily intake of anti-TB drugs between intervention and control group. Nevertheless, there was no significant difference in dosage of anti-TB drugs between two groups. At the end of the intervention, there were no significant differences that discovered on method, dosage, and time of anti-TB drugs consumption between two groups. Finally, after 5 months intervention, it was observed that there was no significant difference about treatment adherence at each group. It was noted that 3 respondents (6%) from control group were dropped out the treatment while the other group does not.

The results of this study are in accordance with Hutapea (2009) which found an effect of family support toward regularity and method of daily intake of anti-TB drugs. The data shows 69.4% respondents taking anti-TB drugs everyday while 72.7% respondents did it all at once [14]. In adherence improvement model based on King's interaction system theory, one of the aspects that focused on family support improvement was improving interaction and communication between patients and their family.

The results showed significant difference in method and time of taking anti-TB drugs between two groups at the

end of month 2 of the treatment. This result was related to the intervention learning about time of taking anti-TB drugs and pulmonary TB treatment. Also, as a part of the intervention, patients were asked to practice the right method of taking anti-TB drugs in front of nurses, thus they will always remember and take anti-TB drugs unhesitatingly. The result of the test shows no significant difference in dosage at each group. It most likely happened because patients at each group had already understood the drug's dosage as clearly written at the prescription.

At the end of 5th month the treatment, there were no significant differences among method, dosage, time, and treatment adherence between intervention and control group. It may have possibility that control group already known the information from health care personnel (doctor, nurse, and pharmacist), other patients, and internet. From the result of treatment adherence (dropped out patients during treatment), it shows only 6% respondents who dropped out the treatment which means statistically insignificant, but theoretically it might have significant impact to causes larger effect such as TB transmission and multidrug-resistant that complicates the treatment and reduce patients' quality life.

The results support the study conducted by Pramonodjati (2010) that discovered tuberculosis learning to patients gave 13% of contribution toward treatment adherence and recovery level of pulmonary TB patients [15]. It has similarity with the present study which focused on intervention model of adherence improvement based on King's interaction system theory. The similarity is how to improve patients' personal system through learning about concept and treatment of pulmonary TB.

V. CONCLUSION

Adherence of pulmonary TB patients can be achieved by improving personal, interpersonal, and social system of patients. In conclusion an improvement in treatment adherence in patients with pulmonary TB can be achieved by implementing the Adherence Improvement Model (AIM).

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