CHAPTER 4

Results and Discussion

This chapter presents the study results of a randomized controlled trial that aimed to examine the effects of the Medication Adherence Enhancement Program on medication adherence and treatment success among newly diagnosed PTB patients. Discussion of the finding is also presented in the last part of the chapter. The results of the study are presented in three parts; demographic characteristics of the participants; effect of Medication Adherence Enhancement Program on medication adherence; and effect of Medication Adherence Enhancement Program on treatment success

4.1 Results of the study

4.1.1 Demographic characteristics of the participants

In the control group, the age of participants ranged from 21 to 58 years with a median age of 40 years. The majority of them were male (68.0%) and less than half of them were married (48.0%). About 52.0% of them completed primary school and 68.0% were employed. The participants had a monthly income ranged from 1,000 to 50,000 baht with a median monthly income of 9,000 baht, two participants (8.0%) had a monthly income less than the poverty line of Thailand in 2011 (2,422 baht per person per month) (Office of the National Economic and Social Development Board, 2013), and five participants (20.0%) had a monthly income ≤ 5,000 baht. However, most of them reported that these were sufficient for their use (96.0%). The majority of them had national health care that was responsible for the health expenditure (64.0%). About 76.0% of them had 1-3 persons in their family and 48.0% had their spouse as their family supporter (Table 4.1).

In the intervention group, the age of participants ranged from 23 to 54 years with a median age of 42 years. The majority of them were male (68.0%) and married

(76.0%). About 56.0% of them completed primary school and 68.0% were employed. The participants had a monthly income ranged from 2,000 to 30,000 baht with a median monthly income of 7,500 baht, only one participant (4.0%) had a monthly income less than the poverty line of Thailand in 2011 (2,422 baht per person per month) (Office of the National Economic and Social Development Board, 2013), and five participants (20.0%) had a monthly income ≤ 5,000 baht. However, all of them reported that these were sufficient for their use. Most of them had national health care that was responsible for the health expenditure (76.0%). About 60.0% of them had 1-3 persons in their family and 52.0% had their spouse as their family supporter (Table 4.1).

There were no significant differences between the control and intervention groups in terms of age, gender, marital status, educational level, occupation, monthly income, sufficient of income, health service expenditure, number of family member, and family supporter (Table 4.1)

Table 4.1 Demographic Characteristics of the Participants in the Control and Intervention Groups

Demographic characteristics	Control group (n = 25)		Intervention group (n = 25)		χ^2	p-value/ Fisher's exact
	n	%	n	%		
Age (year)						
20-40	13	52.0	12	48.0	.080	.777
41-59	12	48.0	13	52.0		
Median(Range)	40(21-58)		42(23-54)			
Gender						
Male	17	68.0	17	68.0	.000	1.000
Female	8	32.0	8	32.0		
Marital status						
Married	12	48.0	19	76.0		.131
Single	8	32.0	3	12.0		
Divorced/ separated	5	20.0	3	12.0		
Educational level						
Primary school	13	52.0	14	56.0	5.310	.070
Secondary school	3	12.0	8	32.0		
College/ university	9	36.0	3	12.0		
Occupation						
Employee	17	68.0	17	68.0		.491
Merchant	5	20.0	3	12.0		
Farmer	1	4.0	1	4.0		
Student	2	8.0	1	4.0		
Own business	0	0.0	3	12.0		

Table 4.1 (Continued)

Demographic characteristics	Control group (n = 25)		Intervention group (n = 25)		χ^2	p-value/ Fisher's exact
	n	%	n	%		
Monthly income (baht)						
≤ 2,400	2	8.0	1	4.0		.638
2,401-5,000	3	12.0	4	16.0		
5,001-7,500	4	16.0	8	32.0		
7,501-10,000	9	36.0	8	32.0		
> 10,000	7	28.0	4	16.0		
Median(Range)	9,000 (1,000-50,000)		7,500 (2,000-30,000)			
Sufficiency of income						
Sufficient	24	96.0	25	100.0		1.000
Insufficient	1	4.0	0	0.0		
Health service expenditure						
National health care	16	64.0	19	76.0		.345
Social insurance	9	36.0	5	20.0		
Government paid	0	0.0	1	4.0		
Number of family member						
1-3	19	76.0	15	60.0		.486
4-6	5	20.0	7	28.0		
7-9	1	4.0	3	12.0		
Family supporter						
Spouse	12	48.0	13	52.0		.171
Son/daughter	3	12.0	1	4.0		
Sister/brother	3	12.0	0	0.0		
Cousin	2	8.0	1	4.0		
Mather/father	3	12.0	9	36.0		
Girlfriend/ boyfriend	1	4.0	0	0.0		
Nephew/niece	1	4.0	1	4.0		

The majority of the participants in the control group reported that they currently consumed alcohol (64.0%) and more than half of them currently smoked (52.0%). Most

of them reported not ever having had a co-morbidity disease (64.0%) or took other drugs during TB treatment (72.0%). Most of them reported not ever having had a drug allergy (96.0%) (Table 4.2).

Less than half of participants in the intervention group reported current consuming alcohol (48.0%) and more than half of them currently smoked (56.0%). Most of them reported not ever having had a co-morbidity disease (80.0%), took other drugs during TB treatment (84.0%) or had drug allergy (88.0%) (Table 4.2).

There was no significant difference between the control and intervention groups in terms of alcohol-consumption, smoking, co-morbidity, other drugs taking, and history of drug allergy (Table 4.2).

Table 4.2 Clinical Characteristics of the Participants in the Control and Intervention Groups

Clinical characteristics	Control group (n = 25)		Intervention group (n = 25)		χ^2	p-value/ Fisher's exact
	n	%	n	%		
Alcohol-consumption						
Never consumed	6	24.0	6	24.0	2.171	.338
Consumed in the past	3	12.0	7	28.0		
Currently consumed	16	64.0	12	48.0		
Smoking						
Never smoked	6	24.0	9	36.0		.305
Smoked in the past	6	24.0	2	8.0		
Currently smoked	13	52.0	14	56.0		
Co-morbidity						
Yes	9	36.0	5	20.0	1.587	.208
Hypertension	3	12.0	1	4.0		
Diabetes mellitus	3	12.0	1	4.0		
Cirrhosis	0	0.0	1	4.0		
Allergy	1	4.0	1	4.0		
Hyperthyroid	1	4.0	0	0.0		
CHF*	0	0.0	1	4.0		
COPD**	1	4.0	0	0.0		
No	16	64.0	20	80.0		
Other drugs taking*** for treat co-morbidity						
Yes	7	28.0	4	16.0	1.049	.306
No	18	72.0	21	84.0		
History of drug allergy						
Yes	1	4.0	3	12.0		.609
No	24	96.0	22	88.0		

Note. * = Congestive heart failure
** = Chronic obstructive pulmonary disease
*** = Such as antihypertensive drugs, diabetes mellitus drugs, anti-thyroid agent, warfarin, propranolol, spironolactone, furozemide

All of the participants in both groups received Bacillus Calmette-Guerin (BCG) vaccine and cough was the most common symptom of PTB among the participants. The second most common symptom of PTB among the participants was weight loss. The majority of sputum examination result at baseline of the participants in the control group was 3+ (44.0%) and that in the intervention group was 2+ (40.0%). Most of participants, 72.0% in both control and intervention groups took TB medicine 3-4 tablets per time in the intensive phase, 52.0% in the control group and 68.0% in the intervention group took 4-5 tablets per time in the continuous phase. Most of them, 64.0% in the control group and 84.0% in the intervention group reported that they had TB drugs side effects. The most common TB drugs side-effect in the control group was muscle or joint pain (24.0%), whereas in the intervention group it was skin itching without rash (32.0%). Most of them, 68.0% in the control group and 72.0% in the intervention group reported not ever getting a home visit by another health care worker (Table 4.3).

The results indicated there were no significant differences between the control and intervention groups in terms of BCG vaccination, symptoms and signs of PTB, sputum examination result at baseline, number of TB medicine taking per time in the intensive and continuation phases, TB drugs side effects, and home visiting by other health care worker (Table 4.3).

Table 4.3 PTB-related Characteristics of the Participants in the Control and Intervention Groups

PTB-related characteristics	Control group (n = 25)		Intervention group (n = 25)		χ^2	p-value/ Fisher's exact
	n	%	n	%		
Received BCG vaccine						
Yes	25	100.0	25	100.0		-
No	0	0.0	0	0.0		
Symptoms and signs of PTB*						
Cough	25	100.0	25	100.0		-
Weight loss	20	80.0	23	92.0		.417
Fever	13	52.0	17	68.0	1.333	.248
Retrosternal pain	15	60.0	12	48.0	.725	.395
Tired	18	72.0	13	52.0	2.122	.145
Hemoptysis	4	8.0	6	24.0	.500	.480
Sputum examination** result at baseline						
1+	8	32.0	7	28.0	1.540	.463
2+	6	24.0	10	40.0		
3+	11	44.0	8	32.0		
Number of medicine tablets in intensive phase						
3-4	18	72.0	18	72.0	.000	1.000
8-11	7	28.0	7	28.0		
Number of medicine tablets in continuous phase						
2-3	12	48.0	8	32.0	1.333	.248
4-5	13	52.0	17	68.0		

Note. * = Some patients had more than one item of symptoms and signs of PTB
** = The result of one specimen contained the highest number of AFB bacilli

Table 4.3 (Continued)

PTB-related characteristics	Control group (n = 25) n	%	Intervention group (n = 25) n	%	χ^2	p-value/ Fisher's exact
TB drug side-effects*						
Yes	16	64.0	21	84.0	2.599	.107
Skin itching without rash	4	16.0	8	32.0	1.754	.185
Muscle/joint pain	6	24.0	5	20.0	.117	.733
Skin itching with rash	4	16.0	5	20.0		1.000
Nausea/vomiting	2	8.0	6	24.0		.247
Peripheral neuropathy	2	8.0	2	8.0		1.000
Abdominal pain	1	4.0	1	4.0		1.000
Others**	3	12.0	6	24.0		.463
No	9	36.0	4	16.0		
Home visiting by other health care worker						
Yes	8	32.0	7	28.0	.095	.758
1-5 times	4	16.0	5	20.0		
6-10 times	2	8.0	2	8.0		
> 10 times	2	8.0	0	0.0		
No	17	68.0	18	72.0		

Note. * = Some patients had more than one item of TB drug side-effects
** = Such as headache, anorexia, influenza- like syndrome, insomnia

4.1.2 Effect of Medication Adherence Enhancement Program on medication adherence

After entering the program for three months, the mean score of medication adherence in the control group was 3.92 (SD±1.11) while in the intervention group, the mean score of that was 4.84 (SD±.47). At the 6th month after entering the program, the mean score of medication adherence in the control group was 4.12 (SD±1.58) while in the intervention group, the mean score of that was 4.80 (SD±.50). The results showed that at the 3rd month after entering the program, the medication adherence in the intervention groups was significantly higher than those in the control group at the level of .001, whereas, there was no significant difference of that at the 6th month after entering the program between groups (Table 4.4).

In addition, the results indicated that at the 3rd month after entering the program, the percentage of participants in the control group who took the right medicine, the right amount of medicine, the right dose, at the correct time, and continuously taking medication were 100.0%, 96.0%, 68.0%, 60.0%, and 68.0%, respectively while in the intervention group, the percentage of participants were 100.0%, 100.0%, 96.0%, 92.0%, and 96.0%, respectively. At the 6th month after entering the program, the percentage of participants in the control group who took the right medicine, the right amount of medicine, the right dose, at the correct time, and continuously taking medication were 92.0%, 92.0%, 80.0%, 68.0%, and 80.0%, respectively while in the intervention group, the percentage of participants were 100.0%, 100.0%, 96.0%, 88.0%, and 96.0%, respectively. The results showed that at the 3rd month after entering the program, the medication adherence subscales of right dose, correct time, and continuously taking medication in the intervention groups were significantly higher than those in the control group at the level of .05, .01, and .05, respectively whereas, there was no significant difference of all subscales of medication adherence, right medication, right amount of medicine, right dose, correct time, and continuously taking medication between groups at the 6th month after entering the program (Table 4.5).

Table 4.4 Comparison of Medication Adherence of the Participants between the Intervention and Control Groups by Mann-Whitney U test

Medication adherence	Control group (n=25) Median (Mean±SD)	Intervention group (n=25) Median (Mean±SD)	Z	p-value
At the 3rd month after entering the program	4(3.92±1.11)	5(4.84±.47)	-3.552	.000
At the 6thmonth after entering the program	5(4.12±1.58)	5(4.80±.50)	-1.518	.129

Table 4.5 Comparison of Medication Adherence Subscales of the Participants between the Intervention and Control Groups

Medication adherence	Control group (n=25)		Intervention group (n=25)		χ^2	p-value/ Fisher's exact
	n	%	n	%		
At the 3rd month after entering the program						
Right medicine	25	100.0	25	100.0		-
Right amount of medicine	24	96.0	25	100.0		1.000
Right dose	17	68.0	24	96.0		.023
Correct time	15	60.0	23	92.0	7.018	.008
Continuously taking medication	17	68.0	24	96.0		.023
At the 6thmonth after entering the program						
Right medicine	23	92.0	25	100.0		.490
Right amount of medicine	23	92.0	25	100.0		.490
Right dose	20	80.0	24	96.0		.189
Correct time	17	68.0	22	88.0	2.914	.088
Continuously taking medication	20	80.0	24	96.0		.189

4.1.3 Effect of Medication Adherence Enhancement Program on treatment success

The result indicated that at the end of treatment, the percentage of participants in the control group who had treatment success was 96.0% (80.0% cure and 16.0% treatment completed), whereas in the intervention group, there was 100.0% (92.0% cure and 8.0% treatment completed) of the participants who had treatment success. The results showed that there was no significant difference in treatment success between the control and intervention groups (Table 4.6).

Table 4.6 Comparison of Treatment Success of the Participants at the End of Treatment between the Intervention and Control Groups

Treatment success	Control group (n = 25)		Intervention group (n = 25)		Fisher's exact
	n	%	n	%	
Treatment success	24	96.0	25	100.0	1.000
Cure	20	80.0	23	92.0	.417
Treatment completed	4	16.0	2	8.0	.667
Treatment failure	1	4.0	0	0.0	

4.2 Discussion

The study results of the effect of the Medication Adherence Enhancement Program on medication adherence and treatment success among newly diagnosed PTB patients are discussed according to the research hypotheses as follows.

4.2.1 Newly diagnosed PTB patients receiving the Medication Adherence Enhancement Program will have higher medication adherence than those receiving usual care.

Results from the study demonstrated that the newly diagnosed PTB patients who received the Medication Adherence Enhancement Program (intervention group) had a significantly higher medication adherence than those who received usual care (control group) at the 3rd month after entering the program. This finding supported hypothesis

one of the study. The increase of the medication adherence score at the 3rd month after entering the program in the intervention group might be from the activities to enhance self-efficacy for self-regulation of TB medication adherence and providing environmental support by choice of the family supporter and telephone reminder and counseling in the Medication Adherence Enhancement Program.

Mechanisms underlying the improvement of medication adherence in this study could be due in part to the increased self-efficacy for self-regulation of medication adherence in the program. Effective self-regulation depends on feeling self-efficacious for using skills to achieve mastery (Bandura, 1986; 1993). Self-efficacy operates during all three phases of self-regulation; forethought, performance, and self-reflection phases. Skillful self-regulators enter learning situations with specific goals and a strong sense of self-efficacy for attaining them. As they work on tasks, they monitor their performance and compare their attainment with their goals to determine progress. Self-perceptions of progress enhance self-efficacy, motivation, and continued use of effective strategies (Ertmer et al., 1996). During periods of self-reflection, they evaluate their progress and decide whether adaptations in self-regulatory processes are necessary. The latter also sets the stage for modifying goals or setting new ones (Schunk & Ertmer, 2000). High self-efficacy for learning in the forethought phase becomes realized as self-efficacy for continued progress in the performance phase and self-efficacy for achievement in the self-reflection phase. These continuous processes, especially the self-monitoring activities could improve participants' cognitive function (Dick & Lombard, 1997), which are the major factors related to TB medication adherence (Bam et al., 2006; Tipaht, 2008) and promote participants themselves for active solving their problems. These strategies fit for managing multi-factor influencing TB medication adherence.

The sources for raising self-efficacy in this study included mastery experience, vicarious experience or modeling, verbal persuasion, and physiological and emotional arousal (Bandura, 1977; 1986; 1993). The methods for educating the participants in the program included seven sessions for discussion combined with multiple sessions of providing information, feedback, counseling, demonstration and return-demonstration, and practice. During the processes of behavior change, the participants were individually taught to know their tasks, trained how to do and practiced in; set goals;

monitor their behaviors, and signs and symptoms; record their medication taking behaviors, signs and symptoms, and sputum examination results. Also, they were trained how to do and practiced in evaluating their behaviors and clinical outcomes compared with goals, and gave them self-incentive. The appropriate multi-session and effective educational strategies in the program might help the participants to actually perform the goal behaviors and promote mastery experience for them to get high confidence to self-regulate for TB medication adherence. These finding were supported by the previous studies which indicated that effective educational interventions need boosters or multiple sessions because its effect on knowledge declined with time (Devine & Reifschneider, 1995); a median of eight sessions, (Dolder et al., 2003) or six sessions of informational interventions that provided educational counseling over a few sessions could improve medication adherence (Kripalani et al., 2007). The results of this study confirms the facts mentioned that in order to perform a particular behavior, the person must know both what the behavior is and how to perform it, and such skill must be nurtured (Bandura, 1986; 1997).

The other successful patient in performing appropriated self-regulation and medication adherence behaviors was used as role model to enhance patient's self-efficacy in the program. The one session for sharing participant's barriers to change behaviors for adhering TB medication and self-regulating with the modeling, then discussed how to eliminate the barriers and tailored to participant's needs might promote vicarious experience for the participant to get high confidence to self-regulate for TB medication adherence. Additionally, the scenarios of the program mentioned the problem-solving experiences of other TB patients acted as a source of self-efficacy by vicarious experiences. The findings of this study were supported by the study of Chen et al. (2010) indicating that a video presentation provided information on vicarious experiences, and an education booklet mentioned vicarious experiences combined with experience-sharing strategy could improve patients self-efficacy, medication adherence, self-monitoring, and regular follow-up visit behaviors among adult asthmatic patients. In addition, the educational booklet attempts to construct a role model and personified by the heroine combined with counseling and self-monitoring could significantly reduce the risk of patient non-adherence to anti-tuberculosis treatment (Dick, & Lombard, 1997).

The sources of verbal persuasion, and physiological and emotional arousal for raising self-efficacy were conducted during the processes of the program. The early individual approach with a good relationship, after the participant registration in the first session might assist a participant and his or her family supporter in feeling more comfortable responding to the researcher concerns, admitting the problems they were having, and even asking for help. The high quality of communication and information providing might help a participant by modifying attitudes, beliefs, motivation, and influencing positive moods, emotions, or feeling. These strategies including discussion and feedback processes based on good relationships and focused on participant centeredness and problem-solving might promote the participant adherence behavior by strongly positive verbal persuasion and physiological and emotional arousal. These findings were supported by the previous studies indicated that the high quality of relations and communications between health worker and patient and supporter was significantly associated with adherence to TB treatment (Mishra et al., 2006; Peltzer et al., 2002; Salles et al., 2004; Zolnierek & Dimatteo, 2009). Additionally, the individual interventions focus on encouragement, verbal reinforcement, and problem solving was significantly improved medication adherence (Smith et al., 2003).

In addition, some parts of the positive language that posted to facilitate and encourage behavior change in the patient's manual and video presentation, such as "If you need help please contact me by phone" or "I believe that you can do it" acted as the verbal persuasion that might help the participants to gain more self-confidence to perform goal behaviors. These findings were supported by the previous studies indicated that used a video as the primary source of information on verbal persuasion combined with other strategies could improve patients self-efficacy and medication adherence (Chen et al. (2010) and receiving verbal persuasion such as "You are going great" and "You can do it" from others could increase self-efficacy (Shortridge-Baggett, 2001; Chen et al., 2010).

The increased self-efficacy for self-regulation of TB medication adherence among newly diagnosed PTB participants in the intervention group was demonstrated by the quantitative data. The data was obtained at the 4^{th}, 6^{th}, and 8^{th} weeks after entering the program. Mean of overall of self-efficacy for self-regulation of TB

medication adherence were 38.20, 39.32, and 39.80, respectively, and had significantly increased at the 4th to 6th week and 4th to 8th week after entering the program at the level of .05 and .001, respectively (Appendix K; Table 3-5). Bandura (1997; 1986) proposed that self-efficacy is the most important prerequisite for behavior change because it affects both how much effort is invested in a given task and what level of performance is attained. Perceived self-efficacy influences all aspects of behavior, including initiation and cessation. Further perceptions of self-efficacy affect the amount of effort people spend on a task, and the amount of time they will persist at a task while facing obstacles (Bandura, 1977). Therefore, the high self-efficacy for self-regulation of TB medication adherence might help the participants in the intervention group develop their medication adherence behavior more than those in the control group.

The results observed in this study are congruent with the results of some studies in health education activities based on the self-efficacy concept which reported that the activities significantly improved TB patients' knowledge, self-efficacy, outcome expectations, and compliance behaviors or appointments compared with the control group (Boonpendecha, 2001; Chuldeja, 1997; Katmanee, 2004; Suksawat, 2002). The effect size of these interventions on compliance behaviors at the 3rd or 5th month after implementing the program were 0.80 (Chuldeja, 1997), 3.27 (Boonpendecha, 2001), 4.62 (Katmanee, 2004), and 27.80 (Suksawat, 2002). Most of previous studies had higher effect size of intervention than this study (1.16) although this study used interventions based on self-efficacy and self-regulation combination concepts, it might be the effect of other combined interventions such as social support or reminder strategies. However, these previous studies had a limitation in that using weakness design. Many studies demonstrated a strong relationship between self-efficacy and short or long term of medication adherence behavior in other chronic ill patients (Barnason et al., 2010; Chen et al., 2010; Johnson et al., 2006; McCann, Clark, & Lu, 2008; Tuldra et al., 2000). The effect size of the interventions on medication adherence were .15 (Chen et al., 2010) and 1.05 (Barnason et al., 2010) at the 6th week and 3rd month after implementing the program, respectively. Additionally, a social cognitive theory intervention for driving exercise adherence by Wolfe (2008) reported that the effect size of intervention on exercise behaviors were .17 and .14 over the one and three months post-intervention, respectively. Considering, the effect sizes of intervention in these

previous studies, they were lower than those in this study, the reasons that might support this situation were that the interventions in this study were driven with two health behavior concepts or the difference in population and target hehavior of the studies.

Environmental supports used to facilitate the participants' behavior change for adhering TB medication in the program were a choice of family supporter and the telephone reminder and counseling by the researcher. These supports acted as external factors or environmental components that can affect a person's behavior (Bandura, 1986). It's easier for the participants to change behaviors if they perceive the availability of environmental supports during the behavior change processes. Environmental supports during early periods of behavior change and maintenance increases long-term success (Bandura, 2004). These supports might buffer stress and allow an individual to engage in more adaptive sick-role behaviors and take positive action toward adherence. Moreover, they might improve participant adherence through improve cognitive function, self-efficacy, intrinsic motivation, personal control, and confidence (DiMatteo, 2004; Seeman, Lusignolo, Albert, & Berkman, 2001; Taal, Rasker, Seydel, & Wiegman, 1993). A choice of family supporter is strategy always convenient and accessible for TB patients. It helps to decrease the problems of limited budget and healthcare staff, as well as disrespect and stigmatization of TB patients (Akkslip et al., 1999; Newell et al., 2006; Zvavamwe & Ehlers, 2009). The choice of family supporter was educated individually along with a video presentation and supporter's manual and was trained how to assist the participants and support them to self-regulate for TB medication adherence. Moreover, the family supporter was educated and trained to use verbal persuasion and physiological and emotional arousal to encourage the participants to self-regulate for TB medication adherence. These methods might help the participants in the program realized that they could get assistance when needed and feel more confident to adhere to TB medication.

The findings of this study were congruent with the study of Chimbanrai et al. (2008) which reported that the combined educational interventions provided the individual patient with healthcare provider and family treatment supporter could improve patient adherence to TB treatment regimen and cure rate. A randomized

controlled trial reported a 12% higher medication adherence in terms of cure rate among PTB patients allowed to select their own supporters and also featured intensive and sustained professional supervision and indicated that choice of a DOT supporter among the patients' family members yielded better treatment outcomes than having other DOT supporters (Thiam et al., 2007). Additionally, a systematic review of Suwannakeeree and Picheansathian (2014) found that DOT by a family member could significantly improve TB medication adherence in terms of success rate, compared to self-supervision or DOT by a case manager, the effect size of these interventions range from 1.05 to 1.07 compared to 1.16 in this study. Although, this study used combined interventions, the effect size of the intervention was nearby the effect size of the previous studies using single intervention. It may imply that the family supporter had a strong component effect on behaviour changes. However, the combined interventions in this study tried to drive the participants to self-directed and sustain their behaviors by themselves in the long-term, whereas the interventions in the previous studies did not mention in this issue. In addition, a meta-analysis by DiMatteo (2004) also appeared that adherence to medical treatment was 1.74 times higher in patients from cohesive families and 1.53 times lower in patients from families in conflict.

During the two sessions of telephone reminder and counseling, the researcher provided the participants with a telephone call a few days prior to the appointment for reminding and counseling, and used verbal persuasion and physiological and emotional arousal to encourage the participants to self-regulate for TB medication adherence. Additionally, the participants were allowed to contact with the researcher by telephone during the program if they faced some problems that they could not solve by themselves. This activity provided a mechanism for a proactive strategy to address real-time needs, such as a method to deal with drug side effects or missing medication doses. These methods might help the participants realize that they can get assistance from the researcher when needed and feel more confidence to self-regulate for TB medication adherence. These findings were congruent with the results from the systematic reviews which found that a telephone-linked reminder system increased medication adherence and was consistently useful for reducing the number of missed clinical appointments of medical care (Macharia et al., 1992; Van Eijken et al., 2003). Moreover, Mahmud et al. (2010) reported that mobile health intervention with cell phones had benefits for TB

patient adherence, appointment reminders, and physician queries and helped the hospital save approximately 2,048 hours of worker time, $2,750 net cost, and double the capacity of the TB treatment program.

Considering the subscales of medication adherence, the percentage of participants who took right medicine and right amount of medicine at the 3rd month after entering the program between the control and intervention groups had no significant difference (Table 4.5). The reasons to support the finding were the simplification of dosage and packaging treatment. The simplification of dosage and packaging are aimed either at reducing the number of doses per day or at reducing the number of different drugs in the regimen. The participants were provided with FDCs drugs if they didn't have the risk or experience of TB drug side-effects. However, for the participants who needed the free-drug component regimen or separate TB drug administration, the TB clinic would provide them with a unit of use packaging (the exact amount of drug's treatment pre-packaged by the pharmacist). FDCs drugs refers to drugs composed of four; isoniazid, rifampicin, pyrazinamide, and ethambutol and two; isoniazid and rifampicin, drugs in a single tablet. Drugs composed of four used in the intensive phase and those composed of two used in the continuous phase.

Approximately 20% of the participants in the intervention group and 8% of the participants in the control group who had positive sputum smear at the end of second month of treatment and must continue to receive the four drugs in the third month of treatment. There was no significant difference in the number of the participants who received four drugs in the third month of treatment between groups (Appendix K; Table 1). Additionally, there was no significant difference of the number of the medicine tablets taken by the participants in the intensive and continuous phases between groups (Table 4.3). These simplification strategies and situation might help the participants in the control and intervention groups to gain a high percentage of taking the right medicine and right amount of medicine, and there was no significant difference between groups.

Compounding multiple medications into a single preparation has been proposed as a means to reduce non-adherence with prescribed therapy (American Thoracic Society, 1994; Moulding et al., 1989). More importantly, FDCs drugs prevent selective

discontinuation of one or more of the drugs; ensuring that patients always take more than one type of medication; decreasing the possibility of making medication errors. A number of meta-analysis studies indicated that FDCs drugs or unit-of-use packaging or reminder packaging were likely to improve medication adherence (Bangalore et al., 2007; Connor et al., 2004; Heneghan et al., 2008). A meta-analysis by Bangalore et al. (2007) also reported that FDCs drugs resulted in a 26% decrease in the risk of non-adherence compared with free-drug component regimen.

The results of this study showed that at the 6th month after entering the program, the overall medication adherence of the participants in the intervention groups was higher than those in the control group, but not significantly different (Table 4.4). Additionally, the percentage of participants who took right all subscales of medication adherence had no significant differences between the groups (Table 4.5). These findings didn't support the hypothesis one of this study. Moreover, there was no significant difference of the overall medication adherence at the 3rd month compared to 6th month after entering the program in both the control and intervention groups (Appendix K; Table 6). In addition, the percentage of participants who took right all subscales of medication adherence at the 3rd month after entering the program had no significant differences compared to at the 6th month after entering the program in both the control and intervention groups (Appendix K; Table 7). Crucially, previous evidences have shown that adherence to most medical regimens is inversely proportional to the length of therapy under the symptoms disappearance (Chaulk & Kazandjian, 2003; Haynes et al., 2008). However, the finding in this study did not agree with the results of previous studies. The reasons for this finding might be the unknown level of medication adherence self-efficacy of the participants after entering the program for three months in both the intervention and control groups. The increasing of medication adherence self-efficacy of the participants in the control group and decreasing of medication adherence self-efficacy of the participants in the intervention group by chance might induce medication adherence score at the 6th month after entering the program did not have difference between groups. Additionally, the added usual care interventions provided the participants in both groups after entering the program for three months might support the finding. These interventions included a money incentive and late patient tracers as supported by the results from the systematic review evidences indicated that

monetary incentives or incentive components including food, clothing, books, and transportation were effective on adherence to and completion of TB treatment (Parent, 1999; Volmink & Garner, 1997). In addition, a systematic review by Liu et al. (2008) showed that late patient tracers had a benefit in increasing adherence to TB treatment.

According the Global Fund Project, the project objective needs to pay a money incentive of 1,200 baht per a participant who was new case of PTB and had smear-positive sputum (The Office of Disease Prevention and Control 9, & Phitsanulok Provicial Health Office, 2013). The project manager must contact and inform the participants about the incentive and encourage them for adhering to TB medication at the initial start of treatment. After that she asked for the patient's documents, used for submission. The participant would receive the money incentive by cash after entering the program for four or five or six months. Moreover, most of them received the incentive after entering the program for five months; this was the point of time before the time period for assessing participants' medication adherence at the 6th month after entering the program. This intervention might motivate the participants for enhancing medication adherence and confounding the effect of the planned interventions at that time. Therefore, medication adherences were not significantly different compared to those at the 3rd month after entering the program or between groups. Incentive was used to motivate the patients to complete treatment. On the other hand, incentive may have negative consequences and affect the patient's behavior and health care service. Incentives are not a substitute for a high-quality relationship with patients based on trust, effective communication, and mutual respect (CDC, 1999; Volmink & Garner, 1997).

This finding was congruent with a randomized control design by Morrisky et al. (1990) which showed that there were no difference of appointment-keeping and medication-taking practices of active TB patients who participated in the special intervention consisted of a tailored health education counselling session, enlistment of family and friend support, and positive reinforcement, compared to those in the usual care. The reason supporting the finding in this study was that the confounded factor by a contingency $10 monetary incentive at each monthly visit to the TB clinic. The authors concluded that the education services and incentives components were effective in

increasing adherence to and completion of TB treatment. However, it was impossible to definitely show which part of intervention contributed to success, since the intervention was delivered as a package.

Financial incentives tend to be more effective than other methods of improving adherence and it was found that a small $5 incentive for homeless people with tuberculosis was more effective than peer health support or usual care (Pilote et al., 1996). Additionally, a systematic review by Giuffrida and Torgerson (1997) reported that financial incentives have a greater effect among low income patients. This result did not support the finding in this study showing that only two participants (8.0%) in the control group and one participant (4.0%) in the intervention groups (Table 4.1) had a monthly income less than the poverty line of Thailand in 2011 (2,422 baht per person per month) (Office of the National Economic and Social Development Board, 2013). However, a study by Ariyothai et al. (2005) among Thai newly smear-positive PTB patients found that the patients who lack income defaulted more on TB treatment than those who had monthly income ≥ 5,000 baht (OR=3.64, p=.006). This result supports the finding in this study which showed that 80.0% of the participants in both the intervention and control groups had monthly income more than 5,000 baht (Table 4.1). This situation might affect medication adherence improvement of the participants in both groups.

Late patient tracers are undertaken when participants fail to keep an appointment, generally to attempt to make contact with the participants, sometimes to find out why they did not attend, and to help participants understand the need to attend treatment and overcome barriers to attend for treatment. The late patient tracers in this study were undertaken by a nurse at a TB clinic or community health care workers and/or village health volunteers. They would contact participants who did not return to the clinic for their appointments. On the appointment day, a nurse at TB clinic would contact the patient by telephone and encouraged them to visit the TB clinic in that day or other day. If this strategy failed, on the first day or as early as after missed appointment, the community health care workers and/or volunteer community members would visit the participants' home to find out why they have not attended the clinic for treatment. Other methods were implemented if the participants subsequently failed to attend including

providing the patient frequently with home visits and taking TB drug to patients at home. Additionally, at the time period of the study, the TB clinic strictly used the late patient tracer strategies with all patients who missed appointment.

Approximately 32% of the participants in the control group and 28% in the intervention group were home visited by other health care workers, and there was no significant difference between the groups (Table 4.3). Moreover, some of the participants in the control group received more than 10 home visits throughout the course of treatment (Table 4.3). These home visits were related to the participants' missing of appointment and health condition of the participants. Most of home visits occurred after entering the program for three months (Appendix K; Table 2) that might relate with the PTB symptoms disappearance. These activities might help the participants in both groups to enhance their medication adherence at the 6th month after entering the program and had no significant difference compared to those at the 3rd month after entering the program or between groups, even though the participants in the control group had significantly greater missed clinical appointments than those in the intervention group at the level of .05 (Appendix K; Table 2). Moreover, medication adherence in the control group at the 6th month was likely higher than those at the 3rd month after entering the program (Appendix K; Table 6); it may be the effect of frequent missed appointments and late patient tracers. During the processes of late patient tracers, a nurse would find out why they did not attend, encouraged them to continuously take medication, and frequent home visits might be provided. These strategies might help the participants overcome barriers to attend for treatment and perform effective medication adherence behavior.

The results of this study were congruent with the findings of previous studies which have shown that an active defaulter tracing system is feasible in reducing the loss to follow-up among TB patients (Thomson et al., 2011). The active tracing serves several functions including as a primary prevention tool and intervening soon after a patient misses an appointment but before they may default entirely. It also contributes to improve care and treatment of TB patients, mitigate default rates, and improve treatment outcomes. However, it needs a well-designed health service system, and requires more resources and staffs (Bronner et al., 2012).

4.2.2 Newly diagnosed PTB patients receiving the Medication Adherence Enhancement Program will have higher treatment success than those receiving usual care.

The result of this study indicated that treatment success in the intervention group was not significantly higher than that in the control group. Nevertheless, the treatment success rate in the intervention group (100.0%) was higher than those in the control group (96.0%) (Table 4.6). This result did not support the hypothesis two of the study. However, both the treatment success rates in the intervention and control groups were higher than the target 85% treatment success rate set by WHO (WHO, 2010a). In addition, these rates were higher than treatment success rates (56.38-79.10%) reported by the TB clinic in the last three years (2011-2013) (The TB clinic of Buddhachinaraj Hospital, 2014). The reasons supported this finding might be the unknown level of medication adherence self-efficacy of the participants and the added interventions of money incentive and effective strategies of late patient tracers during the period of the study. In addition, these treatment success rates reported by the TB clinic included all ages (≥ 15 years old) and all condition of new TB patients who had sputum smear positive, which had more risky factors to get negative outcome than the participants in the study. Considering the 4.0% difference of treatment success between groups, it may be greater if the number of the participants increase. Although this result had no statistically significant difference, there are clinically significant differences in overall public health and health system. The failure treatment occurring in the control group not only leads to more expensive and long-course treatment for the individual participant later in the disease cycle but increases the possibility of developing drug resistant strains of the disease and the infection of other people (Giuffrida & Torgerson, 1997).

These study findings are congruent with a study of Tansakul et al. (2003), who conducted a health education program based on self-regulation concept for newly diagnosed PTB patients and reported that medication adherence and the clinical outcome by sputum conversion rates after the intensive phase of the patients in the intervention group (100% and 87.5%, respectively) were higher than those in the control group (97.4% and 74.3%, respectively), the authors did not contain result of statistic. Moreover, some combined interventions of health education and reminder

based on health belief model or self-efficacy combined with social support for the TB patients consistently reported that the interventions significantly improved adherence behavior but the clinical outcomes by sputum conversion rate at the end of treatment between groups was not significantly different (Boonpendecha, 2001; Suvateerapun, 1994; Wintachai, 1995). However, the sputum conversion rates of all studies were high in both the intervention group (98.0%-100%) and control group (91.6%-97.5%). The reasons for supporting the study results included the effective short course regimen of TB drugs, the short time period of treatment interruption, and the confounded effective care at TB clinic at that time.

Successful TB treatment is heavily dependent on effective treatment of patients and requires adherence throughout the full course of treatment (Blanc & Martinez, 2007). Several studies indicated that prediction factors for successful TB treatment among new smear-positive PTB patients were medication adherence (Bashour & Mamaree, 2003; Phuangngernmak, 2001; Tipaht, 2008). However, adhering to medication regimens translates into improved disease outcomes are confounded by numerous factors including; overall health status or genetic variations in response rates; adherence to non-medication components of a management plan, lifestyle modifications, pertaining to diet, exercise, smoking, and alcohol-consumption; the effectiveness of the recommendation, treatment, and regimen itself; potential for reverse causality; adverse drug reactions; and limitations in current understanding of disease (Boswell, Cook, Burch, Eaddy, & Cantrell, 2012; DiMatteo, Giordani, Lepper, & Croghan, 2002). Considering the confounded factors in this study, it showed that the demographic, clinical and PTB-related characteristics of the participants in the control and intervention groups had no significant difference (Table 4.1, 4.2, 4.3). Therefore, it might imply that whether significant difference of treatment success between groups was not affected by the confounded factors of demographic, clinical or PTB-related characteristics of the participants. The result of treatment success might be affected by the high level of medication adherence at the 6th month after entering the program in the both groups which had no significant difference between groups (Table 4.4) or other factors.

The limitation of the study that might have potentially biased the result was the attrition of two participants in the control group. The participants died before evaluating the medication adherence at 3rd month after entering the program, and were excluded from the study. This situation was a negative outcome of the TB treatment and effect on the proportion of treatment success and all treatment outcomes. Additionally, the death of the participants might be influenced by their experienced with poor medication adherence, but the data was not included for analysis. The situation might imply that the Medication Adherence Enhancement Program useful to prevent mortality of PTB patients. These finding was supported by the study of Smith et al. (2003) who found that a medication self-management program based on self-efficacy and self-regulation concepts did not improve the clinical outcome of viral load within one year follow-up, whereas there were significantly more likely to take medicine 80% or more of their doses each week in the intervention group than the control group by the end of 12 weeks follow-up. The limitations of the study were the attrition of the samples, small sample size, and not knowing whether the high rates of adherence were sustained after 12 weeks follow-up.

Considering in the detail of medication interruption in both the intervention and control groups, this study showed that there was a few cases experienced with treatment interruption and had short time period of treatment interruption. Exceptionally, a participant in the control group who had failure treatment outcome, the participant experienced treatment interruption with three non-consecutive days at the 3rd month after entering the program, and twenty-four consecutive days at the 6th month after entering the program. At the 3rd month after entering the program there was only one participant in the intervention group who experienced treatment interruption with two non-consecutive days (4.0%), whereas in the control group, there were four participants who experienced treatment interruption with one day (16.0%), one participant experienced treatment interruption with two non-consecutive days (4.0%), and three participants experienced treatment interruption with three non-consecutive days (12.0%). Considering the 6th month after entering the program, there was only one participant in the intervention group who experienced treatment interruption with one day (4.0%), whereas in the control group, there were two participants who experienced treatment interruption with four non-consecutive days (8.0%) and one participants who

experienced treatment interruption with five (4.0%) and seven (4.0%) consecutive days (Appendix K; Table 8).

This situation, with a few cases that experienced treatment interruption and short interrupted periods might induce the high rate of treatment success in the intervention and control groups and effected on significant difference between groups. However, the interruption at the 6th month after entering the program were likely more frequency and had longer period than at the 3rd month after entering the program. This finding is congruent with a systematic review by Kruk et al. (2008) which suggested that the majority of default occurred after two months of treatment or intensive phase because most of the patients feel markedly better in signs and symptoms after that. Additionally, some studies showed that the median duration to the first TB treatment interruption was 70-90 days (Podewils, Gler, Quelapio, & Chen, 2013; Yone, Kengne, & Kuaban, 2011), the majority (45-67.39%) of treatment interruption occurred during the continuation phase (Jakubowiak et al., 2009; Singh, Bhardwaj, Mukherjee, Arya, & Mithra, 2013). The patients who had longer interruptions with sporadic variability had a significantly increased risk for poor outcomes compared to the patients who had short and regular interruptions (Podewils et al., 2013). These findings were supported by a study of Jakubowiak et al. (2009) which recommended that a total of three or more non-consecutive days interruption, or two or more consecutive days interruption during the intensive phase might induce a negative outcome. In addition, drug omission for upwards of four days caused a significant reduction in the cure rate (Arkaravichien et al., 2003).