Factors Associated with Compliance among Tuberculosis Patients in Thailand

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Background: *Tuberculosis (TB) is a major health problem in developing countries. There are so many factors which influence the cure rate and one of them is compliance. However, in developing countries like Thailand, there is little information about the factors that can predict the compliance within TB patients.*
Objectives: *To study the level of compliance and associated factors among tuberculosis patients in Thailand.*
Design: *A cross-sectional descriptive study .*
Setting: *Three levels of health care facilities in the 4 regions of Thailand (Zonal TB Centers, Provincial Hospitals and District Hospitals),excluding Bangkok.*
Participants: *A total of 487 adult newly diagnosed TB patients with positive sputum smear at the study location and they were interviewed by trained health personnel with structured questionnaires.*
Main Outcome Measures: *Level of compliance classified into excellent (punctuality), good (missing ≤ 2 consecutive weeks) and poor (missing > 2 consecutive weeks). The socio-economic variables were studied as the independent variables.*
Results: *About 70% (342 out of 487)of the TB patients were males. Mean (SD) of age was 47.2(16.65) years and ranged from 15 to 84 years. The excellent compliance rate of the TB patients was 65.7% (95%CI: 61.5-69.6%) while good and poor compliance were 22.8% and 11.5%, respectively. Using Chi-square test of association, the finding showed that the type of treatment (DOT and SS), gender, working, experience of contacting TB patient, perception in health status, attitude, knowledge and social support were significantly associated with the compliance ($p < .05$). Binary logistic regression (Excellent vs Good and Poor) were used to adjust the confounding factors. Females were more likely to have excellent compliance than males (Adjusted OR = 1.87, 95% CI : 1.17-2.99, p=.009). Patients having perception of fair health status was 2.26 times more to have excellent compliance (95% CI : 1.45-3.53, $p < .001$).*
Conclusion: *Compliance is one of the potential factors to increase the cure rate in TB patients. Finding the significant factors will pave the way to improve the effective treatment of tuberculosis.*

Keywords: *Compliance, Tuberculosis, Thailand*

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Tuberculosis (TB) is a major public health problem in developing countries. It remains the most important cause of death among adults worldwide. The prevalence rate of tuberculosis in Thailand increased every year from 1998 to 2000 with the rate of 51.82 per 100,000 population but it decreased in the year 2001 by the rate of 48.3 per 100,000 population and has increased again since 2001 (Bureau of Epidemiology, MOPH 2002)[1]. TB is one of the most leading causes of death and cause of infectious disease. The death rate from all types of TB was 14.8 per 100,000 population in 2003 (Bureau of Health Policy and Strategy, MOPH)[1]. The death rate from pulmonary tuberculosis was 8.3 per 100,000 population in 2003 (Health Informa-

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tion Unit, Bureau of Health Policy and Strategy). WHO reported that Thailand has had nationwide Directly Observed Treatment (DOT) coverage since 2002 and reached the global target for case detection in 2003. Recent data suggest that the incidence of TB is increasing in Thailand[2].

Tuberculosis is made worse by poor adherence to and frequent interruption of treatment. Treatment of tuberculosis requires strict discipline in order to eradicatet[3]. There are so many factors that influence the cure rate and one of them is compliance. Compliance is one of the potential factors to increase the cure rate in TB patients. Patient compliance remains one of the main obstacles that need to be overcome by a tuberculosis control program in the developing world as well as in industrialized countries. A better understanding of the various factors accounting for treatment default could help to achieve better compliance from patients[4]. On the other hand, non-compliance may also be prolonged and expensive therapy that is less likely to be successful than the treatment of drug-susceptibility tuberculosis[5]. Complying with the prescriptions of the directly observed treatment (DOT), one of the components of the Global Tuberculosis Programme of the WHO, is problematic for many patients[6].

In a developing country like Thailand, there is little information about the risk factors that predict the compliance within TB patients. Therefore, the present study was designed to study the compliance rate and factors associated with compliance in TB patients who received DOT (Directly Observed Treatment) and SS (Self-supervised) methods in Thailand.

Material and Method

Study design and study samples

The present study was a cross-sectional descriptive study and conducted in 3 levels of health care facilities (Zonal TB Centers, Provincial Hospitals and District Hospitals) in the 4 regions of Thailand excluding Bangkok. A sample size was calculated based on the compliance rate of 80 % from a study of Barnhoorn F. et al.[7] with 95% CI and 5% of compliance rate for minimum error. The formula for one sample proportion estimation from Lemeshow, et al.[8] giving a minimum sample size of 384 subjects. Study samples were adults newly diagnosed TB patients in a study of randomized controlled trial of directly observed treatment (DOT) for patients with pulmonary tuberculosis in Thailand (Kamolratanakul P. et al,1999)[9]. who were willing to be recruited.

Data collection and research tools

A total of 487 TB patients were interviewed by trained health personnel with structured questionnaires. Questionnaires were designed to collect the compliance level classified into 3 categories; excellent (punctuality), good(missing $\leq$ 2 consecutive weeks) and poor (missing more than 2 consecutive weeks). The cure rate was defined by negative sputum smear. Socio-demographic data were age, sex, marital status, education level, number of family members and working status. Social factors were measured in knowledge about TB, experience to contact with TB patients, attitude towards TB treatment and social support.

Knowledge was assessed about the prevention and transmission of TB. TB patients were asked in 10 items and good knowledge was defined by 5 correct items or more. The attitude towards TB treatment was assessed on how they believed that TB can be cured by taking drugs. Perceived social support from family and other sources on cooperation with medical treatment were considerable.

Data analysis

After data collection, the questionnaires were checked for completeness and transferred to code for data entry. Data were cleaned before analysis and using SPSS Version 11.5 software. The descriptive statistics was used to describe the variables in percentage, mean and SD as appropriate. Univariate analysis was performed using Pearson Chi-square test to assess the association between each independent variables and the level of compliance. Crude odds ratio (OR) was also calculated. Variable found to be significantly associated ($p < 0.05$) with the compliance in univariate analysis were considered to be included in the multivariable analysis. Patients were classified into 2 groups as compliance (Excellent) and noncompliance (Good and Poor). Therefore, binary logistic regression was utilized to determine the significant variables after adjusting for possible confounding variables in the model, with statistical significance defined as $p < 0.05$. Adjusted ORs and their 95% CI (Confidence Interval) were also estimated.

Results

General characteristics of TB patients

During the study period, 487 TB patients were recruited in the present study. Among the 487 TB patients, 285 of them (58.5%) were from Zonal TB Centers of 4 regions. The others were from Provincial and District Hospitals (20.3% and 21.1%, respectively).

The majority of patients (70.2%) were male and about 75% of them were under 60 years of age and ranged from 15 to 84 years. Nearly 60% of them finished Primary school and some of them (12%) were not literate. Most of them were married (84.8%) and about a half of them had family members less than 4 in the house. When asking about the working status, it was found that nearly half of the TB patients didn't work after they had TB and about 40 % of them mainly earned money in the family. In addition, the authors found that about 27% of the patients experienced contact with TB patients. The details are shown in Table 1.

TB patients in the present study received DOT and SS treatment 54.2% and 45.8% respectively. About 65% of them thought that their health status was good. However, three thirds of theTB patients had other diseases during the time of interview. Knowledge and attitude about TB were assessed by asking the questions. Patients who could answer the correct questions from 5 items would be assessed to have good knowledge. More than half of the patients (54.6%) had poor knowledge. The attitude towards TB treatment was assessed to be good if they believed that TB can be cured by taking drugs. The authors found that most of them (92.1%) had a good attitude towards TB treatment. In addition, patients were asked about the support from their families and friends during their treatment about money and encouragement. The result showed that only 54.3% of them had social support. The results are shown in Table 2.

Compliance rate

The compliance was classified into 3 levels (excellent, good and poor) and the results showed that about 65% (95% CI: 61.5-69.6%) of TB patients had excellent compliance or punctuality. About 35% of them had missing continuation of drugs. It was found that about 23% of them missed ≤ 2 consecutive weeks,

Table 1. General characteristics of tuberculosis patients

Characteristics		Number	Percent
Setting	487		
Zonal TB Centers		285	58.5
Provincial Hospitals		99	20.3
District Hospitals		103	21.1
Age (years)	487		
< = 60		367	75.4
> 60		120	24.6
Mean (SD) = 47.2 (16.65), Median = 48.0, Minimum = 15, Maximum = 84			
Sex	487		
Male		342	70.2
Female		145	29.8
Education	487		
No		59	12.1
Primary school		282	57.9
Secondary school and higher		146	30.0
Marital status	487		
Single		74	15.2
Married		413	84.8
Number of family members	482		
<= 4		275	58.3
> 4		197	41.7
Worked in the last year	484		
Yes		212	56.2
No		272	43.8
Who earned money in family	477		
Patients		195	40.9
Others		282	59.1
Experience of contacting TB patients	483		
Yes		130	26.9
No		353	73.1

known as good compliance, and about 11% of them missed > 2 consecutive weeks, known as poor compliance. The details are shown in Table 3.

The association between socio-demographic data and compliance

All of socio-demographic variables were tested for the association with level of compliance. Pearson Chi-square test was performed and the results are shown in Table 4. It can be seen that TB patients aged under 60 years and over 60 years were not different in compliance. Female patients were more likely to have excellent compliance than male patients (74.5% VS 62.0%) and statistically significant with p = .029. Tuberculosis patients who finished primary school and those who were married had a higher excellent compliance rate than the others (69.5% and 66.8%, respectively). However, the authors found that TB patients in the families with less than 4 or more than 4 family members were not different in compliance rate. When the authors considered their working status when they had TB, those who were still working had less compliance than those who had no work with statistically significant difference (p = .0003). Similarly, TB patients who were responsible for earning money in families had less compliance than those who were not. In addition, among 130 TB patients having the experience to contact other TB patients,74.6% of them had excellent compliance which is higher than those who did not have with statistical significance (p = .045).

Considering type of treatment, the result showed that TB patients who received DOT were more likely to have excellent compliance than those who received SS and the difference was statistically significant (p = .027). When asking about health status, patients who thought that they have fair health status had a higher compliance rate than those who thought that they have good health with statistical significance (p < .001). Patients having or not having other diseases had no significant differences in compliance rate. It was found that knowledge about tuberculosis was not significantly associated with compliance. But the attitude towards tuberculosis treatment and social support were statistically significantly associated with compliance (p = .033 and p = .017, respectively). Patients having a good attitude or social support were more likely to have excellent compliance than those who did not. All details are shown in Table 4.

The results of multivariable analysis, binary logistic regression, are summarized in Table 5. Variables that were statistically significant for p < .05 on univariate analysis were selected to be included in the multivariable model. Those were sex, working status, experienced contact with TB patients, self perceived health status, type of treatment, attitude and social support. After adjusting for potential confounding variables with p < .05, only two variables, sex and self perceived health status, were significantly associated with compliance. Female patients were 1.87 times more likely to have excellent compliance than male patients (Adjusted OR = 1.87, 95% CI: 1.17-2.99, p=.009). Tuberculosis patients who thought that they had fair health status were 2.26 times more likely to have excellent compliance than those who thought that had good health status (Adjusted OR = 2.26, 95% CI: 1.45-3.53, p < .001). However, as of small effect size in other variables, TB patients who had work, experienced contact with TB patients, receiving DOT, good attitude and

Table 2. Type of treatment and social factors of tuberculosis patients

Factor	Number	Percent
Type of treatment	487	54.2
DOT*	264	45.8
SS**	223	
Self-perceived in health status	485	34.2
Fair	169	65.2
Good	316	
Having other diseases	481	75.1
Yes	361	24.9
No	120	
Knowledge about TB	476	45.5
Good	216	54.6
Poor	260	
Attitude towards TB treatment	482	92.1
Good	444	7.9
Poor	38	
Having social support	481	54.3
Yes	261	45.7
No	220	

* Directly Observed Treatment
** Self supervised

Table 3. Compliance rate in tuberculosis patients

Compliance	Number	Percent
Excellent	320	65.7 95% CI = 61.5 – 69.6
Good	111	22.8
Poor	56	11.5
Total	487	100.0

Table 4. Association between compliance and socio-demographic factors

Socio-demographic factors	n	Compliance (%)			X^2	p-value
		Excellent	Good	Poor		
Age (Years)	367	65.7	23.2	11.2	0.228	.892
< = 60	120	65.8	21.7	12.5		
> 60						
Sex	342	62.0	25.4	12.6	7.10	.029*
Male	145	74.5	16.6	9.0		
Female						
Education	59	55.9	27.1	16.9	5.59	.232
No	282	69.5	20.9	9.6		
Primary school	146	62.3	24.7	13.0		
Higher than primary school						
Marital status	74	59.5	27.0	13.5	1.51	.469
Single	413	66.8	22.0	11.1		
Married						
Number of family members	275	66.2	20.0	13.8	3.36	.187
<= 4	197	66.0	24.9	9.1		
> 4						
Worked in the last year	212	65.6	17.9	16.5	11.50	.0003*
Yes	272	66.2	26.1	7.7		
No						
Who earned money in family	195	63.1	23.1	13.8	2.66	.264
Patients	282	69.1	21.3	9.6		
Others						
Experience of contacting TB patient	130	74.6	16.2	9.2	6.18	.045*
Yes	353	62.6	24.9	12.5		
No						
Type of treatment	264	70.1	20.5	9.5	4.88	.027*
DOT	223	60.5	25.6	13.9		
SS						
Self perceived health status	169	76.9	13.0	10.1	16.64	<.001*
Fair	316	59.5	28.2	12.3		
Good						
Having other diseases	361	65.4	23.8	10.8	1.23	.542
Yes	120	65.0	20.8	14.2		
No						
Knowledge about TB	216	66.2	23.6	10.2	0.871	.647
Good	260	65.8	21.5	12.7		
Poor						
Attitude towards TB treatment	444	66.0	23.4	10.6	6.84	.033*
Good	38	63.2	13.2	23.7		
Poor						
Having social support	261	67.8	24.5	7.7	8.17	.017*
Yes	220	63.2	20.9	15.9		
No						

Using Chi-square test * Statistical significance at $p < .05$

social support were more likely to have excellent compliance. All of crude ORs and adjusted ORs with 95% CI are shown in Table 5.

Discussion

From the results of general characteristics of TB patients, it showed that most of the TB patients finished primary school and had poor knowledge about TB. This finding is consistent with the study of Kamolratanakul P et al.[10] that most TB patients had an income below the poverty line and had economic impact of TB at the household level. However, about

Table 5. Crude Odds Ratio (OR) and adjusted ORs for excellent compliance after adjusting potential confounding variables (n = 471)

Factors	Crude OR	Adjusted OR	95%CI Adjusted OR	p-value
Sex				
Female	1.79	1.87	1.17 – 2.99	.009
Male	1	1		
Worked in the last year				
Yes	0.973	1.19	0.78 – 1.81	.427
No	1	1		
Experience of contacting TB patients				
Yes	1.76	1.58	0.98 – 2.54	.059
No	1	1		
Type of treatment				
DOT	1.53	1.39	0.94 – 2.07	.100
SS	1	1		
Self perceived health status				
Fair	2.27	2.26	1.45 – 3.53	<.001
Good	1	1		
Attitude towards TB treatment				
Good	1.13	1.42	0.69 – 2.93	.336
Poor	1	1		
Having social support				
Yes	1.23	1.12	0.73 – 1.71	.603
No	1	1		

Using Binary Logistic Regression
* Statistical significance AT P <0.05

92 % of them had good attitude towards TB treatment. As in a study of Bicica V et al.[11], the attitude of TB patients towards treatment was a factor in the efficacy of chemotherapy. In addition, only half of the TB patients had social support. Many studies found that social support and functioning issues were one of the factors influencing quality of life in patients with active tuberculosis[7,12,13].

The definition of compliance in the present study was defined and using the criteria for noncompliance as the study of Burmann WJ et al.[5] to make it simple and easily applicable. Two consecutive weeks of missing was used as the criteria for good or poor. However, as the authors used excellent compliance for punctuality only (not missing at all) , therefore, the excellent compliance rate was only 65%.

It was found in the univariate analysis that 7 variables were significantly associated with compliance. Those were sex, working, experience, type of treatment, health status,attitude and social support. These findings were consistent with many studies[4,5,7,14]. Barnhoorn F et al [7] found that social support, treatment procedure, knowledge and satisfaction were associated with compliance. Moreover, Burman WF et al [5] reported risk factors for noncompliance as alcohol abuse and homelessness but the authors did not include these factors in this study. Peltzer K et al.[12] studied the factors at first diagnosis of TB in DOT patients. They found that the quality of health practitioner patient interaction and causative belief were associated with compliance whereas knowledge, sociodemographic and health belief were not associated.

According to the binary logistic regression, after adjusting the potential confounding variables, only sex and health status were significant variables. This is similar to the study of Bashour H and Mamaree F [15] who conducted a prospective study of gender and TB outcome. They found that diagnostic delay was significantly longer among males. Significant differences between males and females were noted in relation to the place they usually used to seek care. Although the women reported more barriers to seeking care, compliance with treatment tended to be higher and the treatment success rate was significantly higher among females than males. Additionally, a study of Santha T et al.[16] reported that higher default rates

were associated with irregular treatment and being male. Surprisingly, TB patients who considered their health as only 'fair' were 2.3 times more likely to have excellent compliance than those considering it as 'good'. It might be possible that those in the 'fair' group were more interested in their health than the others. This finding is opposite to the study of Barnhoorn F and Adriaanse H[7] , who found that more than 65% noncompliant groups perceived themselves in a 'fair' or 'poor' health status.

In multivariable analysis, binary logistic regression, 7 significant independent variables were included in the model. Katz MH[17] suggested that there should be at least 10 outcomes for each independent variable in the model. In the present study, there were 320 outcomes (Excellent compliance) and the results showed the narrow confidence interval of adjusted OR. The percent of correct classification of this model was about 67%. A case-control study is suggested to be conducted in a further study. For more information, qualitative research (Focus group) should be added to make the utility of the study. In conclusion, compliance is one of the potential factors to increase the cure rate in TB patients. Improving compliance in patients could encourage more patients to complete their TB treatment.

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ปัจจัยที่สัมพันธ์กับ การได้รับยาครบในผู้ป่วยวัณโรค ในประเทศไทย

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ที่มาและเหตุผล: *วัณโรคยังเป็นปัญหาสาธารณสุขที่สำคัญของประเทศกำลังพัฒนา โดยมีปัจจัยหลายประการที่มีอิทธิพลต่ออัตราการหายของโรคนี้ และหนึ่งในปัจจัยดังกล่าว คือการได้รับยาครบตามกำหนด อย่างไรก็ตาม ในประเทศกำลังพัฒนา เช่นประเทศไทย ยังมีข้อมูลไม่มากนักเกี่ยวกับปัจจัยที่สามารถทำนายการได้รับยาครบของผู้ป่วยวัณโรค*

วัตถุประสงค์: *เพื่อศึกษาระดับการได้รับยาครบ และ ปัจจัยที่สัมพันธ์กับการได้รับยาครบในผู้ป่วยวัณโรคในประเทศไทย*

รูปแบบการศึกษา: *การศึกษาเชิงพรรณนา ชนิดภาคตัดขวาง*

สถานที่ทำการศึกษา: *สถานบริการ 3 ระดับ คือ ศูนย์วัณโรคเขต, โรงพยาบาลจังหวัด และ โรงพยาบาลอำเภอ ใน 4 ภาคของประเทศไทย ยกเว้นกรุงเทพมหานคร*

ตัวอย่างและวิธีการศึกษา: *ผู้ป่วยใหม่ 487 คนที่ได้รับการวินิจฉัยว่าเป็นวัณโรคโดยมีผลตรวจเสมหะเป็นบวก ณ สถานที่ศึกษา และได้รับการสัมภาษณ์โดยบุคลากรสาธารณสุขที่ได้รับการอบรมแล้ว โดยใช้แบบสัมภาษณ์ที่ผ่านการทดสอบแล้ว*

ตัววัดผลหลัก: *ระดับของการได้รับยา แบ่งเป็น 3 ระดับ คือ ได้รับยาครบตามกำหนดเวลา, ขาดยาไม่เกิน 2 สัปดาห์ติดต่อกัน และ ขาดยาเกิน 2 สัปดาห์ติดต่อกัน ตัวแปรอิสระ ได้แก่ตัวแปรทางด้านประชากรและทาง สังคม*

ผลการศึกษา: *ผู้ป่วยวัณโรค ส่วนใหญ่เป็นเพศชาย ร้อยละ70 (342 คน) อายุเฉลี่ย (SD) 47.2 (16.65) ปี และพิสัย 15 ถึง 84 ปี ผู้ป่วยได้รับยาครบตามกำหนด ร้อยละ 65.7 (95% CI: 61.5-69.6%) ขณะที่ ร้อยละ 22.8 ขาดยาไม่เกิน 2 สัปดาห์ และ ร้อยละ 11.5 ขาดยาเกิน 2 สัปดาห์ติดต่อกัน ผลการทดสอบความสัมพันธ์โดยใช้ การทดสอบไค-สแควร์ พบว่า ชนิดของการรักษา, เพศ, การทำงาน, ประสบการณ์เคยสัมผัสผู้ป่วยวัณโรค, สถานะสุขภาพ, ทัศนคติ, ความรู้เกี่ยวกับวัณโรค, และการได้รับการสนับสนุนทางสังคม มีความสัมพันธ์กับการได้รับยาครบอย่างมีนัยสำคัญทางสถิติ ($p < .05$) ภายหลังการปรับตัวแปรกวนด้วยวิธี Binary logistic regression (กลุ่มที่ได้รับยาครบ หรือ ขาดยา) แล้ว พบว่า เพศหญิงมีโอกาส 1.87 เท่า (95%CI: 1.17-2.99, p=.009) ของเพศชาย และผู้ป่วยที่เชื่อว่ามีสถานะสุขภาพอยู่ในเกณฑ์ปานกลาง มีโอกาส 2.26 เท่า (95%CI: 1.45-3.53, p<.001) ที่จะมีโอกาสได้รับยาครบ*

สรุป: *การได้รับยาครบเป็นปัจจัยสำคัญที่มีผลต่อการเพิ่มอัตราการหายขาดจากวัณโรค การได้ค้นหาปัจจัยที่มีนัยสำคัญต่อการได้รับยาจะช่วยนำไปสู่การรักษาวัณโรคอย่างมีประสิทธิภาพต่อไป*