

FACTORS ASSOCIATED WITH THE HOUSEHOLD CONTACT SCREENING ADHERENCE OF TUBERCULOSIS PATIENTS

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Abstract. A cross-sectional study was conducted to explore factors associated with the adherence of tuberculosis patients in bringing their household contacts to a TB clinic in Bangkok, Thailand. During the study period, May to December 2003, 325 sputum-smear-positive tuberculosis patients were recruited into the study. Of the 325 eligible tuberculosis patients, 169 (52.00%, 95% CI=47.00-57.00) brought their household contacts to the TB clinic. Psychosocial and cues to action factors were examined as indicators of the household contact screening adherence of tuberculosis patients. The results reveal that the household contact screening adherence of tuberculosis patients was significantly associated with a higher perceived susceptibility (Adjusted OR=2.90, 95% CI=1.18-7.16), lower perceived barriers (Adjusted OR=4.60, 95% CI=1.99-10.60), a higher intention to bring the contacts to the TB clinic (Adjusted OR=3.35, 95% CI=1.44-7.76), and a short distance from home to the TB clinic (Adjusted OR=11.47, 95% CI=4.57-28.79). The results from this study provide information for TB clinic staff for developing an appropriate intervention program. Through effective intervention and active policy enforcement, a higher percentage of household contact screening adherences can be achieved.

INTRODUCTION

Tuberculosis is a neglected health crisis that is out of control in many parts of the world (WHO, 1998). In developing countries, the control of tuberculosis continues to be one of the major public health concerns. Although pediatric tuberculosis is on the decline, it continues to be a significant cause of morbidity, mortality, and health care expenditure throughout the world (Al-Marri, 2001). The World Health Organization has estimated that at least 180 million children, age less than 15 years, are infected with *Mycobacterium tuberculosis* worldwide (Dolin *et al*, 1994). Approximately one third of the population of Thailand is infected with tuberculosis. Nearly 100,000 people suffer from active tuberculosis every year, including 37,000 who have infectious disease, and spread the bacteria to the community (WHO, 1999). Nearly 20% of people with

tuberculosis live in Bangkok, where one sixth of the total population of Thailand live (WHO, 1998).

Persons living in the household of a tuberculosis patient have a high risk of becoming infected and developing tuberculosis themselves, particularly if their immune defenses are at all impaired (Zellweger, 2002). Young children with tuberculosis infection represent recent, ongoing transmission in the community. They are at a greater risk of activation of their infections, and of development of disseminated disease (American Thoracic Society and the Center for Disease Control and Prevention, 1994). The detection of latent *Mycobacterium tuberculosis* infection is an important tool for the control of the spread of tuberculosis in the community (Rose, 2000). Since children have an increased risk for developing severe disease within a month of infection, they are high priorities when identified as contacts of infectious tuberculosis patients.

The Centers for Disease Control and Prevention recommend identifying and offering therapy to all close contacts of persons with active tuberculosis (ACET, 1999). The Interna-

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tional Union against Tuberculosis and Lung Disease recommends treating children under five who are contacts of infectious cases. Therapy for recently infected persons may not only be beneficial to those treated, but also serve as an effective tuberculosis epidemic control measure (Enarson *et al*, 2001). Newly infected persons may be identified by investigation of close contacts of an infectious case.

Since child household contacts of active TB cases are a high risk group for getting TB infection, prompt and thorough contact investigation is essential for the control of TB. One important measure is screening and preventive therapy programs for persons in these high-risk groups. Contact investigation is rarely done in developing countries because of other priorities and lack of resources. In Thailand, because of the limitation of manpower and finances, contact investigation is performed in a passive way; the staff will ask the active TB cases to bring their household contacts to the TB clinic. However, most of them do not bring their household contacts under 15 years old to the TB clinic. This study was proposed to estimate the adherence level to the contact screening policy and to explore factors associated with household contact screening adherence among tuberculosis patients. There are no published studies to investigate this aspect. The results from this study are beneficial for TB clinic staff in developing an appropriate intervention program.

This study was reviewed and approved by the Ethics Committee of the Ministry of Public Health and the Ethics Committee of the Bangkok Metropolitan Administration (BMA).

MATERIALS AND METHODS

Study population and data collection techniques

Both quantitative and qualitative methods were applied in this study. A cross-sectional study design was conducted to determine adherence levels and to study factors associated with the adherence of tuberculosis patients to bringing their household contacts <15 years old to the TB clinic. The tuberculosis cases who were index cases were sputum-smear-positive pulmonary tuberculosis patients >15 years old who

have lived in the Bangkok area and had registered for tuberculosis treatment at the Bangkok Chest Clinic under the Ministry of Public Health and Health Care Centers under the Bangkok Metropolitan Administration, between May and December 2003.

All sputum-smear-positive pulmonary tuberculosis patients during the specified period were asked to enroll in the study. Three hundred and twenty-five tuberculosis patients were eligible for the study. All the patients were asked to give informed consent for study participation. The medical records of the tuberculosis patients were reviewed, including information on patient demographics, sputum smear results, and chest radiographs. All the subjects were required to complete a structured questionnaire.

During the counseling session at initial diagnosis, the tuberculosis patients were asked to bring their household contacts <15 years of age to the tuberculosis clinic for a tuberculin skin test. The tuberculin skin test performed by the Matoux method, injecting 0.1 ml of 5 tuberculin units (TU) of purified protein derivative (PPD) intradermally into the volar surface of the forearm. The results were read 48-72 hours afterwards (American Thoracic Society, 2000). The participants were instructed to return in 48 hours for their test results. For the cases where tuberculosis patients did not bring their household contacts or did not bring all of the household contacts <15 years old to the TB clinic within two months of the first visit, a home visit was done. In these cases, household contacts had tuberculin skin test and reading at home.

Fifteen tuberculosis patients, who brought their household contacts to TB clinic, were selected for an in-depth interview. They were asked the reasons for bringing their household contacts to the TB clinic. Another 15 tuberculosis patients who did not bring their household contacts to the TB clinic were selected for the in-depth interview. They were asked the reasons for not bringing their household contacts to the TB clinic.

Questionnaire

A structured questionnaire used in this study was divided into three parts: demographic, psychological, and cues to action factors. Demographic factors included socio-demographic

data, residential features, and relationship with contacts. Psychological factors included knowledge of TB and perception of tuberculosis patients. Cues to action factors included satisfaction with service, family support, interaction between patient and provider, intention to adherence, and distance from home to the TB clinic.

A tuberculosis case was defined as a smear-positive pulmonary tuberculosis patient aged >15 years who had at least one household contact aged <15 years. The contact could be a family member or any other person living and sleeping in the same house as the tuberculosis patient for at least three months before the commencement of the treatment of tuberculosis case.

Knowledge of TB referred to understanding the cause, mode of transmission, risk of infection and preventive measures. This was measured by multiple choice questions. The perception of the tuberculosis patients included the perceived susceptibility, perceived severity, perceived benefits, and perceived barriers. Perceived susceptibility was defined as beliefs about one's personal vulnerability to disease. Perceived severity referred to beliefs regarding the degree of seriousness of the condition. Perceived benefit was defined as beliefs concerning the efficacy of an action in reducing the risk of developing the health problem. Perceived barrier referred to beliefs about the cost or negative aspects of a course of action. Responses for all scales were structured on 3-point scales (agree, neutral, and disagree).

Cues to action referred to methods for activating, stimulating, or reminding tuberculosis patients to bring their household contacts to the TB clinic. Satisfaction of service was defined as the opinion of tuberculosis patients on the services that they received. Family Support covered the supports that tuberculosis patients received from their family members, included emotional support, instrumental support, informational support, and appraisal support. Responses for all the scales were structured on 3-point scales (agree, neutral, and disagree).

The interaction between the TB patients and providers was measured in terms of verbal

and nonverbal exchanges of medical information reflecting the dynamics of the relationship between the health care provider and the tuberculosis patient. The intention of TB patients to bring their household contacts to the TB clinic was measured on a 5-point bipolar scale with the endpoints 'most unlikely' and 'most likely'. Distance from TB patient's house to TB clinic was determined by district where patients resided. Near meant TB patient resides in the district where TB clinic locates, far referred to TB patient resides in district around the district where TB clinic locates, and very far defined as TB patient resides in the other district.

Adherence, which was the key outcome of the study, was defined as a binary scale. Patients were considered non-adherent if they did not bring their household contacts to the TB clinic within two months of initial diagnosis. They were considered adherent if they brought their household contacts to the TB clinic within a pre-specified period.

Statistical analysis

The data abstraction and interview form were checked for completeness and then double-entered and validated in the Stata Program version 7 (Stata Corp, College Station, TX). Univariate analysis was performed using χ^2 to assess the associations between each independent factor and the household contact screening adherence of tuberculosis patients. Odds ratios and their 95% confidence intervals were also calculated.

Factors found to be significantly associated with the household contact screening adherence of tuberculosis patients in univariate analysis were considered for inclusion in the multivariate model. In multivariate analysis, multiple logistic regression was used to determine the significant factors adjusting for all variables in the model. Adjusted odds ratios and their 95% confidence intervals were estimated. For all statistical tests, associations were considered significantly at p -value ≤ 0.05 . Data collected from in-depth interview with selected information were reviewed and analyzed using the content analysis technique to gain insightful information about reasons for adherence and non-adherence.

RESULTS

During the study period, 325 eligible tuberculosis patients were enrolled, and 169 (52.00%, 95%CI=47.00-57.00) tuberculosis patients brought their household contacts to the TB clinic. Of the 325 eligible participants, 190 (58.5%) were male, 222 (68.30%) were 21-40 years of age, and 202 (62.20%) finished primary school. About half of the participants (56.30%) were laborers. Fifty-eight percent of the index cases were the parent of the contacts. Half of the participants (50.20%) had poor TB knowledge levels, 170 (52.30%) had a low perceived susceptibility, 171 (52.60%) had a low perceived severity, 181 (55.70%) had a low perceived benefit, and 178 (54.80%) had low perceived barriers. Most of the tuberculosis patients (66.20%) reported low satisfaction with the service, 200 (61.50%) had a good interaction between the patient and the provider. About half of the patients (53.50%) indicated a low intention to bring their children to the TB clinic. Of the 325 index cases, 147 (45.20%) resided near the TB clinic, 92 (28.30%) resided very far from the TB clinic, and 86 (26.50%) resided far from the TB clinic.

The univariate analysis of the factors associated with household-contact screening adherence is summarized in Table 1. Subjects who reported that they had a family income less than 5,000 baht were more likely to bring their household contacts to the TB clinic than those who had a family income more than 10,000 baht (OR=3.17, 95%CI=1.27-7.88). Participants who were family member were more likely to bring their household contacts to the TB clinic than the head of the household (OR=1.73, 95%CI=1.11-2.69).

The household contact screening adherence of the TB patients was significantly associated with a good knowledge of TB (OR=4.94, 95%CI=3.08-7.91), a high perceived susceptibility (OR=11.93, 95%CI=7.05-20.19), a high perceived severity (OR=10.06, 95%CI=6.02-16.82), a high perceived benefit (OR=6.69, 95%CI=4.08-10.97), and a low perceived barrier (OR=19.01, 95%CI=10.84-33.36).

Index cases with high intention were more likely to bring their household contacts to the

TB clinic than index cases with low intention (OR=14.20, 95%CI=8.25-24.46). Participants who resided near the TB clinic were 12 times more likely to bring their household contacts to the TB clinic than those who resided very far from the TB clinic (OR=11.80, 95%CI=6.22-22.37). Tuberculosis patients who resided far from the TB clinic were five times more likely to bring their household contacts to the TB clinic than those who resided very far from TB clinic (OR=4.84, 95%CI=2.46-9.51).

The household contact screening adherence of the TB patients was not significantly associated with gender, age, educational level, occupation, relationship with contacts, satisfaction of service, family support, or interaction between the tuberculosis patients and the providers.

The results of multivariate analysis are summarized in Table 2. Variables that were significant on univariate analysis were included in the multivariate model. Participants who had a high perceived susceptibility were three times more likely to bring their household contacts to the TB clinic than those who had a low perceived susceptibility (Adjusted OR=2.90, 95%CI=1.18-7.16). Index cases with low perceived barriers were more likely to bring their household contacts to the TB clinic (Adjusted OR=4.60, 95%CI=1.99-10.60).

Tuberculosis patients who had a high intention were more likely to bring their household contacts to the TB clinic than those who had a low intention (Adjusted OR=3.35, 95%CI=1.44-7.76). Participants who resided near the TB clinic were 11 times more likely to bring their household contacts to the TB clinic than those who resided very far from the TB clinic (Adjusted OR=11.47, 95%CI=4.57-28.79). Tuberculosis patients who resided far from the TB clinic were four times more likely to bring their household contacts to the TB clinic than those who resided very far from the TB clinic (OR=4.35, 95%CI=1.68-11.24).

The household contact screening adherence of the TB patients was not significantly associated with family income, status in the household, knowledge of TB, perceived severity, or perceived benefits.

Table 1
Factors associated with the household contact screening adherence of TB patients.

Variables	Contact screening adherence No. Adherent /Total	(%)	OR	95%CI	p-value
Demographic factors					
Gender					0.685
Male	97/190	51.05	1		
Female	72/135	53.33	1.09	0.70-1.70	
Age (in years)					0.808
< 21	5/12	41.67	0.71	0.15-3.38	
21-40	119/222	53.60	1.15	0.39-3.40	
41-60	38/77	49.35	0.97	0.31-3.04	
> 60	7/14	50.00	1		
Education					0.228
Primary school	98/202	48.51	0.94	0.32-2.78	
Secondary school	64/109	58.71	1.42	0.47-4.34	
Other	7/14	50.00	1		
Occupation					0.333
Unemployed	48/82	58.54	1		
Officer	11/20	55.00	0.87	0.32-2.32	
Labor	87/183	47.54	0.64	0.38-1.09	
Merchant	23/40	57.50	0.96	0.45-2.06	
Income (Baht)					0.000
<5,000	75/103	72.81	3.17	1.27-7.88	
5,00-10,000	83/198	41.92	0.85	0.36-2.00	
>10,000	11/24	45.83	1		
Relationship with contacts					0.357
Father	57/122	46.72	0.72	0.42-1.22	
Mother	34/66	51.51	0.87	0.47-1.62	
Grandparent	23/37	61.16	1.34	0.62-2.91	
Other	55/100	55.00	1		
Status in household					0.016
Head	63/142	44.37	1		
Member	106/183	57.92	1.73	1.11-2.69	
Psychological factors					
Knowledge on TB					0.000
Poor	54/163	33.12	1		
Good	115/162	70.99	4.94	3.08-7.91	
Perceived susceptibility					0.000
Low	44/170	25.88	1		
High	125/155	80.64	11.93	7.05-20.19	
Perceived severity					0.000
Low	47/171	27.48	1		
High	122/154	79.22	10.06	6.02-16.82	
Perceived benefits					0.000
Low	59/181	32.59	1		
High	110/144	76.39	6.69	4.08-10.97	
Perceived barriers					0.000
Low	143/178	80.34	19.01	10.84-33.36	
High	26/147	17.69	1		

Table 1
Factors associated with the household contact screening adherence of TB patients (Cont).

Variables	Contact screening adherence No. Adherent /Total	(%)	OR	95%CI	p-value
Cues to action					
Satisfaction of service					
Low	105/215	48.84	1		0.111
High	64/110	58.18	1.46	0.92-2.32	
Family support					
Low	77/161	47.83	1		0.136
High	92/164	56.10	1.39	0.90-2.16	
Interaction					
Poor	58/125	46.40	1		0.111
Good	111/200	55.50	1.44	0.92-2.26	
Intention					
Low	44/174	25.29	1		0.000
High	125/151	82.78	14.20	8.25-24.46	
Distance from home to TB clinic					
Near	107/147	72.79	11.80	6.22-22.37	0.000
Far	45/86	52.32	4.84	2.46-9.51	
Very far	17/92	18.48	1		

In-depth interviews

Of the 325 patients, 30 were selected for in-depth interviews to ask the reasons for bringing or not bringing their household contacts to the TB clinic. Major reasons for not bringing their household contacts to the TB clinic were identified as follows:

1. The TB patients were busy, so they could not bring their household contacts to the TB clinic.
2. The contact cases had to go to school.
3. The TB patients had to work in the daytime.
4. The TB patients resided very far from the TB clinic.
5. The contact cases were still healthy and had no TB symptoms, so there was no need to get a TB examination.
6. The TB patients were not directly or closely taking care of their children, so their children had a low risk of getting TB infection.
7. The household contacts were not their children, so they could not bring them to the TB clinic.

Major reasons for bringing household con-

tacts to the TB clinic were as identified follows:

1. The TB patients reported that their children were very young, so they were worried that their children might get TB infection.
2. The TB patients resided near the TB clinic.
3. The contact cases had a cough and the TB patients wondered if their children might have TB infection.
4. There were other TB patients in the index case family.
5. The Index case spouse asked them to bring their children to the TB clinic.
6. The TB clinic staff asked the index cases at least 2 times to bring their household contacts to the TB clinic.

DISCUSSION

The idea of preventing the development of future cases of tuberculosis by better screening of contacts and consequent treatment of those infected is regarded as a part of TB control in developing countries (Hopewell, 2000). Despite this policy, child contact screening in busy hospitals, especially in developing countries, is of-

Table 2
Multivariate analysis of factors associated with the household contact screening adherence of TB patients.

Variables	Adjusted OR	95%CI	p-value
Demographic factors			
Income (baht)			
<5,000	1.83	0.44-7.54	0.405
5,000-10,000	0.64	0.16-2.50	0.518
>10,000	1		
Status in household			
Head	1		
Member	1.50	0.75-3.00	0.253
Psychological factors			
Knowledge on TB			
Poor	1		
Good	1.42	0.64-3.15	0.393
Perceived susceptibility			
Low	1		
High	2.90	1.18-7.16	0.021
Perceived severity			
Low	1		
High	1.80	0.67-4.89	0.246
Perceived benefits			
Low	1		
High	1.56	0.61-3.97	0.354
Perceived barriers			
Low	4.60	1.99-10.60	0.000
High	1		
Cues to action			
Intention			
Low	1		
High	3.35	1.44-7.76	0.005
Distance from home to TB clinic			
Near	11.47	4.57-28.79	0.000
Far	4.35	1.68-11.24	0.002
Very far	1		

ten neglected because of other priorities or a lack of resources. Marks *et al* (2000) presented an assessment of the current status of contact investigation and treatment of latent tuberculosis infection among contacts in the United States. The data suggests that the program was only moderately successful in identifying, evaluating, and treating infected contacts. A similar situation occurs in Bangkok as it is shown in this study. Employing passive contact screening led to only about 52% of TB patients' contacts being brought to the TB clinic.

Due to manpower and budget limitations, contact investigation has only been done in a passive way; the staff ask the active TB cases to bring their household contacts to the TB clinic and no formal follow-up is made. If the tuberculosis patients are not concerned with the importance of tuberculosis screening the household contacts or if they perceive more barriers, they will not bring their household contacts to the TB clinic. In this study, an in-depth interview was conducted to determine the reasons for bringing or not bringing their household contacts to

the TB clinic. Important reasons reported by TB patients included time availability, distance between residence and the TB clinics, the perception of the TB patients, and conflicting schedules between the TB patients and the household contacts.

Several factors associated with the household contact screening adherence of tuberculosis patients were crucial.

Perceived susceptibility

Participants who had a high perceived susceptibility were three times more likely to bring their household contact to the TB clinic than those with a low perceived susceptibility. The results of this study support the Health Belief Model that the more likely the person believes he/she will develop a health problem, the more effective the message will be in persuading the recipient to perform the desired health action or behavior (Janz and Becker, 1984). This result is consistent with other studies. Poss (2000) reported that perceived susceptibility was positively correlated with having a tuberculin test and having it read among Mexican migrant farm workers.

Perceived barriers

Perceived barriers were significantly associated with the household contact screening adherence of tuberculosis patients. Tuberculosis patients with low perceived barriers were more likely to bring their household contact to the TB clinic. The perception of a potential barrier that one will face when attempting to perform the healthy behavior, including physical, psychological, or financial demands, yields a potential negative consequence, such that it may prevent the patient from taking a particular health action. It is similar to a cost/benefit analysis in the sense that if a recommended health action is deemed to be too painful, costly, dangerous, or inconvenient, an individual will likely not adopt it (Janz and Becker, 1984). If the benefits outweigh the costs, the recommended health action will be adopted.

It was noted by Farmer (1997) that structural barriers, inadequate access to care, and environmental factors play a primary role in the TB epidemic that disproportionately affects the

world's poor. Several studies reported impacts of perceived barriers on TB in different settings. The study of Asch *et al* (1998) reported that several perceived access barriers were statistically associated with a delay in the care seeking of tuberculosis patients. Williams *et al* (1998) found that perceived barriers was negatively correlated with long-term medication adherence in adult outpatients as predicted by the health belief model.

Intention

Consistent with previous research, the intention of tuberculosis patients was significantly associated with the household contact screening adherence of tuberculosis patients. Tuberculosis patients with high levels of intention were more likely to bring their household contacts to the TB clinic than those with low levels of intention. This supports the concepts in the Theory of Reasoned Action and Theory of Planned Behavior that human beings are rational, make systematic use of available information, and consider the implication of their actions before engaging in a behavior. A behavior is assumed to be under volitional control and can be predicted from intention. Intention is formed by certain determinants: personal attitude, subjective norms, and perceived behavioral control (Ajzen, 1988). The theories suggest that one who believes that a behavior will lead to positive outcomes tends to hold a favorable attitude. Thus there is likely to be an intention to perform the behavior. The intent to perform a behavior is the best predictor that a desired behavior will actually occur (Kretzer and Larson, 1998).

The study by Poss (2000) revealed that the intention to participate in screening had a strong positive correlation with actual participation in the screening program. Specifically, intention to have the skin test was positively correlated with having the test and intention to have the test read was positively correlated with having it read. In that study, index cases who intended to have the skin test were four times more likely than non-intenders to actually be tested.

Distance from home to the TB clinic

Participants who resided near the TB clinic were 11 times more likely to bring their house-

hold contacts to the TB clinic than those who resided very far from TB clinic. This is clearly consistent with other studies that the distance from home to a health care center is important, as it affects health care seeking and follow-up of the diagnostic procedure. Since the distance between TB patient's home to the health care contributes to a delay in the diagnosis, it should thus be of major concern to the tuberculosis control program (Demissie *et al*, 2002).

Similarly, the study of factors associated with patient and health system delays in the diagnosis of tuberculosis supports the fact that the delay is greater if the patient resides more than 2 km from a health facility. A long distance between home and the health facility is a determinant of patient and health system delay (Rajeswari *et al*, 2002). Gore *et al* (1999) found that the distance from the respondents' homes to the clinic was a predictor of childhood immunization completion in a rural population.

Conclusion

Household contacts of active TB cases are at high risk for getting TB infection; therefore, prompt and thorough contact investigation is essential for the control of TB. The detection of latent *Mycobacterium tuberculosis* infection is an important tool for the control of the spread of tuberculosis in the community. Despite the fact that contact investigation is rarely done in developing countries because of workload, staff limitations, and the lack of resources. Although the assessment and management of household contacts of smear-positive tuberculosis patients is recommended, this rarely occurs in health care centers in Bangkok, except at the Bangkok Chest Clinic, due to several other priorities at the clinic level. Moreover, tuberculosis screening among the household contacts of tuberculosis patients is not an emphasized part of the TB control policy of BMA. As the results of this study indicate only a 52% adherence rate for household contact screening, a policy on this issue should be clearly established. It should be integrated into the routine work of the TB clinic, such that staff at the health care center under BMA and the TB clinic staff should be encouraged to do household contact screening.

The results of this study reveal that per-

ceived susceptibility is one of the important factors associated with the household contact screening adherence of tuberculosis patients. Tuberculosis staff should educate tuberculosis patients regarding the risk of getting TB infection from household contacts. Furthermore, tuberculosis patients should be educated on how to prevent the spread of TB to their household contacts. To increase the awareness of TB patients and to reduce the number of infected cases among contacts, an effective intervention program should be developed and implemented.

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