Mediating Effect of Attitude on the Relationship between Knowledge about Tuberculosis and Preventive Behavior Toward Tuberculosis of Foreign Students

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Abstract

This study attempted to examine the level of foreign students' knowledge, attitude, and preventive behavior toward tuberculosis, and examine relationship between each variable. The results of study are as follows.

First, 5.5% of participants have been infected with tuberculosis. In case of 23.7% of these participants, there were persons infected with tuberculosis around them. 59.6% of participants received a health education relating to tuberculosis

Second, 44.9% of participants answered correctly regarding the knowledge about tuberculosis in total; 35.1% of them answered correctly regarding the knowledge relating to the symptoms of tuberculosis, and the percentage was the lowest. It was shown that a score in attitude towards tuberculosis was 56.99±6.933 on a scale of 75, and a score in preventive behavior towards tuberculosis was an average of 59.61±7.634 on a scale of 75.

Third, in an analysis of Pearson's correlation among knowledge about tuberculosis, attitude towards tuberculosis, and preventive behavior towards tuberculosis, it was verified that there was a positive correlation . An attitude towards tuberculosis had a positive mediating effect in the relationship regarding the effect of total score in knowledge towards tuberculosis (p<.05).

The above results suggest that the tuberculosis management for a growing number of foreign students is urgent, and a health education program that can change the perception and attitude toward tuberculosis needs to be developed.

Keywords: foreign students, knowledge about tuberculosis, attitudes towards tuberculosis, preventive behaviors towards tuberculosis

1. Introduction

Since 2006, tuberculosis has shown a decreasing trend throughout the world. However, there were still a total of 9,000,000 patients with tuberculosis throughout the world in 2013; and among them, the number of deaths amounted to a total of 1,500,000. In particular, the number of people with latent tuberculosis amounted to 2,000,000,000, which is about 30% of the world's population. Thus, tuberculosis still needs to be considered a serious infectious disease [1]. In the past, Korea has contributed a great deal of effort to eradicate tuberculosis. Latent tuberculosis infection was added in 1995 to the National Tuberculosis Control

Program and relevant management has been implemented since then. As a result, the incidence rate of tuberculosis in 2013 was 97 per 100,000 persons, showing a continuous decreasing trend. However, it is much higher than the average incidence rate of the OECD member countries (12.9 per 100,000 persons), and the number of new patients with tuberculosis has no longer decreased in recent years [2].

Recently, overseas studies on tuberculosis have been actively performed by countries with a relatively low tuberculosis incidence rate (e.g., Europe, North America, and Australia) in preparation against a potential increase in the tuberculosis incidence rate as a result of foreigners introduced to its country. According to the results of these studies, most foreigners introduced were young, nationals of low socioeconomic countries with a high tuberculosis incidence rate [3].

In Korea, 1,737 foreign patients were reported to have tuberculosis in 2013. The reported cases increased by eight-folds in the past 10 year from 228 reported foreign national patients in 2003. Also, patients with intractable tuberculosis, such as multidrug-resistant tuberculosis, have entered Korea to receive treatment. Thus, to manage the inflow of tuberculosis patients from overseas countries into Korea, the Ministry of Health and Welfare, has prepared measures to strengthening the management of foreign patients with tuberculosis. In particular, the Ministry of Justice has implemented a strong immigration control for 18 countries with a tuberculosis incidence rate of more than 50 per 100,000 persons that has shown a huge influx of people into Korea Nepal, East Timor, Russia, Malaysia, Mongolia, Myanmar, Bangladesh, Vietnam, Sri Lanka, Uzbekistan, India, Indonesia, China, Cambodia, Kyrgyzstan, Thailand, Pakistan, and the Philippines 4].

Conversely, in Korea, tuberculosis has continuously persisted, centering on schools where a community life is implemented, and universities are no exception. In 2014, broadcasting stations and newspapers reported a mass outbreak of tuberculosis in some universities, surfacing the necessity of increased tuberculosis management for college students [5][6]. In particular, due to an increased introduction of foreign students through the ʹGlobal Education Service Activation Planʹ of the Ministry of Education and Science Technology [7], the number of foreign students have rapidly increased 84,891 students as of 2014. Thus it is an urgent matter to prepare and strengthen a tuberculosis management of foreign students. In the case of foreign students in Korea, other Asian countries account for 86.3%; and among them, Chinese account for the largest proportion (56.7%), followed by Japanese (4.48%), Vietnamese (3.73%), Mongolian (3.67%), Korean-Chinese (2.62%), Taiwanese (2.16%), and Indonesian (1.21%)[8] (Educational Statistic Service, 2015). Most countries, excluding Japan and Taiwan, are countries with high risk of tuberculosis; thus, tuberculosis management for foreign students from these countries should be stressed.

Foreign students have are at risk for serious health problems, made worse by difficulties in overcoming cultural and linguistic differences. Moreover, health care is not as effective due to the linguistic and cultural barriers [9-12]. Therefore, more active health care measures (especially, management of infectious disease such as tuberculosis) need to be established for these foreign students.

To improve health care, in general, health education is a crucial component, along with oneʹs own awareness of the importance of health care. In particular, in the case of tuberculosis, knowledge regarding the cause, propagation, prevention, and treatment of tuberculosis is highly important [13-14]. In according to previous research, patientsʹ general knowledge about tuberculosis was an important element affecting the treatment compliance of tuberculosis [15-16] and thus it is essential to implement tuberculosis-related health education for foreign students. [17] reported that 57.2% of Chinese foreign students needed health education, and 60.3% showed intention to participate in health

education, which shows the necessity of health education. However, in order for health education to improve health behavior, subjects′ knowledge and attitude toward tuberculosis need to be well understood before conducting an education program. The education must be appropriate to the level of students′ previous knowledge.

As for existing studies on knowledge, attitude, and preventive behavior toward tuberculosis, domestic studies were conducted on the following: parents with children from a local health center [17] high school students [13, 19, 20] soldiers [21], and North Korean refugees [22, 23]. However, there has been no study on college students, and especially, foreign students. In addition, recent overseas tuberculosis studies in countries with high risk of tuberculosis included a study on local residents who were aged 18 and above [24] and studies on general college students or medical students [14, 25, 26]. Accordingly, an effective health education program for foreign students is needed, and this study aimed to better understand the actual status of foreign students′ knowledge, attitude, and preventive behavior toward tuberculosis Moreover, a more effective and efficient method of tuberculosis management for foreign students should be prepared by examining the indirect mediating effect, as well as direct relation between each variable. The results of this study may be useful to provide basic data for the management of infectious disease (including tuberculosis) and general health care of the general public, as well as foreign students from countries with high risk of tuberculosis infection.

1.2. Purpose of the Research

This study aimed to prepare basic data for the development of a health education program for effective tuberculosis management of foreign students. The purposes of this study are to 1) examine the general characteristics and tuberculosis-related characteristics of foreign students, 2) examine the level of foreign students′ knowledge, attitude, and preventive behavior toward tuberculosis, and 3) examine the mediating effect between each variable (foreign students′ knowledge, attitude, and preventive behavior toward tuberculosis).

2. Research Method

2.1. Research Design

This study uses a descriptive survey to examine foreign students' knowledge, attitude, and preventive behavior toward tuberculosis, testing the direct and indirect effect between each variable.

2.2. Research Subjects and Data Collection

This study included a total of 228 foreign students from a University located in B metropolitan city and K province. The number of subjects needed to achieve the purpose of this study was examined using G*Power 3.1.3[27]. The result showed that for the expected sample size for a linear multiple regression (fixed model), a minimum sample size was 230 persons when the estimated effect size (f^2) was 0.15, significance level was .05, power of test (1-β) was .95, and number of predictor variables was 22.

Data collection was mostly performed during a foreign student meetings, Korean classes, and liberal arts classes between April 15 and June 30, 2015, with the help of foreign student management center in the university and the deans of each department who is in charge of foreign students. The total number of foreign students in 1 University was 412; among them, the number of subjects who voluntarily signed the written consent

form for the survey after listening to the explanation of the purpose and intent of this study was 247. However, 15 subjects with faithless responses were excluded; and two subjects from Vietnam, one subject from Saudi Arabia, and one subject from Congo were also excluded considering the sociodemographic differentiation from Chinese and Indonesian who accounted for most of the research subjects. Thus, a total of 228 subjects were used for this analysis. For the nationality of the target students, Chinese students accounted for 65.4% (149 persons), and Indonesian students accounted for 34.6% (79 persons).

The questionnaire was translated into Chinese and English considering the nationality of the subject. The validity of the translated questionnaire was tested by two Chinese and English experts, as well as by two nursing professors. A preliminary survey was taken by five Chinese and Indonesian foreign students, and the degree of implementation was examined. Then, the questionnaire was used after a final modification. For Chinese foreign students, the questionnaire in Chinese was used. For Indonesian foreign students, some students had difficulty in understanding the questionnaire in English, and thus a staff from the foreign student management center explained the questionnaire in Indonesian. The average total time to complete the survey was about 30 minutes.

2.3. Research Tool

1) Knowledge about tuberculosis

In the case of knowledge regarding tuberculosis, the tool of [13] (a total of 30 questions) was used. The subordinate domains of the tool consisted of a total of 30 questions: 14 questions on epidemiology and route of infection, five questions on screening for tuberculosis prevention, five questions on the importance of treatment, three questions on infected person screening and cognitive for latent tuberculosis, and three questions on the symptoms of tuberculosis. Subjects responded 'Yes', 'No', or 'Do not know' to answer each question. One point was awarded in the case of correct answer, and 0 points in the case of incorrect answer. The scores were totaled and used for the analysis. The reliability at the time of the tool development was Cronbach's α= .87, and the reliability in the present study was Cronbach's α= .812 (Table 1).

2) Attitude toward tuberculosis

In the case of attitude toward tuberculosis, the [11] (a total of 15 questions) was used. To measure the response, a Likert-type four-point scale was used for each question, from '1 point, strongly disagree' to '4 points, strongly agree'. The range of the score was between 15 and 60 points, and a high score indicated positive attitude toward tuberculosis. The reliability at the time of the tool development was Cronbach's α= .83, and the reliability in the present study was Cronbach's α= .800 (Table 1).

3) Preventive behavior against tuberculosis

In the case of preventive behavior against tuberculosis, [11] was used. To measure the preventive behavior against tuberculosis, a total of 15 questions, include questions on diet, health life, exercise, lifestyle, obesity management, smoking cessation, and screening were used. For the response method, a Likert-type four-point scale was used for each question, from '1 point, strongly disagree' to '4 points, strongly agree'. The range of the score was between 15 and 60 points, and a high score indicated an outstanding power of execution for preventive behavior against tuberculosis. The reliability at the time of tool development was Cronbach's α= .74, and the reliability in the present study was Cronbach's α= .872 (Table 1).

Table 1. Reliabilities(Croronbach's α) for Study Variable Scales

	Variables name	Number of item	Croronbach's α for delated subdomain	Total Chronbach's α
knowledge of tuberculosis	Epidemiology and route of infection	14	.807	.812
	Screening for tuberculosis prevention	5	.771	
	The importance of treatment	5	.777	
	Infected person screening and cognitive for latent tuberculosis	3	.775	
	Symptoms of tuberculosis	3	.784	
Attitude score about tuberculosis		15	-	.800
Preventive behavioral score about tuberculosis		15	-	.872

2.4. Data Analysis Method and Procedure

The data analysis for achieving the purpose of this study was performed using the IBM SPSS Statistics Ver. 21 program, and the detailed analysis method is as follows.

1) The demographic characteristics of the research subjects were examined by performing a frequency analysis.

2) To examine the relation between variables, a correlation analysis was performed.

3) The reliability of the tools used in this study was tested through the Cronbach' α coefficient.

4) In this study, to test the mediating effect between each variable (knowledge, attitude, and preventive behavior toward tuberculosis), the procedure of Baron and Kenny [28] was used. To verify a mediating effect, (1) an independent variable should have a significant effect on the dependent variable in a regression equation, (2) an independent variable should have a significant effect on the assumed mediating variable, and (3) the mediating variable should be able to explain the variance of the dependent variable in the regression equation. When adding a mediating variable in a regression analysis, a full mediation relation is established when the coefficient of the independent variable decreases from a significant level to a non-significant level, and a partial mediation relation is established when the coefficient decreases, but does not decrease to a non-significant level. To examine if the above condition is satisfied, the result of the correlation analysis was examined in stages (1) and (2). In stage (3), the effect of the knowledge about tuberculosis on preventive behavior (i.e., dependent variable) was controlled and the effect of attitude toward tuberculosis (i.e., mediating variable) on the dependent variable was examined based on a hierarchical regression analysis.

2.5. Ethical Consideration for the Research Subjects

This research was approved by the IRB of Y University (Approval number: YSUIRB-201509-HR-02). Questionnaires translated into Chinese and English were used so that the research subjects could understand the purpose and intent of this study. For Indonesian students, most of them understood the questionnaire in English; but regarding insufficient contents, the staff at the foreign student management center at the university who had

majored in Indonesian explained the questionnaire in person. For written consent, subjects were required to write down the name and department in one's own handwriting; and for the questionnaire, anonymous survey was conducted separately from the written consent. In addition, it was explained that the subjects can withdraw from participation even after the completion of the survey and that there would be no disadvantage in case of withdrawal.

3. Results

3.1. General Characteristics of the Subjects

Table 2 summarizes the general characteristics of the research subjects. For the gender of subjects, 60.5% were males (135 persons) and 39.5% were females (88 persons). The average age was 23.07±2.096. The average residence period in Korea was 24.53±17.307 months, and 1~2 years was 32% of the total, which was the most common.

Table 2. General Characteristics of Subjects

Characteristics	Category		N	%	Mean	Standard deviation(±)
Gender	male		135	60.5		
	female		88	39.5		
Age	below 22 years old		95	42.0		
	less than 22~26 years old		101	44.7	23.07	2.096
	more than 26 years old		30	13.3		
Korea residence period	below 1 year		54	23.7		
	less than 1~2 year		73	32.0		
	less than 2~3 year		52	22.8		
	more than 3 year		49	21.5		
	months				24.53	17.307
Sleeping hours	less than 5 hour		25	11.1		
	less than 5~6 hour		67	29.6		
	less than 6~7 hour		80	35.4		
	less than 7~8 hour		37	16.4		
	more than 8 hour		17	7.5		
Level of fatigue people usually notice themselves	very tired		5	2.2		
	tired		39	17.3		
	normal		146	64.6	3.05	.668
	not tired		34	15.0		
	not tired at all		2	0.9		
Smoking	never smoked		145	64.4		
	stopped smoking		34	15.1		
	currently smoking		46	20.4		
		Daily smoking amount			7.74	5.767

※ except for the missing values

For the number of sleeping hours of subjects, 6~7 hours was 35.4% of the total, which was the most common. Less than 5 hours was 11.6%, and more than 8 hours was 7.5%. For the level of fatigue in daily life, the average score was 3.05±0.668 based on a five-point scale, and 64.6% of the total subjects responded ʹnormalʹ. For smoking, 64.4% of the subjects responded ʹnever smokedʹ, and 15.1% responded ʹstopped smokingʹ. On the other hand, 20.4% of the total subjects responded ʹcurrently smokingʹ, and the daily smoking amount was 1.54±4.088 cigarettes on average.

3.2 Tuberculosis-related Characteristics of the Subjects

Table 3 summarizes the tuberculosis-related characteristics of the research subjects. For the experience of tuberculosis-related education at this university, 59.6% of subjects responded that they had received previous education, while 40.4% responded they had never received tuberculosis-related education. For the source of information and knowledge about tuberculosis, 37.9% of the total subjects responded the Internet, followed by TV or news (23.7%), hospital and health center (16.5%), university medical center (10.3%), friends and family (7.1%), and other (4.5%).

For the tuberculosis infection experience, 94.5% of subjects responded that they do not have an infection experience, but 5.5% (12 subjects) responded they have experienced a tuberculosis infection. Among them, 10 subjects (83.3%) responded that they received treatment, and two subjects responded that it was cured without treatment. For the experience of infection with tuberculosis by people around them, 76.4% of the subjects responded ʹNoʹ, but 23.6% responded ʹYesʹ. For the relationship with a person infected with tuberculosis, 27 out of 50 subjects who responded ʹYesʹ responded ʹcollege friendsʹ (54%), followed by family in the home country (20%, 10 subjects), others (16%), and friends in the home country (10%).

For the advisor in case of tuberculosis infection, 34.7% of the total subjects responded parents in the home country, followed by physician in a hospital (29.7%), professor or a staff in my university (11.3%), friends (7.7%), friends in other universities (5.9%), and nurse in my university clinic (4.5%).

Table 3. The Characteristics Related to Characteristics of Subjects

Characteristics	Category		N	%
Experience who received education for tuberculosis at this university	yes		134	59.6
	no		91	40.4
Source of information and knowledge on tuberculosis	television or newspaper		53	23.7
	internet		85	37.9
	university medical center		23	10.3
	friends and family		16	7.1
	hospitals, health centers		37	16.5
	others		10	4.5
TB(Tuberculosis) infection experience	yes		12	5.5
	TB treatment experience	yes	10	83.3
		no	2	16.7
	no		207	94.5

			N	%
Experience of infection with tuberculosis by people around a person		yes	50	23.6
	relationship with a person infected with tuberculosis	A member of my family in my home country	10	20.0
		friend in my home country	5	10.0
		university friends	27	54.0
		others	8	16.0
	no		162	76.4
Advisor in case of tuberculosis infection	parents in my home country		77	34.7
	Korean university friends		5	2.3
	friends from my home country or my university		17	7.7
	foreign university friends		13	5.9
	professor or a staff in my university		25	11.3
	nurse in my university clinic		10	4.5
	physician in a hospital		66	29.7
	others		9	4.1

※ except for the missing values

3.3 Subjects' Knowledge, Attitude, and Preventive behavior Level Toward Tuberculosis

Table 4 summarizes the level of subjects′ knowledge, attitude, and preventive behavior toward tuberculosis.

The total percentage of correct answers for the 30 questions on the subjects′ knowledge about tuberculosis was 44.9% (13.54±5.399 correct answers on average). Among the questions on the knowledge about tuberculosis, the subordinate domain with the highest percentage of correct answers was screening for tuberculosis prevention, where the percentage of correct answers was 63.6% (3.18±1.327 correct answers on average out of five questions). The subordinate domain with the lowest percentage of correct answers was symptoms of tuberculosis, where the percentage of correct answers was 35.1% (0.96±1.114 correct answers on average out of three questions).

For the subjects′ attitude toward tuberculosis, the average score was 56.99±6.933 out of 75 points (15 questions with a five-point scale); and for the preventive behavior against tuberculosis, the average score was 59.61±7.634 out of 75 points (15 questions with a five-point scale).

Table 4. The Subject's Knowledge, Attitude and Preventive Behavioral Score Towards Tuberculosis

Variables	N	Min	Max	Mean	S.D	a percentage of correct answers (%)
Total score of knowledge of tuberculosis	195	0.00	25.00	13.54	5.399	44.9
Epidemiology and route of infection	204	0.00	12.00	5.44	2.334	39.2

Screening for tuberculosis prevention	218	0.00	5.00	3.18	1.327	63.6
The importance of treatment	220	0.00	5.00	2.40	1.506	47.8
Awareness of latent tuberculosis and contact investigation	225	0.00	10.00	1.54	1.369	48.9
Symptoms of tuberculosis	223	0.00	3.00	0.96	1.114	35.1
Attitude score about tuberculosis	211	43.00	75.00	56.99	6.933	-
Preventive behavioral score towards tuberculosis	218	44.00	75.00	59.61	7.634	-

3.4 Test of the Mediating Effect for Each Variable (Knowledge, Attitude, and Preventive Behavior Toward Tuberculosis)

In this study, to test the mediating effect between each variable (knowledge, attitude, and preventive behavior toward tuberculosis), the procedure asserted by Baron and Kenny [28] was used. The result showed that the attitude toward tuberculosis had a mediating role for the relation between the knowledge about tuberculosis and the preventive behavior against tuberculosis. In this study, only the results with a mediating effect were described. Tables 5~8 and Figures 1~3 show the results depending on the procedure of each step for examining the mediating effect between the variables.

3.4.1 Correlation Analysis among the Knowledge, Attitude, and Preventive Behavior

Toward Tuberculosis ; To test the mediating effect of the subjects′ attitude toward tuberculosis, a correlation analysis was performed for the knowledge, preventive behavior, and attitude toward tuberculosis, and the results are summarized in Table 5.

For the subordinate domains of the knowledge about tuberculosis (i.e., independent variable), screening for tuberculosis prevention (r=.198, p<.01), the importance of treatment (r=.263, p<.001), symptoms of tuberculosis (r=.152, p<.05), and total score of knowledge about tuberculosis (r=.230, p<.01) had a significant positive correlation with the attitude toward tuberculosis (i.e., mediating variable). The attitude toward tuberculosis (i.e., mediating variable) also had a significant positive correlation with the preventive behavior against tuberculosis (i.e., dependent variable) (r=.496, p<.001).

In addition, for the subordinate domains of the knowledge about tuberculosis (i.e., independent variable), screening for tuberculosis prevention (r=.199, p<.01), importance of treatment (r=.217, p<.01), infected person screening and cognitive for latent tuberculosis (r=.146, p<.05), and total score of knowledge about tuberculosis (r=.183, p<.05) had a significant positive correlation with the preventive behavior against tuberculosis (i.e., dependent variable).

Table 5. An Analysis of Correlation among Preventive Behavior, Attitude towards Tuberculosis, and Knowledge about Tuberculosis

	1	2	3	4	5	6	7	8
1.Epidemiology and route of infection	1							
2.Screening for tuberculosis prevention	.495***	1						
3.The importance of treatment	.376***	.510***	1					
4.Awareness of latent tuberculosis and contact investigation	.368***	.481***	.390***	1				
5.Symptoms of tuberculosis	.334***	.344***	.358***	.503***	1			

6.Total score of knowledge of tuberculosis	.792***	.771***	.700***	.710***	.618***	1		
7.Attitude about tuberculosis	.097	.198**	.263***	.091	.152*	.230**	1	
8.Preventive behavioral towards tuberculosis	.116	.199**	.217**	.146*	.093	.183*	.496***	1
M	5.21	3.18	2.40	1.47	0.96	13.64	56.99	59.61
S.D	2.223	1.327	1.506	1.146	1.114	5.402	6.933	7.634

3.4.2 The Mediating Effect of Attitude toward Tuberculosis on the Relation between the Knowledge about Tuberculosis and Preventive behavior Against Tuberculosis:

a. The effect of knowledge about screening for tuberculosis prevention on the tuberculosis prevention behavior through the mediation of the attitude toward tuberculosis: To verify the mediating effect of attitude toward tuberculosis on the relation between knowledge about screening for tuberculosis prevention and tuberculosis prevention behavior, a three-step regression analysis was performed. In the first step, the standardized regression coefficient was .199, showing a positive effect; in the second step, the standardized regression coefficient was .198; and in the third step, the standardized regression coefficient of the independent variable was .064 and the regression coefficient of the mediating variable was .505. The t and p values that can estimate the significance level showed significant results in the first and second steps, and the standardized regression coefficient of the independent variable did not show a significant result in the third step. Thus, the attitude toward tuberculosis had a positive full mediating effect on the relation between the knowledge about screening for tuberculosis prevention and the tuberculosis prevention behavior (Table 6).
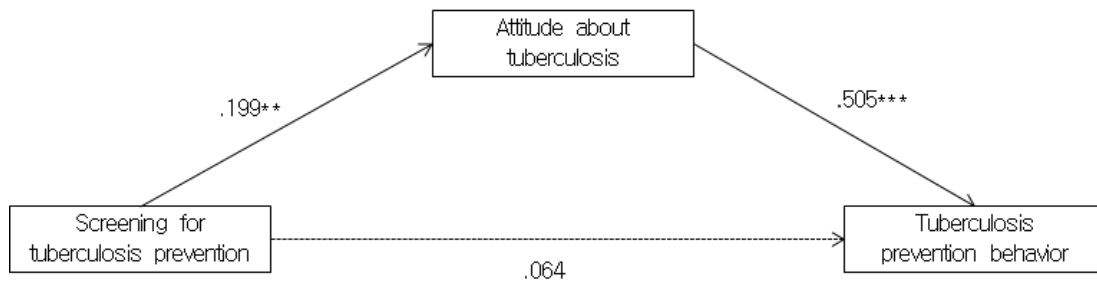
Table 6. An Effect that Knowledge about Preventive Tuberculosis Investigation has on Preventive behavior Towards Tuberculosis through the Mediation of Attitude

step	Variables	Unstandardized coefficient		Standardized coefficient	t (p)	Collinearity statistics		F (p)	R2	ΔR2
		B	S.E	β		Tolerance	VIF			
1	Screening for tuberculosis prevention-> Tuberculosis prevention behavior	1.131	.386	.199	2.932** (.004)	1.000	1.000	8.595** (.004)	.040	-
2	Screening for tuberculosis Prevention-> attitude about tuberculosis	1.049	.365	.198	2.874** (.004)	1.000	1.000	8.260** (.004)	.039	-
3	Screening for tuberculosis prevention-> Tuberculosis prevention behavior	.369	.357	.064	1.035 (.302)	.960	1.041	36.590*** (.000)	.272	.232
	Attitude about tuberculosis-> Tuberculosis prevention behavior	.549	.068	.505	8.115*** (.000)	.960	1.041			

Figure 1. An Effect that Knowledge about Preventive Tuberculosis Investigation has on Preventive behavior Towards Tuberculosis through the Mediation of Attitude towards Tuberculosis

b. The effect of knowledge about the importance of treatment on the tuberculosis prevention behavior through the mediation of the attitude toward tuberculosis: To verify the mediating effect of the attitude toward tuberculosis on the relation between the knowledge about the importance of treatment and the tuberculosis prevention behavior, a three-step regression analysis was performed. In the first step, the standardized regression coefficient was .217 showing a positive effect; in the second step, the standardized regression coefficient was .263; and in the third step, the standardized regression coefficient of the independent variable was .068 and the regression coefficient of the mediating variable was .475. The t and p values that can estimate the significance level showed significant results in the first and second steps, and the standardized regression coefficient of the independent variable did not show a significant result in the third step. Thus, the attitude toward tuberculosis had a positive full mediating effect on the relation between the knowledge about the importance of treatment and the tuberculosis prevention behavior (Table 7).
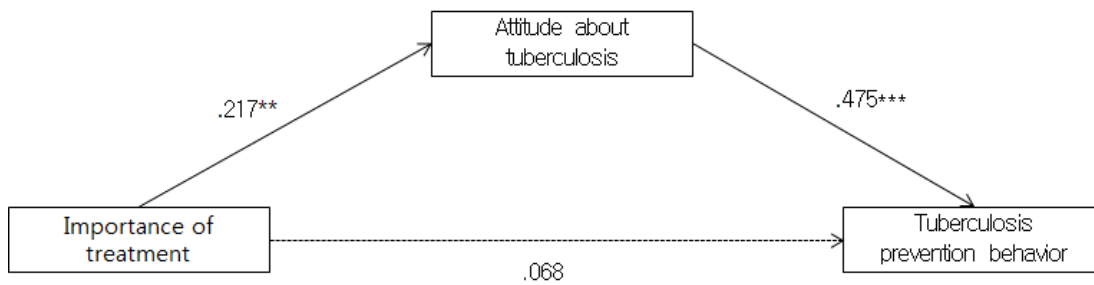
Table 7. An Effect that Knowledge about the Importance of Treatment has on Preventive behavior Towards Tuberculosis through the Mediation of Attitude Towards Tuberculosis

step	Variables	Unstandardized coefficient		Standardized coefficient	t (p)	Collinearity statistics		F (p)	R2	ΔR2
		B	S.E	β		Tolerance	VIF			
1	Importance of treatment-> Tuberculosis prevention behavior	1.106	.343	.217	3.225** (.001)	1.000	1.000	10.399** (.001)	.047	-
2	Importance of treatment-> Attitude about tuberculosis	1.223	.316	.263	3.876*** (.000)	1.000	1.000	15.021*** (.000)	.069	-
3	Importance of treatment-> Tuberculosis prevention behavior	.344	.325	.068	1.059 (.291)	.925	1.081	32.287*** (.000)	.248	.201
	Attitude about tuberculosis-> Tuberculosis prevention behavior	.515	.070	.475	7.369*** (.000)	.925	1.081			

Figure 2. An effect that Knowledge about the Importance of Treatment has on Preventive behavior Towards Tuberculosis through the Mediation of Attitude Towards Tuberculosis

c. The effect of the total score of knowledge about tuberculosis on the tuberculosis prevention behavior through the mediation of the attitude toward tuberculosis: To verify the mediating effect of the attitude toward tuberculosis on the relation between the total score of knowledge about tuberculosis and the tuberculosis prevention behavior, a three-step regression analysis was performed. In the first step, the standardized regression coefficient was .183 showing a positive effect; in the second step, the standardized regression coefficient was .230; and in the third step, the standardized regression coefficient of the independent variable was .020 and the regression coefficient of the mediating variable was .485. The t and p values that can estimate the significance level showed significant results in the first and second steps, and the standardized regression coefficient of the independent variable did not show a significant result in the third step. Thus, the attitude toward tuberculosis had a positive full mediating effect on the relation between the total score of knowledge about tuberculosis and the tuberculosis prevention behavior (Table 8).
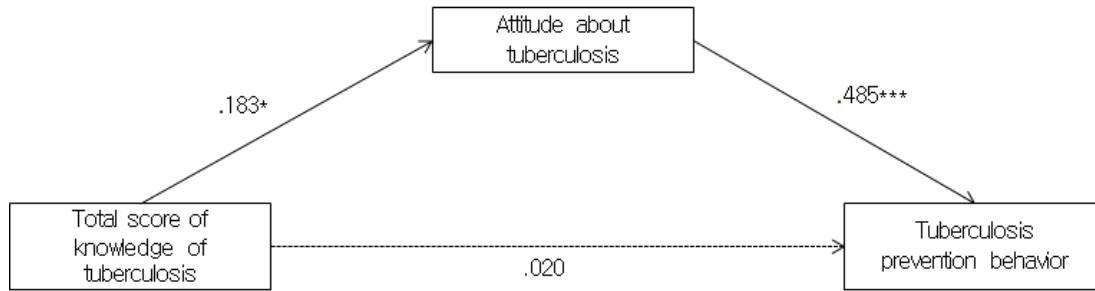
Table 8. An Effect that a Total Score in Knowledge about Tuberculosis has on Preventive Behavior towards Tuberculosis through the Mediation of Attitude towards Tuberculosis

step	Variables	Unstandardized coefficient		Standardized coefficient	t (p)	Collinearity statistics		F (p)	R2	ΔR2
		B	S.E	β		Tolerance	VIF			
1	Total score of knowledge of tuberculosis-> Tuberculosis prevention behavior	.256	.102	.183	2.512* (.013)	1.000	1.000	6.312* (.013)	.034	-
2	Total score of knowledge of tuberculosis-> Attitude about tuberculosis	.300	.096	.230	3.122** (.002)	1.000	1.000	9.747** (.002)	.053	-
3	Total score of knowledge of tuberculosis-> Tuberculosis prevention behavior	.029	.098	.020	.294 (.769)	.942	1.062	26.829*** (.000)	.240	.206
	Attitude about tuberculosis-> Tuberculosis prevention behavior	.526	.075	.485	7.033*** (.000)	.942	1.062			

Figure 3. An Effect that a Total Score in Knowledge about Tuberculosis has on Preventive behavior Towards Tuberculosis through the Mediation of Attitude Towards Tuberculosis

4. Discussion

This study aimed to prepare a basic data for the development of a health education program for an effective tuberculosis management of foreign students from countries with high risk of tuberculosis infection. The current status of foreign students′ knowledge, attitude, and preventive behavior toward tuberculosis was examined, and the direct and indirect effect between these variables was also investigated.

As for the tuberculosis-related characteristics, 11 foreign students (5.5%) had a tuberculosis infection experience; and among the 23.6% who responded ′Yes′ to the experience of infection with tuberculosis by people around a person, 54% responded ′college friends′. This was much higher than the result of [13], where 10.3% had previous experience of tuberculosis infection by people around a person and 6.0% responded high school friends. As the above results suggest, it is an urgent matter to prepare an effective tuberculosis management for Korean college students, including foreign students in a situation where the total number of reported foreign patients with tuberculosis has increased in Korea [4].

For tuberculosis-related health education, 59.6% responded that they had received prior education, which was higher than the tuberculosis education for Korean high school students (39.1%), as shown by [13]. However, for source of information and knowledge about tuberculosis, 61.6% of the foreign students responded the Internet or TV, and 10.3% responded university medical center in the present study, while 36.2% responded a health class provided by the school in the study by [13]. Thus, it is thought that tuberculosis-related health education provided by the university is considered ineffective. Therefore, it is essential to develop and implement a systematic health education program for foreign students at the university level.

For the subjects′ knowledge about tuberculosis, the total percentage of correct answers was 44.9%, which was similar to the results by [13], who studied high school students, but showed a lower percentage than that of [23], who studied North Korean refugee parents. In particular, for symptoms of tuberculosis, the percentage of correct answers was lower than those in other studies, which indicates that the acquisition of knowledge about tuberculosis through tuberculosis-related health education and the Internet or mass media was ineffective. For the attitude toward tuberculosis, the average score was 56.99±6.933 out of 75 points, which was higher than 55.14 points from [13], where a perfect score of 60 points with a four-point scale was converted to a perfect score of 75 points, but was lower than 61.68 points from [23]. It is thought that the low attitude score was attributed

to the lack of knowledge about tuberculosis. For tuberculosis prevention behavior, the average score was 59.61 ± 7.634 out of 75 points (15 questions with a five-point scale), which was similar to 60.49 points from Lee and Park [23], where a perfect score of 60 points with a four-point scale was converted to a perfect score of 75 points. The above results suggest that the attitude and preventive behavior of the subjects would be improved when the knowledge about tuberculosis increases, thus, a proper tuberculosis-related health education for foreign students is necessary.

In the correlation analysis among the knowledge about tuberculosis, attitude toward tuberculosis, and tuberculosis prevention behavior, a positive correlation was found between the knowledge about tuberculosis and the attitude toward tuberculosis ($r=.230$, $p<.05$), and between the total score of knowledge about tuberculosis and the tuberculosis prevention behavior ($r=.183$, $p<.05$). In the study by [23], the knowledge about tuberculosis also had a significant positive correlation with the attitude toward tuberculosis ($r=.270$, $p<.05$) as well as the tuberculosis prevention behavior ($r=.346$, $p<.05$). Therefore, for active attitude and preventive behavior toward tuberculosis, proper knowledge regarding tuberculosis is highly important.

The major purposes of this study are to examine the current status of foreign students′ knowledge, attitude, and preventive behavior toward tuberculosis to implement an effective tuberculosis management of foreign students and to examine the direct and indirect effects between these variables. Thus, the mediating effect between each variable was analyzed. The results showed that the attitude toward tuberculosis had a positive full mediating effect on the relation between the knowledge about screening/knowledge about the importance of treatment/total score of knowledge about tuberculosis and the tuberculosis prevention behavior. In other words, the tuberculosis prevention behavior could be improved when one has an active attitude toward tuberculosis, despite insufficient knowledge about tuberculosis screening. This is a meaningful result in the current situation where tuberculosis-related health education for foreign students is insufficient with an insignificant effect.

In other words, based on a lot of previous studies, it was found that the knowledge about tuberculosis is an important element affecting the treatment compliance of tuberculosis [13,14] as well as an important factor for tuberculosis prevention behavior [13,14,23,24]. Moreover, one cannot actively cope with tuberculosis prevention behavior and treatment when the knowledge about tuberculosis is deficient. Therefore, proper health education is essential; and for effective tuberculosis management, development of an effective education program, which can improve the knowledge about tuberculosis, is more important than anything else. However, it takes a lot of time to develop a health education program that changes the attitude of foreign students with various linguistic and cultural backgrounds.

In this context, it is urgent to prepare measures at the university level before launching a full-scale development and implementation process of a tuberculosis-related health education program. The benefits of health behavior, disorder for activity, interpersonal relation influence, and situational influence that are perceived by an individual affect the health behavior of the individual [29]. Thus, it is necessary to promote tuberculosis prevention behavior, introduce a method with easy access through close cooperation with health screening centers, and exchange information via foreign student meetings. In particular, as shown in the results section of this study, knowledge about tuberculosis screening and about the importance of treatment affected the tuberculosis prevention behavior through the mediation of attitude toward tuberculosis. Thus, if screening is easily available and knowledge about the importance of treatment is continuously provided through direct screening experience or active promotion and campaign, foreign students′ attitude toward tuberculosis could be changed, and the tuberculosis prevention

behavior would be improved through such mediation. Therefore, universities need to be interested in the health care of foreign students as well as attracting foreign students, and should promote tuberculosis prevention behavior based on the change in foreign students′ perception and attitude toward tuberculosis by performing active tuberculosis management activities and by managing foreign students via personal contact through allocating specialized personnel in the health care department within universities.

5. Conclusion

Based on the results of this study, it was found that the current status of tuberculosis infection for foreign students is at a serious level, and the health-related policy for foreign students and the resultant health education are ineffective. Therefore, accurate knowledge about tuberculosis needs to be provided, and a health education program that can change the perception and attitude toward tuberculosis needs to be developed. In particular, in the current situation where tuberculosis management of foreign students is urgent, active promotion and activities that can change the perception and attitude toward tuberculosis are needed before a full-scale development and implementation of a health education program is launched. Thus, universities need to be interested in the health care of foreign students, and also need to prepare relevant measures.

Based on the results of this study, the following suggestions are made.

First, this study is based on a single university and foreign students from two countries among the countries with high risk of tuberculosis infection. Thus, there exists a limitation in generalization of the results. Therefore, further studies incorporating more universities and countries need to be performed.

Second, in this study, the mediating effect between variables (knowledge about tuberculosis, attitude toward tuberculosis, and tuberculosis prevention behavior) was examined through a correlation that is limited to the data obtained from the research subjects. Therefore, in future studies, the overall direct and indirect effects for each variable need to be examined through path analysis, and the like, based on more subjects.

Third, based on the comprehensive understanding of the degree of knowledge about tuberculosis and tuberculosis-related knowledge demand of foreign students examined in this study, an effective tuberculosis-related health education program needs to be developed.

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