

Original article

Factors predicting preventive behaviors of pulmonary tuberculosis among high school students in Bangkok

Chanyaruk Sawangsuk^a, Piyatida Nakagasien^{b,*}

^a Department of Public Health Nursing, Faculty of Nursing, Mahidol University, Nakhon Pathom, Thailand

^b Department of Public Health Nursing, Faculty of Nursing, Mahidol University, Nakhon Pathom, Thailand

Background: The incidence of pulmonary tuberculosis patients in children and adolescents among High school students in Bangkok is increasing. Current reports indicate that tuberculosis epidemics are more prevalent and literature review found that no studies were conducted so far about factors with correlations with and influence on tuberculosis preventive behaviors in high school adolescents in Bangkok.

Objectives: This correlation research aimed to determine predictive power of gender, health literacy and social support on preventive behaviors of pulmonary tuberculosis among high school students in Bangkok based on Nutbeam (2008)'s framework.

Methods: The sample of this study was 182 high school students in Bangkok. The sample was selected based on a simple random sampling. Data were collected by using a 4-part questionnaire.

Results: The results of this research indicated that gender and social support in preventing pulmonary tuberculosis in schools had significantly positive correlation with preventive behaviors of pulmonary tuberculosis ($r = 0.222$, $r = 0.264$, $P < 0.001$, respectively). Health literacy in preventing pulmonary tuberculosis had moderate positive correlation with preventive behaviors of pulmonary tuberculosis ($r = 0.510$, $P < 0.001$). Gender, health literacy and social support could jointly predict preventive behaviors of pulmonary tuberculosis among high school students in Bangkok ($\beta = 0.136, 0.461, 0.191$, $P < 0.05$, respectively). These factors could jointly predict 31.6% of the variation in preventive behaviors of pulmonary tuberculosis among high school students in Bangkok ($r = 0.562$, $P < 0.05$).

Conclusion: The study found that gender, health literacy on tuberculosis prevention and social support could predict tuberculosis preventive behaviors among high school students in Bangkok.

Keywords: Preventive behaviors of pulmonary tuberculosis/health literacy, social support, high school students.

Tuberculosis is a major public health problem that is escalating in incidence. In addition to Thailand, nearly every other country worldwide currently struggles with tuberculosis epidemics. Pulmonary tuberculosis is one of the primary causes of illness and death in people worldwide.⁽¹⁾ The organization reported that one-third of the global population has already contracted asymptomatic tuberculosis. The global prevalence of tuberculosis is 14.4 million people (219 per hundred thousand people). Furthermore,

approximately 9.15 million people are diagnosed with tuberculosis every year (139 per hundred thousand people), as many as 10.4 million people are re-diagnosed with tuberculosis (recurrent cases) each year (140 per hundred thousand people) and over 1.7 million people die from tuberculosis every year.⁽¹⁾

Meanwhile, an international study in tuberculosis in children and adolescents reported that approximately 10 people aged between 11 and 18 years at a high school in England had tuberculosis. The aforementioned high school performed tuberculin skin tests and found that approximately 200 students and staff had positive results and required anti-tuberculosis medications.⁽¹⁾ As for Thailand and tuberculosis in children and adolescents. Furthermore, in 2017, a tuberculosis epidemic report stated that 16 students at a high school in Sathorn District, Bangkok, had

*Correspondence to: Piyatida Nakagasien, Department of Public Health Nursing, Faculty of Nursing, Mahidol University, Nakhon Pathom 73170, Thailand.

E-mail: piyatida.nak@mahidol.ac.th

Received: December 4, 2019

Revised: February 10, 2020

Accepted: September 15, 2020

tuberculosis; of these students, two had the illness in the pleura, while 14 had tuberculosis in the lungs. The same report also noted two cases of pulmonary tuberculosis at an all-girls high school in Sathorn district.⁽²⁾

As for areas in which tuberculosis epidemics exist in Thailand, Bangkok is one province with a high incidence report of tuberculosis because Bangkok is a highly urban and heavily crowded environment.⁽³⁾ Tuberculosis epidemiological data for Bangkok reveals that the most prevalent areas of Bangkok for tuberculosis are Bang Kho Laem, Khlong San and Yannawa districts with illness rates of 209.12, 204.41 and 178.45 per hundred thousand people, respectively. Accordingly, students made up one-seventh of new incidents of tuberculosis, or 3.7% of all cases. In 2017, tuberculosis epidemics were found in many high schools in Bangkok.⁽³⁾ Furthermore, the research found through survey data that a key factor causing epidemics is the school environment. Schools admitted large numbers of students. According to the ratio of students per area, students had limited space inside schools, and education and activities were provided in a crowded setting. In addition, most students stayed together in poorly-ventilated air-conditioned rooms with no suction fans. Therefore, environment is a major factor contributing to dormant tuberculosis infections.⁽⁴⁾ In addition, risky behaviors during school age such as not wearing masks when sick or sneezing significantly contribute to health problems and impacts.⁽⁵⁾

With the presence of tuberculosis epidemics in high school students, the Bangkok Sanitation Department in collaboration with the Bureau of acquired immunodeficiency syndrome, tuberculosis and sexually transmitted infections jointly developed guidelines in 2017 for dealing with tuberculosis in schools and work procedures for handling tuberculosis incidences in students. These guidelines and procedures served as collaboration measures between related agencies for systematically controlling and preventing the spread of tuberculosis and covered four areas as follows: 1) management covering specification of guidelines with emphasis on comprehensively identifying students with tuberculosis and rapidly screening risk-group students in order to provide standard treatment and care; 2) environmental control covering the specification of guidelines for managing the physical and biological aspects of school environments appropriately with education provision

to prevent the harboring of diseases; 3) control and prevention on the personal level with focus on building networks and developing systems for structured information-sharing about students with tuberculosis and monitoring and ensuring that students who are ill receive proper treatment and medications; and 4) communication of knowledge about tuberculosis through supporting education on tuberculosis prevention and promoting management potential in tuberculosis prevention and control for significantly involved personnel in school such as teachers and student health leaders. However, mobilizing human resources to engage in tuberculosis prevention and control activities is only a part of the solution to tuberculosis. The most effective way to resolve and prevent tuberculosis is to promote good health behaviors in students. Good health behaviors include appropriate health behaviors and disease preventive behaviors. If students take responsibility for personal health behaviors, and students are encouraged to learn and possess the ability to appropriately care for their own health and that of families and communities, the problem will be resolved.⁽²⁾

The objective of this study was to investigate is in studying the factors capable of influencing and predicting tuberculosis preventive behaviors in high school students. The aforementioned factors are gender, health literacy, and social support. The researcher found that previous studies did not examine the above factors to clearly determine which factors could affect tuberculosis preventive behaviors in high school students. As a result, the findings of the present study describe the relationships of the above factors in addition to the factors' predictive powers on influencing tuberculosis preventive behaviors in high school students. In addition, since the researchers conducted the present study because the researchers work as community nurse practitioner under the Bangkok Health Office and providing nursing services in promoting and protecting health is an important aspect in the surveillance of student health in schools. Moreover, the researchers conducted the study because the area where the researcher works, as previously stated above, has tuberculosis epidemics in high schools. In any case, the findings of the present study should benefit enhancement of personal abilities in effective tuberculosis preventive behaviors and sustainably prevent tuberculosis. The study's findings should also be applicable in improving work plans or creating health policies for organizing effective

tuberculosis prevention systems in schools to lower the chances of tuberculosis spreading to students' family members and communities and to truly resolve tuberculosis as a national public health problem.

Materials and methods

Data collection was performed from May 2019 to July 2019. The subjects were Thai students aged from 14 - 17 years and study was 107,456 Matthayom 4 - 6 (senior high school) students from 129 schools in the first semester of the 2018 academic year under the Secondary Educational Service Area Office of Bangkok. The researcher set the inclusion criteria to ensure that the sample was representative of the study. The inclusion criteria were as follows: 1) Status as a current Matthayom 4 - 6 (senior high school) student; 2) No previous diagnosis with tuberculosis/no inclusion in a risk group in need of confirmatory diagnosis

The sample size capable of representing the research population was calculated by power of test analysis for multiple regression statistics using the G*power software version 3.1.9.2 with $R^2 = 0.54$, conducted a study in on the influencing factors of sexually-risky behaviors among 98 youths who were amphetamine users.⁽⁶⁾ That study set the power of test to 0.80 and statistical significance to 0.05 and had three predictive variables. Thus, when the values were replaced, the research sample size was 182. It is a random sampling, assuming that all schools in the population are equally likely to be randomized. Therefore, the acquisition of a sample of 5 schools out of a total of 129 schools was a suitable sample. The sample size is sufficient according to the formula for calculating G-power to prevent any discrepancies that may arise in this research.

The study has been approved by the Institutional Review Board (IRB) for Graduate Studies the Faculty of Nursing Science, Mahidol University (Research Ethics Code IRB-NS2019/05.0701). Every students and parents implied consent by action with written informed consent.

Measures

The present study employed questionnaires as the instruments for data collected, which was divided into the following four parts:

Part 1: Demographic data/personal information questionnaire

The demographic data questionnaire contained multiple-choice and fill-in-the-blank questions for a

total of four questions formed by the researcher on the following four topics: gender, grade point average (GPA), parents' occupation and average family income.

Part 2: Health literacy questionnaire

The researchers developed the questionnaire on health literacy by applying the health literacy scale provided by the Health Education Division, Department of Health Service Support, Ministry of Public Health.⁽⁶⁾ As suitable for the context of high school students. The instrument contained a total of 30 item with scores ranging from 30 - 150 points.

The health literacy on tuberculosis prevention scores were interpreted based on the following criteria:

Health literacy scores ranging from 1 - 50 points indicated a low level of health literacy about tuberculosis prevention.

Health literacy scores ranging from 51 - 100 points indicated a moderate level of health literacy about tuberculosis prevention.

Health literacy scores ranging from 101 - 150 points indicated a high level of health literacy about tuberculosis prevention.

Part 3: Questionnaire on the social support of the students (21 items)

Social support was evaluated by applying the social support questionnaire of Saelim S, *et al.*⁽⁷⁾, which contained a total of 21 items.

Total scores ranged from 21 - 105 points.

The social support scores were interpreted based on the following criteria:

Social support scores ranging from 1 - 35 points indicated that the sample had a low level of social support.

Social support scores ranging from 36 - 70 points indicated that the sample had a moderate level of social support.

Social support scores ranging from 71 - 105 points indicated that the sample had a high level of social support.

Part 4: Questionnaire on tuberculosis prevention behaviors

The questionnaire covers the practices or expressions of the students about disease preventing behaviors by using the questionnaire created by the researcher based on the researchers' review of related

literature and application of the guidelines in the disease prevention manual provided by the Department of Disease Control, Ministry of Public Health (2018), which usually contains a total of 24 items.

Total scores ranged from 24 - 96 points.

The scores for tuberculosis prevention behaviors were interpreted based on the following criteria:

Tuberculosis prevention behavior scores ranging from 1 - 32 points indicated that the sample had a low level of tuberculosis prevention behavior at school.

Tuberculosis prevention behavior scores ranging from 33 - 64 points indicated that the sample had a moderate level of tuberculosis prevention behavior at school.

Tuberculosis prevention behavior scores ranging from 65 - 96 points indicated that the sample had a high level of tuberculosis prevention behavior at school.

Statistical analyses

Descriptive statistics were studied by using the mean values and standard deviations (SD) and covered the first part with the general data questionnaire, the second part with the health literacy questionnaire, the third part with the pulmonary tuberculosis prevention health behaviors questionnaire and the fourth part with the social support questionnaire. Inferential statistics were analyzed

using the predictive powers of factors predicting preventive behaviors of pulmonary tuberculosis by using multiple regression analysis. A P -value < 0.05 was considered statistically significant.

Results

The results of this research indicated that gender and social support in preventing pulmonary tuberculosis in schools had low positive correlation with preventive behaviors of pulmonary tuberculosis ($r = 0.222$, $r = 0.264$, $P < 0.001$, respectively). Health literacy in preventing pulmonary tuberculosis had moderate positive correlation with preventive behaviors of pulmonary tuberculosis ($r = 0.510$, $P < 0.001$). Gender, health literacy and social support could jointly predict preventive behaviors of pulmonary tuberculosis among high school students in Bangkok ($\beta = 0.136, 0.461, 0.191$, $P < 0.05$, respectively). These factors could jointly predict 31.6% of the variation in preventive behaviors of pulmonary tuberculosis among high school students in Bangkok ($r = 0.562$, $P < 0.05$).

Part 1: Analysis of the sample's demographic data/personal information

The demographic data/personal information of the subjects who were high school students in Bangkok, Thailand, displays the descriptive statistics of the variables as shown in Table 1.

Table 1. Numbers and percentages of the sample categorized by demographic factors.

Demographic data	No.	Percentage
Gender		
Male	64	35.2
Female	118	64.8
Parent's occupation		
Company employee/worker	87	47.8
Private business/vendor	46	25.3
Civil servant/state enterprise employee	27	14.8
Other	15	8.2
Unemployed	7	3.8
Grade point average (GPA)		
Mean \pm SD	3.4 \pm 0.5	
Minimum - Maximum	1.0 - 4.0	
Average monthly family income (baht)		
Mean \pm SD	32,250.4 \pm 21,135.6	
Minimum - Maximum	7,000 - 100,000	

According to Table 1, most of the subjects were females at a number of 118 people (64.8%) with 64 males (35.2%). The data on parent's occupation for the sample indicated the most of the parents were company employees/workers at a number of 87 people (47.3%), followed by 46 parents who were had private businesses/were vendors (25.3%), 27 parents who were civil servants/state enterprise employees (14.8%) and 15 parents who had other occupations (8.2%) and 7 parents who were unemployed (3.8%).

Part 2: Subjects' health literacy about tuber-culosis prevention, social support and tuber-culosis prevention behavior.

The research shows the subjects' health literacy, social support and tuberculosis prevention behavior in Table 2.

According to Table 2, the subjects' mean score for health literacy about tuberculosis prevention was high, thereby indicating that the sample had an overall high level of health literacy about tuberculosis prevention. The mean score for social support was moderate, thereby indicating a moderate level of social support. And the subjects' mean score for tuberculosis prevention behavior was high, thereby indicating that the subjects had a high level of tuberculosis prevention behavior.

Part 3: Analysis of the correlations of health literacy about tuberculosis prevention and social support with the subjects' tuberculosis prevention behavior.

Pearson's rank correlation was used for the analysis of the correlations of health literacy about tuberculosis prevention and social support with the tuberculosis prevention behavior of the high schools students in Bangkok, Thailand. The findings are shown in Table 3.

The results of the correlation coefficient analysis between the independent and dependent variables, gender was negatively correlated with the subjects' tuberculosis prevention behavior ($r = -0.222$, $P < 0.001$), while health literacy about tuberculosis prevention and social support in preventing tuberculosis were found to be positively correlated with the subjects' tuberculosis prevention behavior ($r = 0.510$ and $r = 0.264$, $P < 0.001$, respectively).

Part 4: Results of the multiple regression analysis of the correlations of health literacy about tuberculosis prevention and social support with the subjects' tuberculosis prevention behavior.

The researchers performed correlation coefficient analysis based on the demographic data/personal information, gender and health literacy about tuberculosis prevention and social support. There was a correlation between the disease prevention behavior of the high school students, which supported the preliminary agreement for using multiple regression analysis in every aspect. Therefore, the researchers proceeded to perform multiple regression analysis by selecting independent variables for the enter regression equation. According to the results of the analysis, gender, health literacy about tuberculosis prevention and social support were the factors capable of co-predicting the tuberculosis prevention behavior of the high school students in Bangkok, Thailand at 31.6% ($r = -0.562$, $P < 0.05$). Gender, health literacy about tuberculosis prevention and social support were also found to be capable of predicting the tuberculosis prevention behaviors of the high school students in Bangkok ($\beta = -0.136$, 0.461 and 0.191, $P < 0.05$, respectively) as shown in Table 4.

Table 2. Mean, standard deviation, possible scoring range and actual scoring range of the subjects on scores for health literacy about tuberculosis prevention, tuberculosis behavior and social support (n = 182).

Variable studied	Mean	SD	Possible range	Actual range
Health literacy	108.6	12.1	30 - 150	74 - 135
Social support	64.0	13.0	21 - 105	30 - 92
Tuberculosis prevention behavior	67.1	9.1	24 - 96	43 - 90

Remarks: High mean scores indicate a strong positive effect.

Table 3. Correlation coefficients among the variables studied (n = 182).

	1	2	3	4
1. Gender	1			
2. Health literacy	-0.160*	1		
3. Social support	-0.065	0.140	1	
4. Tuberculosis prevention behavior	-0.222**	0.510**	0.264**	1

* $P < 0.05$, ** $P < 0.001$ **Table 4.** Multiple regression analysis of the factors predicting the subjects' tuberculosis prevention behavior.

Predictive variable	b	SE	β	t	P-value
Constant	25.398	6.186		4.106	<0.001*
Health literacy	0.344	0.047	0.461	7.277	<0.001*
Social support	0.134	0.044	0.191	3.048	0.003*
Gender	-2.590	1.196	-0.136	2.167	0.032*

* $P < 0.05$

Discussion

This study of the factors predicting the tuberculosis prevention behaviors of high school students at schools in Bangkok, Thailand, was based on a predictive correlational design with the objective of exploring the predictive power of the following factors: gender, tuberculosis prevention health literacy and social support for tuberculosis prevention behaviors in high school students in Bangkok, Thailand. The researcher can discuss the research findings according to the research hypotheses as follows:

Part 1. Subjects' demographic data/personal information

The fact that the sample was mostly composed of more females than males might have been due to the fact that the researcher invited and publicized the students who were interested in participating in the research project by volunteering, which indicates that female students had greater interest and volunteered to participate in the research project in greater numbers than the male students. This finding corresponds with the findings of previous studies conducted in samples of high school students or adolescents⁽⁸⁾, which found their respective samples who volunteered to participate in research projects to be composed of more females than males. The above findings can be explained in that the female gender is more public-minded and gives more importance to personal health care and the health care of others than males.⁽⁹⁾

The students' high grade point averages might have been due to the fact that the schools in the area from which data was collected for the present study were high schools had been evaluated by the Office for National Education Standards and Quality Assessment and ranked based on basic national testing scores for Grade 9 (Matthayom 3) and Grade 12 (Mattayom 6; O-net) and were ranked among the top 200 highest scoring schools in the country.⁽¹⁰⁾ This shows that the schools in the sample gave importance to academic strength and had been accredited for standards and educational quality by the National Institute of Educational Testing. Hence, the students of these schools tended to have good cognitive standards, including the receipt of intensive tutoring, attentive care and the creation of an academic climate focused on learning and skilled literacy for students.

Part 2. Health literacy about tuberculosis prevention, social support and co-prediction of tuberculosis prevention behaviors among high school students in Bangkok.

The researchers found the co-predictors of tuberculosis prevention behaviors among high school students to be gender, health literacy about tuberculosis prevention and social support. This indicated male and female high school students with health literacy about tuberculosis prevention and social support were able to predict tuberculosis prevention behaviors. The findings were consistent with the hypothesis.

Health literacy about tuberculosis prevention

The findings from this study indicate health literacy to be a major factor influencing sustainable and suitable tuberculosis prevention behaviors. Health literacy means a person's literacy and ability to filter, assess (data received from every channel) and make decisions to modify behaviors. Health literacy also includes cognitive processes and social skills in building motivation and the ability to access, understand and use information leading to appropriate decisions and good health.⁽¹¹⁾ The researchers studied and searched for domestic and foreign studies on health literacy about tuberculosis prevention among high school students and found no previous studies on health literacy about tuberculosis prevention in this group. The researcher found only one similar study on the correlations between health literacy regarding obesity, food consumption and exercising behaviors among children with obesity in Bangkok conducted by Tipwong A. According to the findings, the subjects had the highest mean score of health literacy about obesity in the area of access to health information skills, followed by decision-making skills. The mean scores for food consumption and exercising behaviors were also high⁽¹²⁾, possibly because the subjects were motivated by adoption of student health management policies. Problems from students' obesity were a major issue prioritized by the Ministry of Education. Health principles, thereby causing the students to organize activities and campaigns to build skills, encourage learning and support exercise, including sports equipment and access to electronic media while printed media was more easily accessed. Therefore, the aforementioned factors may have caused the students in the study to have the highest health literacy scores about obesity in the area of access to information skills. Furthermore, the researchers found a health literacy survey conducted among high school students on knowledge and health literacy about Guideline Daily Amounts (GDA) nutrition labels by Jaiboon O, *et al.* According to the findings, students (54.0%) had low health literacy about nutrition labels.⁽¹³⁾ Low health literacy about nutrition labels among the subjects may have been because Guideline Daily Amounts nutrition labels were far from the subjects' interests. The findings are obviously inconsistent with the findings of this study, which found the question with the highest mean score to be in the area of ability to read and understand self-care and protection data against tuberculosis from media such

as printed media, pamphlets, posters, doctor's orders, mobile phone applications and online media (Facebook, LINE) with a mean score of 4.02. In other words, if the subjects had high health literacy about tuberculosis prevention, the subjects would have high tuberculosis prevention behaviors. This corresponded with Nutbeam's health literacy concept (2008). Nutbeam described health literacy as the ability and skills to access information, knowledge and understanding to analyze and assess practices and self-management, including providing recommendations about personal, familial and community health to prevent tuberculosis infections. This was a major factor influencing students' health behaviors. Students with high health literacy were able to keep up with media to analyze, compare, assess and use health information to protect against tuberculosis. Nutbeam (2008) divided health literacy into the following three levels: Level 1 – Functional Health Literacy consisted of listening, speaking, reading and writing skills necessary for understanding and practice in daily life. Nutbeam explained further on health literacy as the ability to apply reading skills and numeracy skills such as reading consent forms, medical labels, writing healthcare information, understanding of information formats and the ability to read, write and listen to healthcare information from medical personnel such as in taking medications and making appointments. Level 2 – Communicative/Interactive Health Literacy consisted of basic and cognitive skills including social skills, ability to use news and apply news and information to modify health behaviors. Level 3 – Critical Health Literacy consisted of higher cognitive and social skills with the ability to compare and control situations in daily life.⁽¹⁴⁾ The high health literacy showed the subjects to have high overall health literacy about tuberculosis prevention. High school students in Bangkok in this study can be described as students born in 1995 – 2010 or Generation Z (Gen Z) with constant new technological developments, outstanding learning personalities, rapid access to technology and high confidence.⁽¹⁵⁾ Generation Z children are at an age with excellent development and ability to use technology because adolescents or most students are a group with access to media by multiple channels such as printed media, online media, the Internet and the LINE application, which differs from other age groups in the past.⁽⁶⁾ Furthermore, all of the schools selected for data collection in this study were located in an area under Secondary Education Service Area

Office 1 and Secondary Education Service Area Office 2, Bangkok. The education facilities were certified and assessed by the Office for National Education Standards and Quality Assessment⁽¹⁰⁾ with an emphasis on students' learning skills in the 21st century and preparations for students to have three basic knowledge and skills for living (3Rs) or reading, writing and arithmetic in addition to technology development to enable students access to news, information and sources of learning without borders.⁽¹⁶⁾

It can be concluded, therefore that the health literacy of the high school students was positively correlated with health behaviors about tuberculosis prevention. Higher health literacy among the high school students can be said to increase tuberculosis prevention behaviors. On the contrary, lower health literacy among the high school students reduced tuberculosis prevention behaviors. The findings corresponded with the findings of a study conducted by Techawijitjaru C.⁽¹⁷⁾ who stated that knowledge is a key leading to positive health behaviors and outcomes. Therefore, health literacy development for awareness among the population of every age group and health condition is important to give the public awareness and ability to select and use health information with appropriate self-management in the area of health, including sustainable healthy behaviors. Nurses who provide care for public health in every context should play a role in developing service recipients' health literacy by assessing health literacy accurately and selecting suitable assessment instruments in addition to developing effective health communication skills and creative health media that are easy for service recipients to understand. More importantly, nurses should participate in creating friendly environments for health literacy development to encourage awareness of the importance of health literacy among health care teams as a health determiner, while also conducting research to create health literacy knowledge to improve service recipients' health literacy.

Social support about tuberculosis prevention

Pender stated that interpersonal influences directly and indirectly influence health promotion behaviors through social drive. According to the findings of this study, The item with the highest mean score was found to be, "Parents pay attention to students' tuberculosis prevention behaviors such as washing hands with soap

or disinfectant frequently and wearing hygienic masks when close to a sneezing person, etc." at 3.53 points. This corresponded with the findings of a study conducted by Tanomsak K and Sunsern R. who found high correlations between personal influence on health promotion behaviors and adolescents receiving health recommendations and support from persons such as family members, friends and loved ones, causing adolescents to pay more attention to health and influencing better health promotion behaviors among adolescents.⁽¹⁸⁾ Furthermore, social support was correlated with health promotion behaviors. A person's health promotion behaviors are a result of information support and support from others. This enabled adolescents to perform health promotion behaviors more conveniently and have continued practice.⁽¹⁸⁾ Moreover, the findings concurred with House's concept, which stated that social support is interpersonal interactions consisting of love, concern, trust, financial support, material support, labor support, information support including feedback data for self-assessments and data for learning.⁽¹⁹⁾ Therefore, social support was a major factor influencing adolescents' health.

Gender

In this study with high school student as subjects, the male students had better tuberculosis prevention behaviors than the female, possibly because the data in this study were collected from an all-male high school with a significant tuberculosis outbreak reported in 2017.⁽²⁰⁾ After the tuberculosis outbreak, therefore, the agencies involved and the school might have created tuberculosis prevention behaviors and supported media for disseminating knowledge on tuberculosis prevention, organized tuberculosis prevention activities and added health education knowledge to courses, causing most of the male students in the data collected to show more knowledge and understanding of self-protection against tuberculosis and appropriate behaviors than the female subjects. This finding did not correspond with the findings of previous studies indicating a belief that the female gender was close to family members with instruction and teaching from parents, guardians, relatives, teachers, experience exchanges and behaviors in copying admired persons, including socialization such as imparting of discipline, values and prioritization of health care and protection. Therefore, the female gender had better health care behaviors

against disease, more responsibility for health and more attention to health when they are sick, compared to their male counterpart.⁽²¹⁾ These findings concurred with the findings of Orem who stated that gender is a determiner of roles and personalities in families, communities and society.⁽²²⁾ Similarly, a study on the factors influencing health promotion behaviors in food consumption among nursing staff at Phra Mongkut Klao Hospital found gender correlated with health promotion behaviors among nursing staff, and females were found to have better health promotion behaviors than males.⁽²³⁾ In addition, Orem's concept was corresponded with the findings of this study. In this study, the female adolescents were found to have higher life skill scores in the affective domain than male adolescents and higher refusal of sexual intercourse. The male and female genders influenced health promotion and were able to predict health promotion behaviors. The female gender had a high proportion of abstinence from sexual intercourse (73.1%).⁽²⁴⁾

Therefore, the researchers in the present study were able to test the factors and found gender, health literacy about tuberculosis prevention and social support to be able to co-predict tuberculosis prevention behaviors among high school students in Bangkok. Health literacy had the greatest influence on students' tuberculosis prevention behaviors, followed by social support and students' gender, respectively. Variables had predictive power on health behaviors about tuberculosis prevention among high school students with a Durbin-Watson score of 2.064, meaning all predictors had no auto-correlation problems (normal score of 1.5 – 2.5), which was consistent with preliminary agreements for using multiple regression analysis statistics.

Conclusion

Gender, health literacy about tuberculosis prevention and social support were able to co-predict health behaviors in preventing tuberculosis among high school students. Health literacy and social support influenced tuberculosis prevention behaviors among high school students. Gender, health literacy about tuberculosis prevention and social support were predictors positively correlated with tuberculosis prevention behaviors among the high school students. All three of the studied factors were able to predict tuberculosis prevention behavior among high school students in Bangkok.

Acknowledgements

The authors would like to express our gratitude to all the subjects who were involved in this study.

Conflict of interest

The authors, hereby, declare no conflict of interest.

References

1. World Health Organization. Global tuberculosis report. Geneva: WHO; 2017.
2. Department of Disease Control, Ministry of Public Health. National Disease and Health Treat Prevention and Control System Development Strategy under the National Health Development Plan in the 12th National Economic and Social Development Plan of B.E. 2540-2564 (A.D. 1997-2021). Bangkok: Aksorn Graphic & Design; 2016.
3. Bureau of Epidemiology Department of Disease Control, Ministry of Public Health. Disease situation report of 2017. Nonthaburi: Ministry of Public Health; 2017.
4. Pupagdee N, Pagpearn K, Usahakit S, Kumthakrea R, Intuyanon M. An investigation on tuberculosis among students at a secondary school in yan yao, Sawankalok, Sukhothai on 14 September – 22 December 2011. *Wkly Epemiol Surveil Rep* 2011;44: S57-63.
5. Bunmuksik P, Rutchanagul P, Kumphalikit S. Health behaviors and health care needs of adolescent street children. *Thai J Nurs Counc* 2011;26 Special Issue: 81-94.
6. Health Education Division. Promotion and assessment of health literacy and health behaviors, Revised edition. Health Education Division, Department of Health Service Support, Ministry of Public Health. New York: Harper & Row; 2017.
7. Saelim S, Moopayak K, Suwonnaroop N. Factors related to alcohol drinking behavior of adolescents. *Songklanagarind J Nurs* 2015;37:25-36.
8. Wajee J. The factors on public mind behavior of the secondary school students in Bangkok. [thesis]. Chanthaburi: Rambhai Barni Rajabhat University; 2016.
9. Wongdang A, Kittipichai W, Taechaboonsermsak P. Public minded attitudes and behaviors of junior secondary school students in Bangkok. *J Faculty Appl Arts* 2011;26:11-8.
10. National Institute of Educational Testing Service (Public Organization). O-NET 3 testing handbook for grade 9 and grade 12 students. Bangkok: NIETS; 2016.

11. World Health Organization. Health promotion glossary. Geneva: Division of Health Education and Health Promotion Unit WHO;1998.
12. Numpoon J, Tipwong A. Relationships between health intelligence, obesity-related conditions and food consumption and exercising behaviors among children with over nutrition in Bangkok. *J Public Health Nurs* 2014;28:1-11.
13. Jaiboon O, Vatanasomboon P, Termsirikulchai L, Satheannoppakao W. Knowledge and health literacy concerning GDA nutrition labels among secondary school students. 17th National Health Education Academic Convention on Public Roles and Health Behavior Adjustment [dissertation]. Chonburi: Burapha University; 2015.
14. Nutbeam D. The evolving concept of health literacy. *Soc Sci Med* 2008;67:2072-8.
15. Waridda WA. 5 Inside generation. Bangkok: Bangkok Business; 2014.
16. Teppanya P. Basic education quality development in schools in Bangkok, *Research Journal – Thai Version*, Silpakorn University, Department of Humanities, *Social Sci Arts* 2018;11:476-92.
17. Techawijitjaru C. C.U.T Nurses and Sam Khwai Phueak Health Promotion Hospital: Care and visit to reduce chronic non – communicable diseases. Nakhon Pathom: Christian Nakhon Pathom Hospital; 2018.
18. Thanomsat K, Sunsern R. Factors correlated with smoking in the early stage among male junior secondary school students under the Trad Education Service Area Office. *J Nurs Educ* 2011;4:38-47.
19. House JS. Work stress and social support. Reading, MA: Addison-Wesley;1981.
20. Bureau of Tuberculosis, Department of Disease Control, Ministry of Public Health. Tuberculosis control guidelines for Thailand of B.E. 2561 (2018). Bangkok: Aksorn Graphic & Design; 2018.
21. Harris DM, Guten S. Health-protective behavior: An exploratory study. *J Health Soc Behav* 1979;20:17-29.
22. Orem DE. Nursing concepts of practice. New York: McGraw-Hill Book; 1985.
23. Sutasunthorn D. Factors affecting health promotion behaviors concerning food consumption among nursing staffs in Phramongkutklao hospital [Thesis]. Bangkok: Kasetsart University; 2003.
24. Suthinphuak B, Chamroonsawasdi K, Suprap J, Taechaboonsersmask P. Factors influencing sexual abstinence behavior among secondary school students in Samutprakan Province. Thailand. *J Public Health* 2010;40:302-12.