Predicting Factors of Tuberculosis Preventive Behaviors in Community Among Village Health Volunteers, Udon Thani Province

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Abstract

This study uses a predictive correlational research design. This study aims to analyze the predictability of three common factors: training experience, health literacy, and perception of self-efficacy in tuberculosis (TB) prevention on prevention behaviors in the community of the village health volunteers (VHVs). The samples were obtained from the convenience sampling method. The sample size was determined using the power analysis method and qualified according to the inclusion criteria for a total of 100 people. Data were collected using questionnaires. Data were analyzed using descriptive statistics, Pearson product-moment correlation, and multiple regression analysis. The study revealed that all three factors could predict TB prevention behaviors in the community VHVs in Udon Thani province by 8.8% (R^2 = .088, $F(3)$ = 3.070). Only one variable was able to predict TB prevention behavior in the community with statistical significance. Factors of self-efficacy in TB prevention were statistically predictive of TB prevention behavior in the community (β = .244, p < .05). The findings suggest that government officials involved in the development of VHVs' capacity should encourage VHVs to recognize their potential and competence in TB prevention, as well as develop health literacy on TB prevention, support TB surveillance training policies, prevention, and control.

Keywords

Health literacy; preventive behavior; self-efficacy; training experience; Tuberculosis

Introduction

From a recent global tuberculosis (TB) report, in 2020, Thailand had 105,000 new and relapse TB cases, accounting for 150 per 100,000 of the population. Roughly 12,000 of these cases resulted in death. Of the total cases, the Ministry of Public Health (2021b) found only 85,837 new and relapsed TB cases registered for treatment. The Ministry of Public Health (2021a) estimated that in 2022 there would be 2,352 new and relapsed TB cases in Udon Thani province (150 per 100,000 population). From interviews with TB village health volunteers (VHVs) in the Udon Thani area, it was found that in the past three years, 10 VHVs were sick with TB in 2017, 6 in 2018, and 12 in 2019.

Village health volunteers have a role in promoting and preventing TB in villages. So, VHVs have to be a person who practices good TB prevention behaviors. The roles related to these behaviors include: 1) being a mentor to take care of taking medication, 2) visiting the homes of TB patients, and 3) cooperating with the staff of the Health Promoting Hospital in finding TB patients in the community (Ministry of Public Health, 2018).

Based on the literature review, the researcher found three critical factors related to TB prevention behavior among public health volunteers: TB prevention training experiences, health literacy, and perception of self-efficacy in TB prevention. First, for TB prevention training experiences, a person's experience produces their perception, and beliefs determine a person's tendency to do something. If properly stimulated, beliefs about health and illness can also tend toward the individual's behavior in maintaining their health (Saejung, 2004). In addition, Numdee (2020), when looking into VHVs' behavior in using antibiotics in Doem Bang Nang Buat district, Suphan Buri province, found that the antibiotic use training factor was associated with antibiotic use behavior ($p < .001$), indicating the importance of the training experience. Village health volunteers who have training experience in TB prevention may promote TB prevention behaviors in the community.

Secondly, health literacy is the intellectual and social skill that gives rise to the motivation and ability of a person to achieve understanding and use the information in a way that promotes health and maintains good health on an ongoing basis (Nutbeam, 2008). Health literacy will also lead to appropriate TB prevention behaviors. Especially in VHVs, it is of great importance. Incorrect TB prevention behaviors may affect the performance of TB patients in the community.

Third, Bandura (1977) described how a person performs a behavior. They stated that it depends on two components: the perception of one's competency and the expected outcome of that action. The researcher believes that one factor that enables VHVs to perform their duties effectively depends on the perception of one's competence in carrying out that mission successfully. In addition, a review of related research found that a study on health beliefs, personality traits, and interpersonal concerns predicting TB prevention behavior among Japanese adults found that self-efficacy was positively correlated with TB prevention behaviors ($r = .22$, $p < .01$) (Yoshitake et al., 2019).

Village health volunteers are also vital participants closest to the community and are trusted by 10 to 15 households. In addition, from selecting 11 outstanding VHVs, the first group focuses on surveillance, prevention, and control of communicable diseases (Ministry of Public Health, 2017). From the roles and duties of the VHVs, it is shown that VHVs need to develop

capacity and knowledge of health regarding TB. However, from past operations, it was found that the VHVs still lacked knowledge about TB prevention and control operations in the community. This is consistent with Khueankaew (2014), who showed that the VHVs had low overall knowledge of TB prevention and control. Khampeera et al. (2021) also found that knowledge of preventing the spread of pulmonary TB was positively correlated with work performance (r = .195, p < .01). Knowledge of TB prevention and control was essential and affected TB prevention behavior in the community of VHVs.

Nowadays, knowledge may not be able to achieve the goal of appropriate health behavior modification. Therefore, the concept of health literacy has been applied to provide a comprehensive definition of access to knowledge and decision-making to apply and disseminate it to others. The Health Education Division (2018) noted that the meaning of "health literacy" is the ability and skills to access information, knowledge, and understanding to analyze, assess, practice, and self-manage as well as to be able to guide personal, family, and community health issues for good health. Applying the concept of developing health literacy for TB prevention and applying it in the community, the Health Education Division (2019) designed a health education program to enhance health literacy and community TB prevention for public health volunteers and the working-age population. The objective was to enable public health officials or public health networks to use this program to promote systematic learning for working-aged people until they develop skills in health care and have proper and appropriate TB prevention behaviors in the community, including being a model for health.

It can be seen that the government sector by the Ministry of Public Health has placed great emphasis on health literacy on TB prevention in the community of VHVs, seeing as health literacy will lead to having appropriate TB prevention behaviors, especially in VHVs. In contrast, incorrect TB prevention behaviors may affect the performance of TB patients in the community. The literature review and related research in Thailand found that the level of health literacy on TB prevention has never been studied in the VHVs group. However, Sawangsuk and Nakagasien (2021) showed that the health literacy factor on TB prevention was positively correlated with the TB prevention behavior of the samples with statistical significance (r = .510, p < .001). They were also able to statistically predict the TB prevention behavior of the sample (β = .461, p < .05).

Aboard, there have been no studies on the health literacy issue of TB prevention among volunteers or social health volunteer groups. Similar research concerning health literacy in TB (Yang et al., 2020) showed that health literacy was a predictive factor for self-care behavior (β = .298, p < .001). It has been shown that health literacy factors are essential to the self-care behaviors of TB patients in the community. However, from the literature review and related research, there was a significant gap in the study on TB prevention behavior among the VHVs, which was still small.

It was found that the relationship between these factors, TB knowledge, and training experience, only affects the VHV's anti-TB practice. It also lacks other factors that may affect TB prevention behaviors in the community of VHVs in modern times, such as perception of self-efficacy, health literacy of TB prevention, and other variables of interest in international research studies. In particular, the analysis of factors can predict TB prevention behaviors of VHVs. Therefore, the researcher has looked at these three crucial factors: health literacy on TB prevention, perceived self-efficacy in TB prevention, training experience in TB prevention, and the important variables to predict TB prevention behavior in the community of VHVs.

This research will predict TB prevention behavior in the community of VHVs as a guideline for health promotion and TB prevention behavior in the community of VHVs.

Research hypotheses

Tuberculosis prevention training experiences, health literacy on TB prevention, and perception of self-efficacy in TB prevention could predict TB prevention behavior in the community of VHVs.

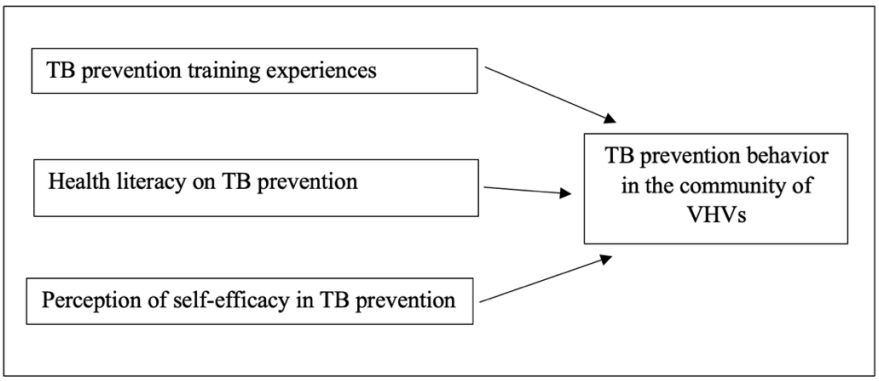
Conceptual framework

The conceptual framework used in this study was based on a review of literature and research related to factors affecting TB prevention behavior in the community of VHVs. It was found that training VHVs is conducive to national development. It is also in line with the 11th National Economic and Social Development Plan (2012–2016), which develops people holistically. Based on emphasis on lifelong learning and other training experiences of VHVs, Numdee (2020), in their exploration into antibiotic use behavior of VHVs in Doem Bang Nang Buat district, Suphan Buri province, found that the antibiotic use training factor was associated with antibiotic use behavior ($p < .001$), indicating the importance of the training experience. Those VHVs who have experience with training on TB prevention may contribute to promoting TB prevention behaviors in the community.

Health literacy on TB prevention is a cognitive and social skill that guides individuals' motivation and ability to achieve better health. Nutbeam (2008) explained that understanding and using the information to continually promote and maintain good health results in TB prevention behavior in the community. In this study, the researcher applied the components of health literacy in six aspects: 1) access to health-related information and services, 2) understanding and knowledge of TB prevention, 3) communication skills in TB prevention, 4) TB prevention decision-making skills, 5) TB prevention self-management skills, and 6) TB prevention media literacy (Health Education Division, 2015).

The self-efficacy theory (Bandura, 1977) was used to develop the perception of self-efficacy in TB prevention. This theory assumes that if a person can expect or have faith in their abilities by knowing what to do and when to do it, they can expect results. That person will act accordingly to critical components of the theory. These are efficacy expectations and outcome expectations. This would result in the perception of self-efficacy in TB prevention and TB prevention behavior in the community. The researcher, therefore, summarizes the conceptual framework in Figure 1.

Figure 1: Summary of Conceptual Framework



Method

This study is a predictive correlational design. The population used in this research study was 28,144 VHVs in Udon Thani province, data as of September 7, 2020 (Ministry of Public Health, 2020). The sample group was 100 VHVs in Udon Thani province.

Sample size was determined using the power analysis method (Ponkaew & Sanasuttipun, 2013; Tiwaree et al., 2016; Tonklai et al., 2014), and statistics using multiple regression analysis by setting the power of the test at .80 level, significance level .05. The number of predictors of 3 variables was estimated by calculating the effect size from the correlation coefficient (r) from a study similar to that of Maneewong and Panthu (2013). They studied factors predicting the health promoting behaviors of VHVs in Tambon Sanam Chai, Suphan Buri province. It was found that the perceived self-efficacy variables showed a statistically significant moderate positive correlation to the health promoting behaviors of the village health volunteers at .001. The correlation coefficient (r) = 0.349 is added to the multiple correlation coefficient (R^2) to calculate the sample size from the formula for calculating the sample size as follows:

$$N = \frac{L(1 - R^2)}{R^2} + u + 1$$

N = number of samples
L = specific tabular values for numerical multiple regression analysis of alpha values at .05 and Power .80 (Effect size index) (Cohen, 1988).
R^2 = multiple correlation coefficient
u = number of predictor variables

$$N = \frac{L(1 - R^2)}{R^2} + u + 1$$

$$= \frac{10.9(1 - 0.349^2)}{0.349^2} + 3 + 1$$

$$= 82.59$$

The calculated sample size was at least 83 people. To prevent loss of sample size, the researcher increased the sample size by 20% (Waivongkitjakarn et al., 2018). This accounted for a total sample size of 100 people.

The selection of the sample group had the inclusion criteria according to the specified qualifications as follows:

1. Being a village health volunteer who worked during the study period and was a village health volunteer for not less than one year.
2. Had at least one experience caring for TB patients in the community.
3. Able to read and write Thai.

The sample group was obtained from the convenience sampling method. The sample size was determined using the power analysis method and qualified according to the inclusion criteria, totaling 100 people. The researcher collected the data by answering the predictive factor questionnaire on TB prevention behavior in the community of VHVs, Udon Thani province. In March 2021, there were 100 copies distributed and 100 returned (100%).

Research instruments

The tools used for data collection in this research consisted of 4 parts as follows:

Part 1 - General Information Questionnaire: The researcher-generated general information questionnaire was based on a review of the relevant literature and was a multiple-choice, fill-in-the-blank, 7-item questionnaire. The following factors were considered while evaluating TB prevention training: TB prevention training experience, the number of times TB prevention training was given, and the last time TB prevention training was provided.

Part 2 - Tuberculosis prevention health literacy assessment: The health literacy measure on TB prevention was created by the researcher and applied from the components of health literacy in six areas (Health Education Division, 2015), amounting to 22 items (see Appendix 1).

Part 3 - Self-efficacy in tuberculosis prevention questionnaire: The researcher-generated self-efficacy questionnaire in TB prevention was created by a literature review from a conceptual framework (Bandura, 1977) and related research, amounting to 18 items (see Appendix 2).

Part 4 - The questionnaire on tuberculosis prevention behaviors in the community of village health volunteers: The community TB prevention behavior questionnaire of VHVs was created by a literature review and related research (Montaisong, 2017), amounting to 14 items (see Appendix 3).

Inspection of the instrument quality

Content validity was checked by five experts and used to find a content validity index (CVI) to determine the validity, content sequencing, suitability of content and language used, and congruence between questions and operational definitions of variables. The health literacy questionnaire on TB prevention was 0.90, the self-efficacy questionnaire on TB prevention was 0.85, and the community TB prevention behavior questionnaire of VHVs was 0.90.

The reliability of the instrument was tested using Cronbach's alpha coefficient method. The health literacy questionnaire on TB prevention was 0.883, the self-efficacy questionnaire in TB prevention was 0.910, and the community TB prevention behavior questionnaire of VHVs was 0.778, respectively.

Ethical consideration

The data were collected manually when the samples passed the inclusion criteria after approval by the Institutional Review Board, Faculty of Nursing, Mahidol University (IRB-NS2020/38.0610). A letter of approval was also received from the Udon Thani Provincial Public Health Doctor and the director of Kumphawapi Hospital.

The researcher introduced themself, built relationships, and explained the process and research details until the participants clearly understood. The subjects consented to participate in the research by expressing their consent in writing to participate in the research. The researcher explained to the participants to understand the responses to each part of the questionnaire. Then let the participants answer the questionnaire themselves during the questionnaire. They can ask questions at any time. This took about 60 minutes. In the end, the researcher checked the correctness and completeness of the questions.

Statistical data

Descriptive statistics using mean and standard deviation were used for personal data, health literacy on TB prevention, perceived self-efficacy in TB prevention, and TB prevention behaviors in the community, and analyze the predictive power of the experience factor. Tuberculosis prevention training, health literacy on TB prevention, and perceived self-efficacy in TB prevention on TB prevention behaviors in the community were analyzed using multiple regression analysis inferential statistics. Statistics were reported by using the SPSS program version 20.

Results

General data analysis of the samples

The demographic data of the samples 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	11	11
Female	89	89
Ages (years)		
18–30	2	2
31–40	9	9
41–50	37	37
51–60	42	42
61–70	9	9
71–80	1	1
(*M* = 50.02, *SD* = 8.458 [21, 75])		
Duration of VHVs		
1–10	42	42
11–20	42	42
21–30	12	12
31–40	3	3
41–50	1	1
(*M* = 13.72, *SD* = 9.264 [1, 43)		
Get screened for TB by taking chest x-ray once a year		
Yes	41	41
No	59	59
Experience with training on TB prevention		
Yes	73	73
No	27	27
Number of training sessions		
1–10 times	66	90.4
11–20 times	6	8.2
31–40 times	1	1.4
(*M* = 5.12, *SD* = 6.091)		
The last training on TB prevention		
not more than 5 years (2017–2021)	52	71.2
5–10 years (2012–2016)	17	23.3
11–15 years (2007–2011)	2	2.7
16–20 years (2002–2006)	1	1.4
26–30 years (1992–1996)	1	1.4

Note: VHVs=Village health volunteers, TB=Tuberculosis, M=Mean, SD=Standard Deviation

According to Table 1, the results show that most of the samples were female (89%), aged 51–60 years (42%), with an average age of 50.02 years (*SD* = 8.458 [21, 75]). Duration of being a VHV between 1–10 years, 42 people (42%). The average duration of being a VHV was 13.72 years (*SD* = 9.264 [1, 43]). Forty-one participants were screened for TB by chest x-ray once a year (41%).

Results of predictive variable

Table 2: Actual and Possible Range of TB Prevention Health Literacy, Perception of Self-Efficacy in TB Prevention, and TB Prevention Behavior in the Community (n =100)

Studied variable	M	SD	Possible range	Actual range
Health literacy on TB prevention	90.9	9.5	22–110	66–110
Perception of self-efficacy in TB prevention	76.2	15.4	0–100	31–100
TB prevention behavior in the community	51	3.8	14–56	42–56

Note: TB= Tuberculosis, M=Mean, SD=Standard Deviation

According to Table 2, the results of this study revealed that the mean scores of the sample's health literacy score on TB prevention were at a high level (*M* = 90.9, *SD* = 9.5). It showed that the overall sample group had a high level of health literacy on TB prevention. The mean scores of the subjects' perceived self-efficacy in TB prevention were high (*M* = 76.2, *SD* = 15.4). It showed that the overall sample group had a high perception of self-efficacy in TB prevention, and the mean score of TB prevention behavior in the community of the sample group had a high score on TB prevention behavior in the community (*M* = 51, *SD* = 3.8). It showed that the overall sample group had TB prevention behaviors in the community at a high level.

Table 3: Health Literacy on TB Prevention Classified by Aspects (n =100)

Health literacy on TB prevention	M	SD
Access to health-related information and services	4.19	.60
Understanding and knowledge of TB prevention	4.09	.52
Communication skills in TB prevention	3.84	.60
TB prevention decision-making skills	4.15	.57
TB prevention self-management skills	4.31	.47
TB prevention media literacy	4.03	.63

Note: TB= Tuberculosis, M=Mean, SD= Standard Deviation

According to Table 3, the results of this study revealed that the mean of the sample's health literacy score on TB prevention classified by aspects of TB prevention self-management skills was highest (*M* = 4.31, *SD* = .47), followed by access to health-related information and services (*M* = 4.19, *SD* = .60) and communication skills in TB prevention were lowest (*M* = 3.84, *SD* = .60).

Table 4: Tuberculosis Prevention Behavior in the Community Classified by Aspects (n =100)

TB prevention behavior in the community	M	SD
Self-protection behaviors from TB infection in daily life	3.83	.33
Health care behaviors to prevent TB	3.37	.51
Self-protection behavior from TB infection while working on TB in the community	3.69	.30

Note: TB= Tuberculosis, M=Mean, SD= Standard Deviation

According to Table 4, the results of this study revealed that the mean of the sample's TB prevention behavior in the community classified by aspects of self-protection behaviors from

TB infection in daily life were highest (M = 3.83, SD = .33), followed by self-protection behavior from TB infection while working on TB in the community (M = 3.69, SD = .30) and health care behaviors to prevent TB were lowest (M = 3.37, SD = .51).

Analysis of the Relationships

Table 5: Correlation Coefficient Among the Variables Studied (n =100)

Studied variable	1	2	3	4
1. TB prevention training experiences	1			
2. Health literacy on TB prevention	.036	1		
3. Perception of self-efficacy in TB prevention	.036	.404**	1	
4. TB prevention behavior in the community	.135	.145	.265**	1

*Note: TB= Tuberculosis, **p < .001*

According to Table 5, analysis between independent variables and dependent variables found that self-efficacy in TB prevention was positively correlated with community TB prevention behavior of the sample group (r = .265, p < .001). However the TB prevention training experience was not significantly associated with TB prevention behaviors in the community (r = .135, p > .05), health literacy on TB prevention was not correlated with TB prevention behaviors in the community (r = .145, p > .05).

Results of multiple regression analysis

Table 6: Multiple Regression Analysis of the Sample Group TB Prevention Behavior in the Community

Predictive variable	b	SE	β	t	p value
Constant	44.079	3.691		11.942	< .001**
TB prevention training experiences	1.086	.848	.125	1.282	.203
Health literacy on TB prevention	.017	.043	.042	.393	.695
Perception of self-efficacy in TB prevention	.003	.001	.244	2.285	.024*

*Note: TB= Tuberculosis, *p < .05, **p < .001*

According to Table 6, the results of the analysis revealed that TB prevention training experience, health literacy on TB prevention, and perception of self-efficacy in TB prevention were co-factors that predicted TB prevention behavior in the community of VHVs was at 8.8% (R^2 = .088, F(3) = 3.070) with statistically significance (p < .05). It was found that the self-efficacy factor in TB prevention was statistically significant (β = .244, p < .05). The factors of training experience on TB prevention and health literacy factors on TB prevention could not predict TB prevention behaviors in the community of village health volunteers, Udon Thani province.

Discussion

The results showed that the hypothesis was partially supported. It was found that all three factors: TB prevention training experiences, health literacy on TB prevention, and perception of self-efficacy in TB prevention, could predict TB prevention behaviors in the community of VHVs in Udon Thani province: 8.8% (R^2 = .088, F(3) = 3.070). Only one variable was statistically significant in predicting TB prevention behavior in the VHVs. The perceived self-

efficacy factor in TB prevention was statistically predictive of TB prevention behavior in the community ($\beta = .244$, $p < .05$). The experience of TB prevention training and health literacy on TB prevention were not predictive of TB prevention behavior in the community. The results can be discussed according to the research assumptions as follows:

The perceived self-efficacy factor

This study revealed that the average self-efficacy in TB prevention among VHVs was at a good level. This may be due to the operations or duties of the VHVs will be under the supervision and support of the Community Nurse Practitioner, per the advanced practice nursing scope and competencies. Competency 4 of the Community Nurse Practitioner has the potential to improve empowerment, teaching methods, training, and practical mentoring (Thailand Nursing and Midwifery Council, 2009) that would develop VHV's potential and operations in surveillance, prevention, control of TB in the community.

As a result, VHVs would have a good level of self-perception, consistent with Chawadet (2018), who looked at the development of a mentor-directed treatment model for TB in Huaithabthan district, Sisaket province. They revealed guidelines for carrying out activities for the hospital staff and VHVs. This included arranging a doctor to be a counselor, organizing a TB workshop on knowledge of TB, drugs used to treat it, adverse drug reactions, developing skills in directly observed treatment (DOT) procedures, negotiation techniques with patients, home visits, screening, household contacts, and evaluation of treatment, along with arranging VHVs to lead TB treatment. This also included activities under the "Health Promotion Program for Empowerment in New Sputum-Positive Pulmonary TB Patients."

Having a staff member of the sub-district Health Promoting Hospital and the VHVs lead, the potential program will result in the comprehension of DOT for working groups consisting of the TB clinic staff and public health officers at Tambon Health Promoting Hospital and apply the principles of empowerment. The operating guidelines are as follows: 1) Provide knowledge to community leaders, volunteers, and make health education media available to the public, and 2) Visit homes to empower TB patients within the community. Visiting patients in their homes empowers TB patients in the community.

In addition, in the study of Sridawruang et al. (2016) regarding the collaboration of VHVs working on health promotion in primary health care units in the northern part of the Isan region, they found that the supporting factors were positively correlated with the participation of VHVs and network sector in the development of health promotion work. They showed that VHVs who receive support, whether support from the authorities or public support, will be highly involved in the implementation of health promotion activities.

Rueankham (2019) studied the development of health volunteers' competency for TB screening in a community in Nam Pat district, Uttaradit province. From its summary of activities in developing the VHVs' potential, the study found that the development that increased VHVs' potential was the building of confidence in the operation. Health workers mentor small groups, provide advice, and match VHVs between older people who have a lot of working experience in public health and younger people who have a clear vision. Fluency is a reinforcement to carry out more effective TB screening. They showed that VHVs want to learn from "mastery experiences," and "modeling" is to see experiences or examples of others' success in action. It was a factor influencing the perception of self-efficacy (Bandura, 1982).

As a result, this study found that the VHVs had an average level of perceived self-efficacy in TB prevention. In addition, Ahmadi and Hakim (2019) studied self-efficacy and selected demographics as determinants of family behavior on examination for patients with TB in Pamekasan. They found that self-efficacy had a significant relationship with family behavior on TB examination. Likewise, Hidayat et al. (2020) studied predictor factors of TB transmission prevention in Surabaya, Indonesia. They found that self-efficacy influenced TB transmission prevention behavior. From the above findings, it can be explained that the person or the VHVs have a good self-efficacy level. It also affects the behavior of preventing TB in the community, which is consistent with Swangsap and Chuchuen (2019), who looked at the perception of self-efficacy in physical health care behaviors and the mental health of VHVs. They found that most VHVs had a level of self-efficacy in physical and mental health care in the community. The behavioral score in community physical and mental health care was moderate. The perceptions of self-efficacy in health care and community mental health among VHVs had a high positive correlation with statistically significant physical and community health care behaviors ($r = .79$, $p < .05$). An individual's effective behavior is related to perceiving a person's self-efficacy when the VHVs perceived competency in physical and mental health care of the community at a moderate and high level.

This will result in confidence in the health and mental health of the community at a moderate and high level as well. Prombutr et al. (2015) explored the effect of a self-efficacy program on knowledge and self-efficacy of VHVs in diabetic and hypertension patient care in the community in the Northeast province. For the identity of the VHVs in caring for people with diabetes and hypertension in the community of a province in the Northeast, they found that the perceived self-efficacy of the VHVs after receiving the self-efficacy enhancing program was significantly higher than before receiving the program at the level ($p < 0.001$). As a result, VHVs had the skills necessary to take care of patients, pride, and feel empowered to perform their roles, thus gaining confidence and intent in caring for patients, having knowledge, knowledge, and advice. By having actual practice and having direct experience, and self-efficacy, they became more confident in their abilities. They had more behaviors in caring for diabetic and high blood pressure patients.

The results indicated that the VHVs had a good perception of self-efficacy in TB prevention, resulting in VHVs having good TB prevention behaviors in the community ($M = 76.20$, $SD = 15.40$). Consistent with the concept of self-efficacy perception theory, Bandura (1982) described the relationship between perceived self-efficacy and expectations for the outcome of the action that will occur. Suppose a person had high self-efficacy and had high expectations of the outcome of the action. Likewise, that individual would be more likely to decide to commit that behavior.

Factors related to training experience in tuberculosis prevention

The researcher discussed that the VHVs' experience in receiving TB prevention training was not related to TB prevention behaviors in the community. This was probably since the duration of being a VHV is relatively long, on average at 13.72 years ($SD = 9.264$), but most volunteers were trained 1 to 10 times (90.4%) throughout their entire terms. Additionally, the VHVs' topic of TB prevention training was regarded merely as supplementary training in other communicable disease training programs.

This research also found that most VHVs were older, with a mean age of 50.02 years ($SD = 8.458$). A review of the literature found that by the age of 50, a change in color vision may

decrease up to 25% (Assantachai, 2014). It can be seen that, at present, various training uses teaching aids or lectures in color by presenting the image of a slide through a computer program such as PowerPoint, which may result in a decrease in color image content recognition related to TB prevention training. Consistent with Rueankham (2019), who found that most of the VHVs were quite old and therefore had problems with their eyesight, and writing may result in the VHVs not being able to perform their work at their full potential, this would result in TB screening not covering the target group and no new cases, demonstrating the importance of activities, forms, methods, and age-appropriate training techniques for VHVs. This will affect the operational potential and correct TB prevention behavior in the community.

Following the reviewed affiliated studies by Tejativaddhana and Kitreerawutiwong (2013), who studied capacity-building for VHVs through a context-based learning approach, it was found that the training to educate VHVs should be organized in an appropriate format, such as using examples from the area for visualization, using easy-to-understand language, case studies in the area as learning media, and having interaction between teachers and students.

Similarly, Kasemsuk and Koshakri (2015) found that health volunteers needed to provide training to improve their knowledge and abilities to improve health volunteers' home visits for diabetes people in the communities. They want ongoing training sessions to foster the exchange of diverse experiences among health volunteers representing different areas.

In addition, VHVs' learning can also search for knowledge and learn from other learning sources. In addition to training, technology plays a vital role in information and public relations, surveillance, and disease prevention, such as the use of the LINE application. Chaina et al. (2019) looked at the development of guidelines for the roles and duties of VHVs in the surveillance and prevention of communicable diseases in the area, Ban Chan Health Promoting Hospital, Mueang Udon Thani district, Udon Thani province. They found that the work related to information and public relations on surveillance and prevention of communicable diseases, the chairman of the VHVs in all three villages to receive information and public relations about surveillance and prevention of communicable diseases regularly and timely from two important channels: A letter informing the village headman to help publicize the epidemic of the disease and message notification via LINE, creating a specific group for the VHVs in coordination with the sub-district Promoting Hospital in line to use for communication and the perception of information among the VHVs in Ban Chan sub-district.

Importantly, all five VHVs presidents expressed the same opinion that using the LINE application as a communication medium or communication channel can help increase awareness and access to information (fast, concise, clear, & highly accurate). It can be regarded as a new alternative that makes the VHVs' duties timelier, causing problems that have arisen in the past, such as delays in the performance of duties or not responding directly to the problems. The real need is almost gone.

The results of this study highlight the importance of providing training experiences on TB prevention for VHVs (especially the training that must be designed to practice skills and practice). Knowledge and skills on TB prevention were essential and affected TB prevention behaviors in the community of VHVs. This is consistent with the study by Khampeera et al. (2021), which examined factors related to the performance of VHVs in preventing the spread of pulmonary TB in the community. It was found that knowledge of the prevention of pulmonary TB was positively correlated with performance (r = .195, p < .01). The results showed that 27% of VHVs have no experience training on TB prevention. Training on TB

prevention will help VHVs increase their knowledge, promote a positive attitude, and help to practice better TB prevention behaviors. The benefit of training may explain this as it increases operational efficiency by changing work behavior and is also a critical process for resolving shortcomings or errors in operation. However, organizations or departments need to focus on their practitioners. If the operator had been trained and had good knowledge and expertise, the resulting work would be valuable and beneficial to the public (Raksawong, 2016). The training was a necessary process. This could lead to learning which is a process of permanent behavior change (Putachote, 2013).

Factors in health literacy on tuberculosis prevention

This study revealed that the average health literacy on TB prevention was at a high level. When classified by aspects, it was found that self-management skills in tuberculosis prevention had the highest mean (M = 4.31, SD = .47), and communication skills in tuberculosis prevention had the lowest mean (M = 3.84, SD = .60). This did not support the hypothesis set by the authors that, although average TB prevention health literacy was at a high level, it was considered insufficient to correlate and predict TB prevention behaviors in the community. Having a person with full health literacy in TB prevention was down to various compositions. There were some obstacles to having data access, and the case area was considered far from the targeted zone, resulting in limited resources following the report study and review of academic data to synthesize the situations, develop the proposals, and drive the policy of the vital strategic points "the health literacy issues." The study showed the situations, challenges, gaps, and limitations in conducting the health literacy work, as follows: 1) the lack of "digital literacy" and "media literacy," 2) the variations of health literacy definitions even in the COVID-19 crisis, and 3) the disregarding of the health literacy issues have become present, with the lack of consistency and strategic process to conduct the health literacy work (Satawedin, 2020).

In addition to the review of affiliated medical literature, enhancing and correcting the personnel's health literacy and health behavior will require some psychological empowerment. As Diviani et al. (2012), cited in Kaeodumkoeng (2018), described the relationship model between empowerment, health literacy, and health behaviors. It must also focus on the development of four critical attributes as follows: 1) expertise, 2) significance, 3) impact, and 4) self-determination. It was also found that the results of this study were different from the study of Konsnan and Poum (2020), which found that health literacy was statistically related to dengue prevention and control behaviors (r = .710, p < .001). A study by Sawangsuk and Nakagasien (2021) found that health literacy on TB prevention affects TB prevention behaviors of high school students in Bangkok (β = .461, p < .05). It may be explained that although the average health literacy on TB prevention is good, there may not be an incentive to practice TB prevention behaviors in the community.

Strength and limitations of the study

Research can be recommended to the Department of Disease Control from the findings. The Ministry of Public Health further leads in developing and designing programs to increase health literacy on TB prevention. In addition, the data collection in the VHVs study was considered a critical population group, the VHVs in primary care. In the part limitation of the study, the independent variables were tested for the preliminary agreement of statistical use of the correlation between independent variables (Multicollinearity). However, if the

independent variables are similar or similar in terms of content or concepts, the results are obtained through a preliminary agreement on the use of statistics. But in fact, the initial variables may be related, resulting in the study of the relationship between the independent variable and the dependent variable. The results were correlated and unpredictable. The variants of training experience in TB prevention were not specified as the experience gained only in TB prevention training but also included in the TB prevention training experience for other communicable diseases training programs.

Conclusion, recommendations, and suggestions

Multiple regression statistical analysis is used to test research hypotheses. It was found that TB prevention training experiences, health literacy on TB prevention, and the perceived self-efficacy factor in TB prevention could jointly predict TB prevention behavior in the community of VHVs in Udon Thani province, 8.8% (R^2 = .088, $F(3)$ = 3.070). It was also found that the perceived self-efficacy factor in TB prevention could predict TB prevention behavior in the community statistically significant (β = .244, p < .05). Tuberculosis prevention training experiences and health literacy on TB prevention could not predict TB prevention behavior in the community. In conclusion, the results were partially supported by the hypothesis.

For further research suggestions, the agencies involved in the potential development of VHVs should constantly promote and develop health literacy on TB prevention among VHVs and be involved in VHVs support training policies on TB surveillance, prevention, and control to raise awareness of self-protection against TB. This is to continuously improve the performance of TB prevention operations in the community. In addition, the interested person can study in quasi-experimental research by creating a program based on self-efficacy in TB prevention on TB prevention behaviors in the community so that they can be used to promote and develop the potential of the VHVs and study the qualitative research or the participatory action research that allows access to the VHVs and other related sectors in participation in developing TB prevention behaviors in the community and study other factors related to TB prevention behaviors in the community of VHVs, such as work empowerment factors associated with TB, factors supporting personal protective equipment such as N95 particulate masks, face masks, alcohol gel, hand wash, etc. And in this study, the sample size was determined. Using the power analysis method, the sample sizes in this study may be too small to be 100 people. This may result in the two independent variables being unable to predict the dependent variable. In subsequent research, the sample size should be calculated using another method.

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Appendices

Appendix 1: Prevention Health Literacy Assessment

Question	Most	More	Moderate	Low	Very low
Access to health-related information and services					
1. Where can I find information about protecting myself from TB? from reliable sources such as knowledgeable people, print media, online media, etc.	26 (26%)	39 (39%)	30 (30%)	3 (3%)	2 (2%)
2. Where can I find health care resources? (Sub-district Health Promoting Hospital, Hospital, Clinic) if you need help with self-protection from tuberculosis.	40 (40%)	49 (49%)	7 (7%)	4 (4%)	0
3. I have at least one health care provider (doctor, nurse, health worker) who can provide accurate information, advice, and counseling on TB self-prevention.	39 (39%)	50 (50%)	8 (8%)	2 (2%)	1 (1%)
4. I am sure that the health service (Subdistrict Health Promoting Hospital, Hospital, Clinic) that I choose to use can provide care and assistance in protecting themselves from Tuberculosis.	49 (49%)	45 (45%)	6 (6%)	0	0
Understanding and knowledge of TB prevention					
5. I can read and understand information about TB self-defense from media such as prints, brochures, posters, and mobile applications. (Application) and online media (Facebook, Line).	31 (31%)	43 (43%)	24 (24%)	2 (2%)	0
6. I know and understand the descriptions of doctors, nurses, and health workers in the field of self-protection against tuberculosis.	36 (36%)	51 (51%)	12 (12%)	1 (1%)	0
7. I often compare various information about protecting yourself from tuberculosis for accurate and reliable understanding before implementing.	19 (19%)	58 (58%)	21 (21%)	2 (2%)	0
8. I can put into practice my knowledge of TB prevention.	33 (33%)	51 (51%)	16 (16%)	0	0
Communication skills in TB prevention					
9. I can communicate with people who have knowledge of tuberculosis prevention, such as telephone calls, meetings, and discussions or using various online media.	21 (21%)	41 (41%)	36 (36%)	2 (2%)	0
10. I can educate or recommend TB care and prevention and allow other people to accept and understand that information.	14 (14%)	54 (54%)	32 (32%)	0	0
11. I have shared, discussed, or written information about tuberculosis prevention	22 (22%)	45 (45%)	33 (33%)	0	0

Question	Most	More	Moderate	Low	Very low
with family members, friends, or others I got to know.					
TB prevention decision-making skills					
12. Before carrying out activities to prevent tuberculosis, such as choosing the type of mask, I'll do some research before making a decision.	26 (26%)	53 (53%)	21 (21%)	0	0
13. I analyzed the positives and negatives of tuberculosis prevention activities, such as choosing to wear a mask and washing your hands prior to the activity.	39 (39%)	49 (49%)	11 (11%)	1 (1%)	0
TB prevention self-management skills					
14. I can protect myself from TB through various methods, such as wearing a mask every time I visit a TB patient's home.	62 (62%)	33 (33%)	5 (5%)	0	0
15. I was able to fulfill my role as VHV in preventing tuberculosis by learning from experience and developing practical skills.	34 (34%)	48 (48%)	17 (17%)	1 (1%)	0
16. Even though I have a lot of missions, I will spend at least 15 minutes studying the information from the brochure or various media to build knowledge on tuberculosis prevention and health care.	20 (20%)	57 (57%)	19 (19%)	3 (3%)	1 (1%)
17. Before going out to a slum place or going out to touch a TB patient, I must wear a mask at all times.	68 (68%)	30 (30%)	1 (1%)	0	1 (1%)
18. I set goals and make a plan to care for and protect myself from tuberculosis and will do as intended.	51 (51%)	45 (45%)	3 (3%)	1 (1%)	0
19. If I have inappropriate TB prevention behaviors, such as forgetting to wear a mask in a crowded place. I can modify the way I behave properly.	32 (32%)	55 (55%)	11 (11%)	2 (2%)	0
TB prevention media literacy					
20. I use reasoning to analyze the advantages and disadvantages of opt-in to receive information about tuberculosis prevention from that medium before following.	21 (21%)	61 (61%)	16 (16%)	2 (2%)	0
21. Whenever I watch and listen to television, radio, and the Internet presenting health information for tuberculosis prevention before deciding to believe, I have to double-check for accuracy and credibility.	26 (26%)	58 (58%)	14 (14%)	1 (1%)	1 (1%)
22. When I receive information about tuberculosis prevention via Facebook or various online media, I will look for information from several sources to verify credibility before making a decision.	28 (28%)	50 (50%)	19 (19%)	2 (2%)	1 (1%)

Appendix 2: Self-Efficacy in TB Prevention Questionnaire

Question	Percent average confidence
1. I am confident that I can protect myself from TB with the information and knowledge I have.	77.95
2. I am confident that I can prevent tuberculosis from going on duty. VHVs in-home visits or disease screenings in the community.	78.25
3. I am confident that I go for TB screening once a year.	68.72
4. I am confident that I can protect myself from contracting TB while on duty where there is a high risk of contracting a sick person.	79.90
5. I am sure I can always wear a particulate filter mask when visiting the homes of tuberculosis patients; even if you feel uncomfortable, it's hard to breathe.	85.05
6. I make sure I wash my hands in 7 steps after every home visit tuberculosis patient.	86.05
7. I am confident that I can be a role model in taking care of myself for others in the community.	75.70
8. I am confident that I can find a solution to the problem of insufficient masks to protect people in the community from tuberculosis.	72.00
9. I am confident that I can give accurate advice to anyone who suspects they may have TB or who has TB.	74.85
10. I am confident that I can accurately screen people at risk of TB.	65.05
11. I am confident that I can provide rapid referrals for TB patients.	71.80
12. I am confident that I can advise TB patients on a diet. Ongoing tuberculosis drugs.	76.95
13. I am confident that I can find TB resources such as brochures, posters, or online materials to advise relatives and patients while visiting home.	75.05
14. I am confident that I can get TB patients to cooperate in taking their medication regularly.	77.84
15. I am confident that I can find a way to build my morale and morale in performing the duties of VHVs for TB prevention.	80.55
16. I am confident that I can draw cooperation from all parties involved in searching for TB patients in the community.	72.05
17. I am confident that I can direct TB patients to continue medication to reduce the spread of TB in the community.	77.40
18. I am confident that I will be able to follow up with TB people in my home for screening for TB.	76.70

Appendix 3: Questionnaire on TB Prevention Behaviors in the Community of VHVs

Question	Perform regularly (4)	Perform frequently (3)	Perform sometime (2)	Never perform (1)
Self-protection behaviors from TB infection in daily life				
1. I protect myself from TB by using a mask. To prevent coughing and sneezing.	85 (85%)	15 (15%)	0	0
2. I always wear a mask when going to crowded places or lacking proper ventilation.	84 (84%)	14 (14%)	2 (2%)	0
Health care behaviors to prevent TB				
3. I exercise regularly, not less than three times a week, at least 30 minutes each time for good health. Reduce the chances of getting sick with TB.	46 (46%)	27 (27%)	27 (27%)	0
4. I eat all five food groups: proteins and carbohydrates, minerals, vitamins, and fats such as meat, fish, eggs, beans, rice, vegetable fruit, and vegetable and animal fats to be healthy reduce the chances of getting sick with TB.	50 (50%)	40 (40%)	10 (10%)	0
5. I rest by getting enough sleep 6–8 hours a day to stay healthy to reduce the chances of getting sick with TB.	60 (60%)	33 (33%)	7 (7%)	0
Self-protection behavior from tuberculosis infection while working on TB in the community				
6. When I get sick with a respiratory infection like the flu, it makes my body weak. I wear a mask to protect myself from TB infection.	84 (84%)	15 (15%)	1 (1%)	0
7. I wear a particulate filter mask. To be close and to give evidence caring for TB patients in the community while visiting home.	87 (87%)	10 (10%)	3 (3%)	0
8. While I was visiting a TB patient's home, I have protected myself from TB by having a patient or relative open the door and window of the bedroom. Reduce the chances of spreading TB.	79 (79%)	17 (17%)	3 (3%)	1 (1%)
9. When I visit a TB patient's home, I will sit in the direction of the wind to let the airflow from me to the sick every time.	65 (65%)	23 (23%)	9 (9%)	3 (3%)
10. I make sure TB patients in the community wear masks whenever I'm with others.	84 (84%)	12 (12%)	4 (4%)	0

Question	Perform regularly (4)	Perform frequently (3)	Perform sometime (2)	Never perform (1)
11. When I visit a TB patient's home, I advise TB patients to cover their mouths and noses when coughing or sneezing to prevent the spread of tuberculosis.	92 (92%)	7 (7%)	0	1 (1%)
12. I am a caretaker of complete and ongoing medication for TB patients in the community.	46 (46%)	29 (29%)	18 (18%)	7 (7%)
13. When I visit a TB patient's home, I wash my hands for seven steps with soap or disinfectant before and after using a mask every time.	74 (74%)	21 (21%)	4 (4%)	1 (1%)
14. I wear a mask all the time to prevent TB when cooperating to find TB patients in the community with public health officials.	87 (87%)	12 (12%)	1 (1%)	0