FACTORS ASSOCIATED WITH COVID-19 OUTBREAK PREVENTION BEHAVIOR AMONG VILLAGE HEALTH VOLUNTEERS IN CHIANG RAI, THAILAND

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Abstract. Coronavirus disease 2019 (COVID-19) remains a public health concern in Thailand, posing significant risks to individuals with chronic illnesses and the elderly. To reduce the spread of COVID-19, village health volunteers (VHVs) play a vital role in preventing and controlling diseases at the community level. The cross-sectional study examined factors associated with COVID-19 prevention behavior among VHVs in Chiang Rai Province. Participants (n = 362) were selected using a two-stage cluster random sampling method, and data were collected between June and August 2022 using a structured questionnaire. The results showed that VHVs had a high level of COVID-19 prevention behavior, which was associated with knowledge of disease, perceived self-efficacy, work motivation, and social support. Female VHVs exhibited significantly better prevention behavior than males (p-value <0.05). To further maintain and reinforce VHVs' COVID-19 prevention behavior, more training programs should be organized, and initiatives that foster self-efficacy, boost work motivation and offer ongoing social support should be implemented.

Keywords: COVID-19 outbreak, prevention behavior, self-efficacy, social support, village health volunteer, work motivation

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) is a respiratory infectious disease that was first reported in Wuhan, China (Huang *et al*, 2020). The first confirmed case

in Thailand occurred in January 2020 (WHO, 2020a). Since then, the COVID-19 virus has continued to mutate, prolonging the global outbreak. As of 02 January 2022, there were 289 million confirmed cases worldwide, with 5.4 million deaths (WHO, 2022). In Thailand, there were 2.23 million confirmed cases and 21,720 deaths (Bureau of Emerging Infectious Disease, 2022).

Chiang Rai, the northernmost province of Thailand, has a population of over 1.2 million characterized by its multi-ethnic diversity, which includes Lowland Thais, various highland ethnic groups (hill tribes), and the Chin Hor (Yunnanese Chinese). Geographically, the province shares a 153-kilometer border with Myanmar and a 155-kilometer border with the Lao People's Democratic Republic (Chiang Rai Provincial Office of Social Development and Human Security, 2021). Due to its strategic location, Chiang Rai experienced early outbreaks stemming from both illegal border crossings and domestic transmission as early as 2020. This onset, occurring during the second wave, was notably more rapid than in non-border provinces (Ministry of Public Health, 2022). Furthermore, several initial clusters were identified among individuals entering the country through natural border channels (Muangmor *et al*, 2020). In addition, the region has experienced outbreaks of several COVID-19 virus strains, namely Alpha, Gamma, Delta, and Omicron variants (Andre *et al*, 2023).

COVID-19 has an incubation period of 2 to 14 days (Lauer *et al*, 2020). The virus is primarily transmitted between people through respiratory droplets (WHO, 2020b). Although most infected individuals experience mild symptoms (with ~20% developing severe illness), the overall mortality rate is low. However, severe symptoms are more common among the elderly and patients with chronic diseases (Department of Disease Control, 2021). COVID-19 prevention and control have become a national priority in many countries, which aim to reduce transmission and minimize both human and economic loss.

Efforts to monitor, control and prevent COVID-19 transmission require collaboration across multiple sectors, such as central and regional government agencies, public and private sectors, and all government ministries in the country. The Ministry of Public Health is the primary responsible agency, with medical and public health personnel managing both communicable and non-communicable diseases. However, a shortage of personnel remains, especially in rural areas (Nittayasoot *et al*, 2021). Hence, village health volunteers (VHVs), numbering over one million, play a vital role in supporting medical and public health staff, as well as improving access to services, with a focus on community-centered care. The core responsibilities of VHVs are health promotion, disease surveillance, prevention and control, rehabilitation, and consumer protection of health products (Yaebka and Wongsawat, 2020). During the COVID-19 pandemic, VHVs have played a key role in identifying target groups, screening for symptoms, and monitoring and keeping reports of cases (Narkvichien, 2020).

Knowledge and perception of COVID-19 surveillance and prevention among VHVs are critical to their effectiveness. The focus of most studies on COVID-19 among VHVs in the country has primarily focused on knowledge (Yeunyow and Boonserm, 2020; Munthi, 2021; Siriworawatchai, 2021) and perception of the disease (Nawasuwan *et al*, 2020a; Munthi, 2021; Siripornwut, 2021), but few studies have been conducted on perceived self-efficacy to prevent COVID-19 infection (Keaitipattanachai *et al*, 2024).

Work-related factors, such as salary allowances and social benefits, can boost morale. Based on the Herzberg Two-Factor Theory (Herzberg *et al*, 1959), motivation and hygienic work conditions are the true drivers of job satisfaction and enhanced performance. However, there is a lack of studies on the motivation in COVID-19

prevention behavior among VHVs (Aiamnui, 2021; Siriworawatchai, 2021). Social support in the form of information, counseling and feedback can enhance performance (House, 1981). However, a review of the literature revealed a limited amount of research on these factors.

Therefore, the study examined the behaviors of VHVs in preventing the spread of in Chiang Rai Province, compared the role of personal factors on the behaviors, and identified the key influences on their COVID-19 infection prevention actions. The findings can serve as background data to inform the future development of policies that optimize the role of VHVs in managing current and future COVID-19 outbreaks in the region, and possibly as a model for the rest of the country.

MATERIALS AND METHODS

Study design, setting and participants

The study employed a cross-sectional study design in a total population of 25,048 VHVs in Chiang Rai Province (Department of Health Service Support, 2019). Inclusion criteria were: (i) listed in the 2021 VHV registry for Chiang Rai Province and (ii) actively working in subdistricts affected by COVID-19 (Department of Health Service Support, 2019). Individuals unable to read or write the Thai language were excluded, as the study used a self-administered questionnaire. Sample size was calculated using Daniel's formula (Daniel, 2010) and drew on the mean and standard deviation (SD) from the previous study of Siriworawatchai (2021), resulting in 362 research participants.

Sampling used a two-stage cluster random method. First, 3/18 districts in Chiang Rai Province were randomly selected, and then one subdistrict from each district was again randomly selected (Fig 1). Qualified VHVs were chosen through a systematic sampling method, with the number of participants per subdistrict determined by the probability proportional to size (PPS) method (Cochran, 1977).

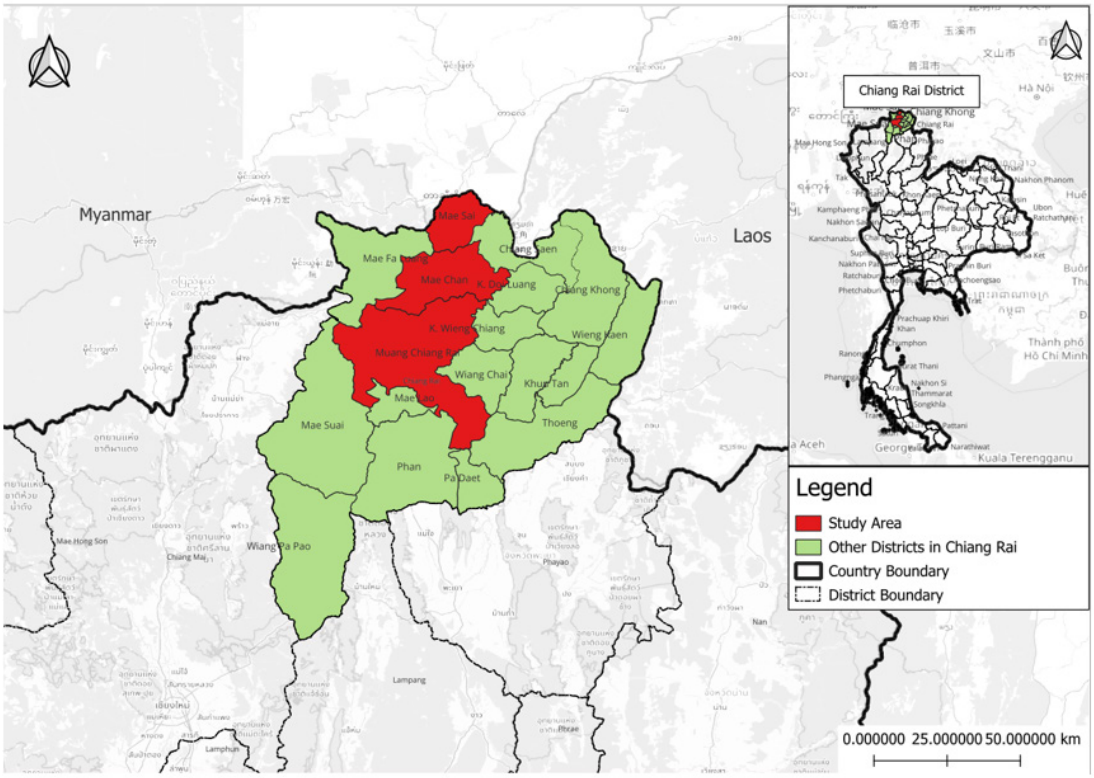

Fig 1 - Map of Chiang Rai Province, Thailand, indicating the study location
Note: Map created by the authors using QGIS software

Study instruments and data collection

Data were collected between June and August 2022 using a questionnaire consisting of the following six sections:

1. Sociodemographic information

Data were collected on sex, age, education level, occupation, monthly income, marital status, duration as a VHV, other community roles, training on COVID-19 prevention, and number of households under responsibility. This section included both closed and open-ended questions (10 items).

2. Knowledge of COVID-19 prevention

Questions were derived from the COVID-19 prevention guidelines of the Department of Disease Control (2021). Questions covered causes, symptoms, prevention, treatment, and the role of VHVs in monitoring, controlling and preventing COVID-19. This section contained 18 statements, positive or negative, with multiple-choice answers ("True", "False" or "Uncertain"). Scoring followed Bloom (1956) category: low, moderate or high.

3. Perceived self-efficacy

Questions were based on the Bandura Self-Efficacy Theory (Bandura, 1997), which assessed self-efficacy and outcome expectations regarding prevention behaviors. This section contained 15 items, which were scored using a scale from 0 to 10.

4. Work motivation

Questions were based on the Herzberg Two-Factor Theory (Herzberg *et al*, 1959), which assessed motivational factors (achievement, recognition, advancement, job characteristics, and responsibility) and hygiene factors (compensation, benefit, interpersonal relationship, working condition, policy, and administration). This section was rated used a five-point Likert scale (from 5 = "strongly agree" to 1 = "strongly disagree") across two main questions and 26 sub-items and interpreted according to Best (1977) category: low, moderate or high.

5. Social support

The House Social Support Theory (House, 1981), which assessed resource support, informational support, emotional support, and acceptance. This section contained 18 items, both positive and negative, and rated on a four-point Likert scale (4 = "high agreement", 3 = "moderate agreement", 2 = "low agreement", and 1 = "not agree"), and interpreted according to Best (1977) category: low, moderate or high.

6. Prevention behaviors

Questions were based on the

National Guidelines for VHVs in COVID-19 surveillance and control (Department of Disease Control, 2021). This section contained 18 items on health promotion and disease surveillance, prevention and control, which were rated on a five-point Likert scale (from 5 = "most frequent" to 1 = "least frequent") across two main questions and 15 sub-items and interpreted according to Best (1977) category: low, moderate or high.

The questionnaire was validated by experts using the Index of Item Objective Congruence (IOC) (Rovinellib and Hambleton, 1977), with acceptable values ranging from 0.67 to 1.00. Revisions were made in response to the experts' feedback. A pilot test was conducted with 30 VHVs from non-sampled districts in Chiang Rai Province to assess reliability. Knowledge reliability was analyzed using the KR-20 coefficient (Kuder and Richardson, 1937), yielding a value of 0.70. The Cronbach's alpha coefficient was employed to determine the reliability of perceived self-efficacy, work motivation, social support, and preventive behavior, with value of 0.98, 0.94, 0.93, and 0.97, respectively.

Prior to data collection, the researchers coordinated with VHV leaders in each target subdistrict to explain the study objectives and procedures. Then, the leaders distributed the questionnaire to the selected VHV members.

Statistical analysis

Data were analyzed in two parts: descriptive statistics (frequency, percentage, mean, and SD) and analytical statistics. Normality of the data was tested using the Kolmogorov-Smirnov test, which confirmed normality across all variables. Differences in prevention behavior based on sociodemographic features were analyzed using a t-test. Relationships between independent variables and prevention behavior were evaluated using Pearson's correlation coefficient (r). All the statistical tests were two-sided, with a p-value <0.050 considered significant. All calculations were

carried out on the Statistical Package for the Social Sciences (SPSS) version 18.0 (IBM Corp, Armonk, NY).

Ethical consideration

The study protocol was approval by the Human Research Ethics Committee of Ramkhamhaeng University (no. RU-HRE 65/0095). Prior written informed consent was received from each participant.

RESULTS

Three hundred and sixty-two VHVs responded to the questionnaire. Their sociodemographic profile was as follows: 57 ± 8 (mean ± SD) years of age, 67% females, 58% completed only primary education, 33% farmers or daily wage workers, 67% married, 62% served as VHVs for >10 years (17 ± 19 (mean ± SD) years), 56% responsible for >10 households (12 ± 5 (mean ± SD) households), and 96% received a training session on COVID-19 prevention during the study year (Table 1).

Evaluation of the participants' knowledge of COVID-19 prevention measures was considered at a moderate level (mean score ± SD = 14.4 ± 2.5), and at a high level for perceived self-efficacy (mean score ± SD = 123.0 ± 21.8), work motivation (mean score ± SD = 4.2 ± 0.3), social support (mean score ± SD = 3.4 ± 0.4), and prevention behavior s (mean score ± SD = 4.2 ± 0.6) (Table 2).

Analysis of COVID-19 prevention behavior based on sociodemographic features revealed only a statistically significant difference between the participants' sex (gender) (p-value = 0.008) (Table 3). Correlation analysis revealed that the following factors are positively associated with COVID-19 prevention behavior (p-value <0.05), namely knowledge, perceived self-efficacy, work motivation, and social support (Table 4).

DISCUSSION

Ninety-five percent of VHVs demonstrated a high level of

Table 1

Association of sociodemographic parameters and COVID-19 outbreak prevention behavior among VHVs, Chiang Rai province, Thailand, 2022

Sociodemographic parameter	Number of participants	Prevention behavior category, *n* (%)	
		Low - moderate*	High*
Sex			
Male	119	23 (19)	96 (81)
Female	243	34 (14)	209 (86)
Age			
<40 years	13	5 (39)	8 (61)
40-59 years	216	33 (15)	183 (85)
>59 years	133	19 (14)	114 (86)
Education level			
Primary school	209	30 (14)	179 (86)
Secondary school	130	22 (17)	108 (83)
Vocational certificate	7	2 (29)	5 (71)
Bachelor's degree or higher	16	3 (19)	13 (81)
Occupation			
Unemployed	30	5 (17)	25 (83)
Employed	332	52 (16)	280 (84)

Table 1 (cont)

Sociodemographic parameter	Number of participants	Prevention behavior category, *n* (%)	
		Low - moderate*	High*
Marital status			
Single	35	8 (23)	27 (77)
Widow(er)/divorced/separated	99	32 (32)	67 (68)
Married	228	17 (8)	211 (92)
Duration as VHV			
<6 years	30	7 (23)	23 (77)
6-10 years	109	18 (17)	91 (83)
>10 years	223	32 (14)	191 (86)
Number of households under the responsibility			
1-10	149	24 (16)	125 (84)
>10	193	29 (15)	164 (85)
Received COVID-19 prevention training in study year[†]			
No	14	2 (14)	12 (86)
Yes	336	53 (16)	283 (84)

*Based on 5-point Likert score: low-moderate = 1.00-3.66; high = 3.67-5

[†]Total responses for this item = 350 (12 missing values)

COVID-19: coronavirus disease 2019; VHV: village health volunteer

Table 2

Level of knowledge, perceived self-efficacy, work motivation, social support, and COVID-19 prevention behavior among village health volunteers (N = 362), Chiang Rai province, Thailand, 2022

Parameter	Frequency by category, *n* (%)			Mean score	SD	Range
	Low	Moderate	High			
Knowledge[a]	84 (23)	202 (56)	76 (21)	14.4	2.5	6.0-19.0
Perceived self-efficacy[b]	33 (9)	106 (29)	223 (62)	123.0	21.8	53.0-150
Work motivation[c]	0 (0)	12 (3)	350 (97)	4.2	0.4	2.9-5
Social support[d]	3 (1)	70 (19)	289 (80)	3.4	0.4	2.0-4
COVID-19 outbreak prevention behavior[c]	2 (1)	48 (13)	312 (86)	4.2	0.6	1.9-5

[a]Low: 1-12 score; Moderate: 13-15 score; High: 16-20 score

[b]Low: 0-89 score; Moderate: 90-119 score; High: 120-150 score

[c]Low: 1-2.3 score; Moderate: 2.4-3.7 score; High: 3.8-5 score

[d]Low: 0-1.3 score; Moderate: 1.4 -2.7 score; High: 2.8-4 score

COVID-19: coronavirus disease 2019; SD: standard deviation

Table 3

Differences in sociodemographic parameters and COVID-19 prevention behavior among VHVs (N = 362), Chiang Rai province, Thailand, 2022

Sociodemographic parameter	Number of participants	Prevention behavior mean score	t	*p*-value*
Sex			-2.681	0.008
Male	119	72.9		
Female	243	76.0		
Age			-0.016	0.987
<60 years	229	74.9		
≥60 years	133	75.0		
Education level			-0.691	0.490
<Secondary school	209	74.6		
≥Secondary school	153	75.4		
Occupation			0.790	0.430
Unemployed	30	76.4		
Employed	332	74.9		
Marital status			-0.567	0.571
Single/Widow(er)/divorced/ separated	119	74.5		
Married	243	75.1		
Duration as VHV			-0.288	0.774
<10 years	139	74.6		
≥10 years	223	75.0		
Number of households under the responsibility			-0.358	0.841
<10	149	74.1		
≥10	193	75.3		

Table 3 (cont)

Sociodemographic parameter	Number of participants	Prevention behavior mean score	t	*p*-value*
Received COVID 19 prevention training in study year[†]			0.604	0.546
No	14	76.5		
Yes	336	75.0		

Mean score of behavior was calculated from a 18 item × 5 scale; range of score: 18-90

*p-value<0.050 considered significantly different

[†]Total responses for this item = 350 (12 missing values)

COVID-19: coronavirus disease 2019; t: t-test; VHV: village health volunteer

Table 4

Association of knowledge, perceived self-efficacy, work motivation, and social support with COVID-19 outbreak prevention behavior among village health volunteers (n = 362), Chiang Rai province, Thailand, 2022

Variable	COVID-19 prevention behavior	
	r	*p*-value*
Knowledge	0.116	0.028
Perceived self-efficacy	0.486	<0.001
Work motivation	0.622	<0.001
Social support	0.395	<0.001

*p-value<0.05 considered significantly different

COVID-19: coronavirus disease 2019; r: Pearson's correlation coefficient

COVID-19 prevention behavior. VHVs played active roles in educating the public on the epidemiology of COVID-19, including causes, symptoms, transmission methods, and updates on the pandemic (Kaweenuttayanon *et al*, 2021). They also facilitated communication during periods of quarantine. These activities were likely possible due to attendance of at least one annual training session. These findings agree with studies from other provinces in Thailand, which also reported high or appropriate levels of COVID-19 prevention and control behavior among VHVs (Chaobanpho, 2021; Chinnabutr and Phakdisorawit, 2021; Munthi, 2021; Keaitipattanachai *et al*, 2024). Although VHVs do not exist in other countries, similar studies among healthcare workers and the general public have shown high engagement in COVID-19 prevention behavior (Bashirian *et al*, 2020; Yıldırım and Güler, 2020; Shah *et al*, 2022; Lestari *et al*, 2024).

Female VHVs have a significantly higher level of COVID-19 prevention behavior than males (p-value = 0.008), which likely reflects the cultural role of Thai women as primary family and community caregivers. Such roles aligned with VHV duties, *viz*, fostering higher engagement and perceived vulnerability, which led to a stricter adherence to COVID-19 prevention protocols. Previously, Nawasuwan *et al* (2020b) found a gender-based difference in the successful community-level COVID-19 control taken among VHVs in the country (p-value <0.001). In Turkey, Kucukkarapinar *et al* (2022) reported a better COVID-19 protection behavior among women.

Knowledge of COVID-19 prevention was positively correlated with VHV prevention behavior (p-value <0.050). Respondents understood the importance of advising community members to avoid crowded places, such as markets, department stores, and bus terminals, and to place high-risk individuals under public health supervision. This agrees with the Bloom Learning Theory (Bloom, 1971), which posits that increased knowledge leads to improved

behavior. Similar findings were reported in other Thai provinces (Yeunyow and Boonserm, 2020; Siriworawatchai, 2021) and among healthcare workers in the country (Limkunakul *et al*, 2022). Similar findings were reported from Ethiopia (Zenbaba *et al*, 2022), Indonesia (Ernawaty and Dherindri, 2023), South Korea (Jang, 2022) and Turkey (Kucukkarapinar *et al*, 2022).

Other factors showing positive association with VHV COVID-19 prevention behavior were perceived self-efficacy, work motivation, and social support.

VHVs expressed confidence in their ability to stay informed and educate others on COVID-19. This conforms with the Bandura theory (Bandura, 1986), which posits that individuals with high self-confidence and outcome expectation are more likely to engage in a positive behavior. Supporting findings have been reported in other studies from Thailand (Aiamnui, 2021; Keaitipattanachai *et al*, 2024), as well as from Iran (Toghanian *et al*, 2022), Saudi Arabia (Mortada *et al*, 2021), the USA (White *et al*, 2022), and Turkey (Kucukkarapinar *et al*, 2022).

VHVs reported high self-motivation due to their pride in their role, social recognition, and opportunities for learning and knowledge acquisition. They also reported high levels of satisfaction with hygiene factors, citing support from supervisors, local agencies, and fellow VHVs. These findings were consistent with previous studies in Thailand (Aiamnui, 2021; Siriworawatchai, 2021) and Iran (Toghanian *et al*, 2022). This observation was consistent with the Herzberg Two-Factor Theory (Herzberg *et al*, 1959), which posits that motivator factors (*eg*, recognition and responsibility) and hygiene factors (*eg*, working conditions and management policy) are essential for enhancing professional performance.

VHVs received support from various sources: emotional support from family, peers and health agencies; informational

support through regular updates and guidance; resource support in the form of equipment and compensation; and appraisal support through constructive feedback. This was in accordance with the House Theory (Glanz *et al*, 2008), which posits that social support influences behavior. Similar findings were reported in other studies from the country (Aiamnui, 2021; Keaitipattanachai *et al*, 2024), and from Hong Kong (Zhang *et al*, 2025), and Indonesia (Ernawaty and Dherindri, 2023).

However, this study has several methodological limitations. Firstly, the use of a self-administered questionnaire may lead to self-reporting bias, where participants might provide socially desirable answers. And secondly, the cross-sectional design only captured a snapshot of behavior at a specific time. Future research should consider longitudinal designs and face-to-face approaches, such as in-depth interview, to gain a deeper understanding and of duration of the aforementioned factors impacting COVID-19 protection behavior among VHVs.

In conclusion, VHVs demonstrated a high level of prevention behavior against the spread of coronavirus disease 2019. The factors significantly associated with the behavior were knowledge, perceived self-efficacy, work motivation, and social support. A comparison of differences between sociodemographic features revealed that only the sex (gender) of VHVs exhibited a significant dissimilarity, with females having a higher level of COVID-19 prevention behavior. Hence, motivating actions, such as continual education and enhancement of self-efficacy provided through various channels (*eg,* social media, on-line messaging and in-person training); and work motivation and social support through both psychological (*eg,* certificate of merit) and tangible (*eg,* bonus, severance payment) incentives, should be promoted to ensure effective and sustained COVID-19 prevention efforts by the village health volunteers in Chiang Rai Province.

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CONFLICT OF INTEREST DISCLOSURE

The authors declare no conflict of interest.

REFERENCES

Aiamnui S. Factors influencing surveillance and prevention practices of COVID -19 among village health volunteers in Kongkrailat District, Sukhothai Province, 2021 [cited 2022 Nov 10]. Available from: URL: https://he02.tci-thaijo.org/index.php/tjphe/article/view/252212/171395 [in Thai]

Andre M, Lau LS, Pokharel MD, *et al*. From Alpha to Omicron: how different variants of concern of the SARS-coronavirus-2 impacted the world. *Biology (Basel)* 2023; 12(9): 1267.

Bandura A. Self-efficacy: the exercise of control. New York, NY: WH Freeman; 1997.

Bandura A. Social foundations of thought and action: a social cognitive theory. Englewood Cliffs, NJ: Prentice Hall; 1986.

Bashirian S, Jenabi E, Khazaei S, *et al*. Factors associated with preventive behaviours of COVID-19 among hospital staff in Iran in 2020: an application of the Protection Motivation Theory. *J Hosp Infect* 2020; 105(3): 430-3.

Best J. Research in education. 3rd ed. Englewood Cliffs, NJ: Prentice Hall; 1977.

Bloom BS. Mastery learning. In Block JH, editor. Mastery learning: theory and practice. New York, NY: Holt, Rinehart and Winston Inc; 1971. p. 47-63.

Bloom B. Taxonomy of educational objectives: the classification of educational goals. Handbook I: Cognitive domain. London, UK: Longmans; 1956.

Bureau of Emerging Infectious Disease. COVID-19 infection situation report, 2022 [cited 2022 Nov 10]. Available from: URL: https://ddc.moph.go.th/viralpneumonia/file/

situation/situation-no730-020165.pdf [in Thai]

Chaobanpho Y. The role of village health volunteers in preventing the COVID-19 in Phrapradaeng District, Samutprakarn Province, 2021 [cited 2021 Dec 19]. Available from: URL: https://so04.tci-thaijo.org/index.php/SSRUJPD/article/view/250988/170617 [in Thai]

Chiang Rai Provincial Office of Social Development and Human Security. Chiang Rai Social Situation Report 2021, 2021 [cited 2025 Sep 20]. Available from: URL: https://www.m-society.go.th/ewtadmin/ewt/mso_web/download/article/article_20211110150503.pdf [in Thai]

Chinnabutr W, Phakdisorawit N. The role of village health volunteers (VHVs) in preventing the outbreak of the coronavirus 2019 (COVID-19) outbreak according to government policy of Mueang district, Suphanburi province, 2021 [cited 2021 Dec 19]. Available from: URL: https://so04.tci-thaijo.org/index.php/JSBA/article/view/247844/169264 [in Thai]

Cochran WG. Sampling techniques. 3rd ed. New York, NY: John Wiley & Sons; 1977.

Daniel WW. Biostatistics: basic concepts and methodology for the health sciences. 9th ed. New York, NY: John Wiley & Sons; 2010.

Department of Disease Control. Guidelines for COVID-19 vaccination during the 2021 outbreak in Thailand (Revision 1), 2021 [cited 2021 Sep 29]. Available from: URL: https://amed.rta.mi.th/main/download/upload/upload-20210609161720.pdf [in Thai]

Department of Health Service Support. Public health information system, primary health care division: GHB-VHV Database, Chiang Rai Province, 2019 [cited 2021 Sep 29]. Available from: URL: http://www.thaiphc.net/new2020/cremation/district?year=2562&province=57 [in Thai]

Ernawaty E, Dherindri NB. Factors influencing COVID-19 prevention behavior: a community-based cross-sectional study. *Open Access Maced J Med Sci* 2023; 11(E): 191-7.

Glanz K, Rimer BK, Viswanath K, editors. Health behavior and health education: theory, research, and practice. 4th ed. San Francisco, CA: Jossey-Bass/Wiley; 2008.

Herzberg F, Mausner B, Snyderman BB. The motivation to work. 2nd ed. New York, NY: John Wiley & Sons; 1959.

House JS. Work stress and social support. Reading, MA: Addison-Wesley; 1981.

Huang C, Wang Y, Li X, *et al*. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. *Lancet* 2020; 395(10223): 497-506.

Jang SH. Social-ecological factors related to preventive behaviors during the COVID-19 pandemic in South Korea. *PLoS One* 2022; 17(3): e0266264.

Kaweenuttayanon N, Pattanarattanamolee R, Sorncha N, Nakahara S. Community surveillance of COVID-19 by village health volunteers, Thailand. *Bull World Health Organ* 2021; 99(5): 393-7.

Keaitipattanachai K, Rutchanagul P, Sangnimitchaikul W. The factors related to COVID-19 prevention and control behaviors among village health volunteers in Pathum Thani Province, 2024 [cited 2025 Sep 20]. Available from: URL: https://he02.tci-thaijo.org/index.php/trcnj/article/view/269921/185718 [in Thai]

Kucukkarapinar M, Karadag F, Budakoglu I, *et al*. The relationship between COVID-19 protection behaviors and pandemic-related knowledge, perceptions, worry content, and public trust in a Turkish sample. *Vaccines (Basel)* 2022; 10(12): 2027.

Kuder GF, Richardson MW. The theory of the estimation of test reliability. *Psychometrika* 1937; 2(3): 151-60.

Lauer SA, Grantz KH, Bi Q, *et al*. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. *Ann Intern Med* 2020; 172(9): 577-82.

Lestari SK, Wardani RK, Arguni E, *et al*. Patterns of adherence to COVID-19 preventive behaviors and its associated factors: a cross-sectional study in Yogyakarta, Indonesia. *Asian J Social Health Behav* 2024; 7(3): 140-7.

Limkunakul C, Phuthomdee S, Srinithiwat P, Chanthanaroj S, Boonsawat W, Sawanyawisuth K. Factors associated with preventive behaviors for COVID-19 infection among healthcare workers by a

health behavior model. *Trop Med Health* 2022; 50(1): 65.

Ministry of Public Health. Report on lessons learned in preparing for the COVID-19 pandemic at the health region level, 2022 [cited 2025 Sep 20]. Available from: URL: https://mahidol.ac.th/documents/covid19.pdf [in Thai]

Mortada E, Abdel-Azeem A, Showair AA, Zalat MM. Preventive behaviors towards COVID-19 pandemic among healthcare providers in Saudi Arabia using the protection motivation theory. *Risk Manag Healthc Policy* 2021; 14: 685-94.

Muangmor H, Upala P, Apidechkul T. COVID-19 Outbreak in the Chiang Rai border area due to illegal immigration to Thailand: a field investigation, 2020 [cited 2025 Nov 06]. Available from: URL: https://he01.tci-thaijo.org/index.php/jhealthscialternmed/article/view/246326/167622

Munthi C. Factors influencing preventive behavior of coronavirus disease 2019 among village health volunteers in Kong Krailat District, Sukhothai Province, 2021 [cited 2025 Sep 20]. Available from: URL: https://he02.tci-thaijo.org/index.php/ODPC9/article/view/249484/170658 [in Thai]

Narkvichien M. Thailand's 1 million village health volunteers - "unsung heroes" - are helping guard communities nationwide from COVID-19, 2020 [cited 2025 Nov 06]. Available from: URL: https://www.who.int/thailand/news/feature-stories/detail/thailands-1-million-village-health-volunteers-unsung-heroes-are-helping-guard-communities-nationwide-from-covid-19

Nawasuwan K, Singhaviratham N, Damsangsawas N. Correlation of perception disease severity to implementation role for control of COVID-19 in communities among village health volunteers in Thailand. 2020a [cited 2025 Sep 20]. Available from: URL: https://he01.tci-thaijo.org/index.php/bamrasjournal/article/view/241960 [in Thai]

Nawasuwan K, Singweratham N, Waichompu N, *et al*. The successful implementation of novel coronavirus (COVID-19) in the community of village health volunteers (VHVs) in Thailand,

2020b [cited 2025 Sep 20]. Available from: URL: https://li01.tcithaijo.org/index.php/pnujr/article/view/242995 [in Thai]

Nittayasoot N, Suphanchaimat R, Namwat C, Dejburum P, Tangcharoensathien V. Public health policies and health-care workers' response to the COVID-19 pandemic, Thailand. *Bull World Health Organ* 2021; 99(4): 312-8.

Rovinelli RJ, Hambleton RK. On the use of content specialists in the assessment of criterion-referenced test item validity. *Tijdschr Onderwijsres* 1977; 2(2): 49-60.

Shah ST, Akter K, Hasan MS, Chakrovarty T, Sakib N, Islam MT. Factors determining preventive practices of the healthcare workers regarding COVID-19 in Bangladesh. *Health Sci Rep* 2022; 5(1): e484.

Siripornwut N. Perception on the coronavirus disease COVID-19 into the role in disease control of village health volunteers in Phrom Buri District, Sing Buri Province, 2021 [cited 2025 Sep 20]. Available from: URL: https://so01.tci-thaijo.org/index.php/NBU/article/view/245923/167731 [in Thai]

Siriworawatchai W. Factors influencing in-role performance of village health volunteer (VHV) on COVID-19 surveillance and prevention in Phuphiang District, Nan Province, 2021 [cited 2025 Sep 20]. Available from: URL: https://he01.tci-thaijo.org/index.php/MNSTMedJ/article/view/248281/168138 [in Thai]

Toghanian R, Ghasemi S, Hosseini M, Nasiri M. Protection behaviors and related factors against COVID-19 in the healthcare workers of the hospitals in Iran: a cross-sectional study. *Iran J Nurs Midwifery Res* 2022; 27(6): 587-92.

White A, Maloney E, Boehm M, Bleakley A, Langbaum J. Factors associated with COVID-19 masking behavior: an application of the Health Belief Model. *Health Educ Res* 2022; 37(6): 452-65.

World Health Organization (WHO). Novel coronavirus (2019-nCoV) situation report - 2, 2020a [cited 2025 Nov 06]. Available from: URL: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200122-sitrep-2-2019-ncov.pdf

World Health Organization (WHO). Coronavirus disease 2019 (COVID-19) situation report - 73, 2020b [cited 2025 Nov 06]. Available from: URL: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20200402-sitrep-73-covid-19.pdf

World Health Organization (WHO). Weekly epidemiological update on COVID-19 - 6 January 2022, 2022 [cited 2025 Nov 06]. Available from: URL: https://www.who.int/docs/default-source/coronaviruse/situation-reports/20220106_weekly_epi_update_73.pdf?sfvrsn=c731e59b_3&download=true

Yaebka Y, Wongsawat P. Main role performances of village health volunteers, 2020 [cited 2025 Sep 20]. Available from: URL: https://he01.tci-thaijo.org/index.php/pnc/article/view/245517/167392 [in Thai]

Yeunyow T, Boonserm P. The relationship between knowledge and attitude toward on prevention behavior of coronavirus infection 2019 (COVID-19) among female village health volunteer (VHV), 2020 [cited 2025 Sep 20]. Available from: URL: https://he02.tci-thaijo.org/index.php/MJSSBH/article/view/248112/168910 [in Thai]

Yıldırım M, Güler A. COVID-19 severity, self-efficacy, knowledge, preventive behaviors, and mental health in Turkey. *Death Stud* 2020; 46(4): 979-86.

Zenbaba D, Sahiledengle B, Beressa G, *et al*. Healthcare workers' compliance with COVID-19 preventive measures, and associated factors, in Ethiopia: a systematic review and meta-analysis. *BMJ Open* 2022; 12(8): e060681.

Zhang X, Luan Y, Tang Y, *et al*. Perceived social support and self-stigma as factors of COVID-19 booster vaccination behavior and intention via cognitive coping and emotion regulation among people infected with COVID-19 in Hong Kong. *BMC Public Health* 2025; 25(1): 659.