# Capacity strengthening of village health volunteers during and post-COVID-19: a model to prepare for emerging diseases

**Punnatorn Nawan[1,2], Monthicha Raksilp[3], Waratip Kankarn[3,4], Nopparat Songserm[3]**
[1]Department of Public Health, Faculty of Public Health, Ubon Ratchathani Rajabhat University, Ubon Ratchathani, Thailand
[2]Nam Khun Hospital, Nam Khun District, Ubon Ratchathani, Thailand
[3]Department of Health Sciences, Faculty of Public Health, Ubon Ratchathani Rajabhat University, Ubon Ratchathani, Thailand
[4]Faculty of Nursing, Ubon Ratchathani Rajabhat University, Ubon Ratchathani, Thailand

## Article Info

## ABSTRACT

Village health volunteers (VHVs) were essential in handling during and post-coronavirus disease 2019 (COVID-19). This study aimed to develop the capacity enhancement model of VHVs in preventing COVID-19 in Thailand. The development process and data collection used 12 stakeholders and 55 VHVs, respectively. The research tools were focus group discussions and questionnaires. We employed descriptive and inferential statistics for quantitative and content analysis for qualitative data. The model development was implemented in 9 processes: i) study the situation, ii) brainstorm to analyze the problems, iii) set the guidelines for model development, iv) organize training, v) review of role-based skills, vi) conduct public relations, vii) observe and follow up, viii) evaluate the operation, and ix) reflect on the results and lessons learned. After the model was developed, knowledge, attitude, and behavior in preventing COVID-19 were significantly better than before their capacity was enhanced ($p<0.001$). The model named "NAMKHUN Model," which consisted of N=working as a network; A=ability to use application; M=effective management; K=up-to-date knowledge; H=having health literacy; U=having unity; and N=fast, accurate and up-to-date News). The success factor from the lesson learned was teamwork, which complements up-to-date knowledge and will create desirable skills for dealing with emerging diseases in the future.

*This is an open access article under the CC BY-SA license.*

*Corresponding Author:*

Nopparat Songserm
Department of Health Sciences, Faculty of Public Health, Ubon Ratchathani Rajabhat University
Ubon Ratchathani, 34000, Thailand
Email: nopparat.s@ubru.ac.th

## 1. INTRODUCTION

The World Health Organization declared Coronavirus Disease 2019 (COVID-19) a global pandemic on March 11, 2020 [1]–[3]. The Ministry of Public Health of Thailand issued a notification in the Royal Gazette, effective on March 1, 2020, designating COVID-19 as a dangerous communicable disease No. 14 under the Communicable Diseases Act B.E. 2558 for surveillance, prevention, and control of hazardous infectious diseases [4]–[7]. According to the global pandemic, as of November 30, 2021, there were 262,505,478 cumulative confirmed cases and 5,227,127 cumulative deaths. In Thailand, 2,115,872 cumulative confirmed cases and 20,771 cumulative deaths were reported [8]. In Ubon Ratchathani, as of November 30, 2021, there were 22,391 cumulative cases and 174 cumulative deaths [9]. Nam Khun District, Ubon Ratchathani, was a high-risk area. The COVID-19 outbreak occurred around November 2021. A new

epidemic of COVID-19 appeared in Nam Khun District. As of November 30, 2021, there were 492 accumulated cases and one death [9].

During the COVID-19 pandemic, village health volunteers (VHVs) played an essential role in stopping the spread of COVID-19, especially at the community level. They monitor, control, and prevent the spread of the disease. VHVs have become an essential social capital of the health system in performing surveillance, prevention, and management of COVID-19 in the community. In addition, they also play a role as the change agents in changing the health behaviors of the people in the community by serving to prevent infectious diseases [10], including COVID-19 [11]–[15], non-communicable diseases [16], [17], including proactive prevention to reduce risk factors for some cancers [18]–[20]. Although the spread of COVID-19 will likely decrease, a lack of effective disease prevention and control may cause the space to reoccur. Currently, VHVs have insufficient capacity to prevent and control the spread of the disease. Since COVID-19 is an emerging disease, VHVs lack up-to-date knowledge and the right attitude. As a result, their practical behaviors and skills in disease prevention and control are inefficient.

Nam Khun District, Ubon Ratchathani, is a high-risk area affected during and post-COVID-19. VHVs are front-line health personnel playing an essential role in health care in the community. However, the part and capacity of VHVs in preventing and controlling COVID-19 have not been as effective as they should be. Many factors may cause this. Since COVID-19 is an emerging disease until now in post-COVID-19, VHVs lack up-to-date knowledge and the right attitude. Their practical behaviors and disease prevention and control skills are inefficient. For this reason, enhancing the capacity of VHVs in proactive disease prevention and control is probably one of the most important and valuable ways during and post-COVID-19. Therefore, this study aimed to create a model for improving the ability of VHVs to prevent COVID-19 in Nam Khun District, Ubon Ratchathani. The significant results obtained from this study should be helpful as a critical proactive model for dealing with emerging diseases that may occur in the future.

## 2. METHOD
### 2.1. Study design
It was action research based on the conceptual framework of Kemmis and McTaggart [21]. The concept of action research was employed in Figure 1. This research was approved by the Ubon Ratchathani Rajabhat University Ethics Committee for Human Research (Ref. No. HE642015). The research was conducted from June 2022 to September 2022 and followed in the post-COVID-19 period.

### 2.2. Participants/informants
The population included 717 VHVs in Nam Khun District, Ubon Ratchathani. The samples were divided into two groups: i) the samples used in the development process were 12 people involved in the prevention and control of COVID-19, selected through purposive sampling, consisting of 4 community leaders from 4 sub-districts; 5 community chairpersons, 6 hospital directors from 6 Tambon Health Promoting Hospitals and 7 primary care unit heads; ii) the samples used in the model trials and data aggregation were 55 VHVs, selected by simple random sampling. They were the representatives from 55 villages/communities in Nam Khun District, Ubon Ratchathani: 1 person per village/community.

### 2.3. Instruments
The tools used in developing and assessing this research were divided into qualitative and quantitative data collection tools. The qualitative data collection tools comprised interview, observation, and focus group discussion record forms. The quantitative data collection tool was a questionnaire consisting of the four following parts: i) part 1: General information of the respondents consists of gender, religion, age, marital status, education, occupation, number of responsible households, duration of work as VHVs, information source, training/obtaining knowledge about COVID-19, and specialist training; ii) part 2: A knowledge test on COVID-19 of VHVs consists of 15 items with positive and negative statements. They are closed-ended questions with "Yes" or "No"; iii) part 3: A questionnaire on the VHVs' attitude towards COVID-19 consists of 15 items with positive and negative statements. They are closed-ended questions with three levels of simple attitude scaling: "Agree", "Unsure," and "Disagree" [22]; iv) part 4: A questionnaire on the VHVs' behavior in preventing COVID-19 consisted of 15 items with 5-point rating scales: "Every time," "Often," "Sometimes", "Rarely" and "Never."

Five experts validated the questionnaire. Its Index of item objective congruence (IOC) was between 0.60-1.00. It was tried with 30 VHVs in Thung Si Udom District, Ubon Ratchathani, selected through random sample sampling. The reliability of the tools was also analyzed. The Kuder-Richardson 20 (KR-20) was used to investigate the reliability of the knowledge test on COVID-19 of VHVs, and its reliability was 0.77. We also determined the reliability of the questionnaire on the attitude and prevention behaviors toward COVID-19 using Cronbach's alpha coefficient. It was found that the reliability values of these two questionnaires were 0.72 and 0.88, respectively.
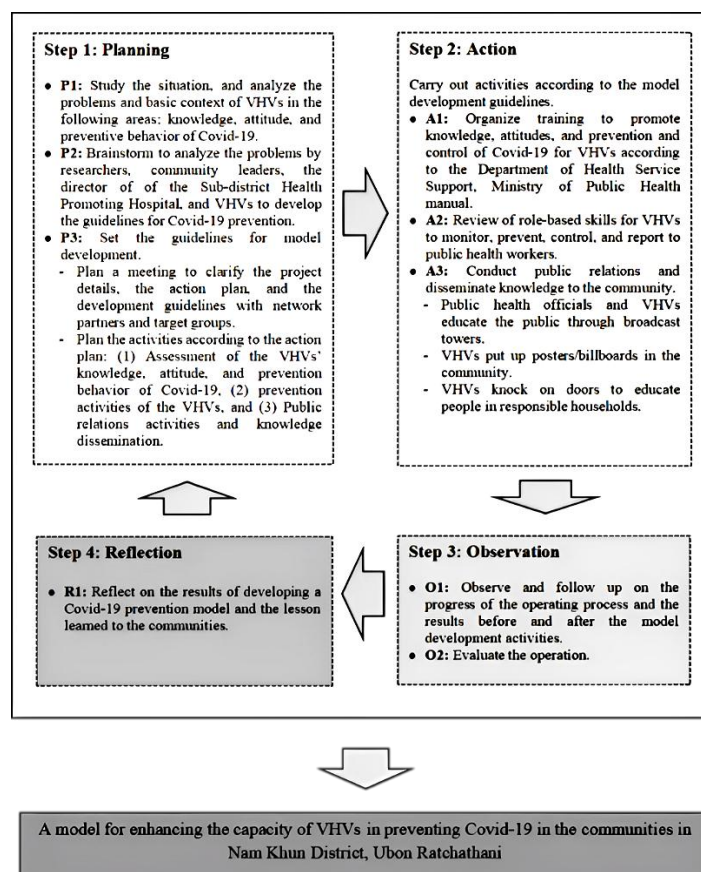
Figure 1. Conceptual framework

## 2.4. Data collection

The data collection was conducted in 3 phases as:

a. Phase 1 planning: organize a meeting with the research team and appoint a working group. Study the situations, problems, causes, and contexts of VHVs in controlling and preventing COVID-19 in the communities in Nam Khun District, Ubon Ratchathani.

b. Phase 2 research conduction: the development of a model for enhancing the capacity of VHVs in preventing COVID-19 in communities applied a 4-step cycle action research (PAOR), namely Step 1: planning, step 2: action, step 3: observation and step 4: reflection. The details were as:
   - Step 1 planning: Data from the study of situations, problems, causes, and contexts of VHVs were used in the planning stage. The guidelines for the development of a COVID-19 prevention model were defined.
   - Step 2 action: a meeting was held to clarify the project details and the action plan and assess the VHVs' capacity in knowledge, attitude, and behavior in preventing COVID-19. The development guidelines were defined in collaboration with network partners and target groups. Activities were organized according to the action plan, such as reviewing knowledge and attitude toward COVID-19 and carrying out disease prevention activities for the VHVs.
   - Step 3 observation: the progress of the activities was followed up, and the results were inspected according to the action plan. The knowledge, attitude, and behavior in preventing COVID-19 of the VHVs who participated in the research were assessed. The operation was also evaluated.
   - Step 4 reflection: the operation, the development, the problems and obstacles, and the lessons learned were summarized. The obtained information was presented to the communities.

c. Phase 3 evaluation: the model's effectiveness for enhancing the capacity of VHVs in preventing COVID-19 in the communities in Nam Khun District was evaluated.

## 2.5. Data analysis

The data analysis in this study are: i) qualitative analysis, it employed for the data obtained from the records of focus group discussions, interviews, observations, and practices. The collected data were classified, categorized, and analyzed by content analysis; ii) quantitative analysis: the following statistics were used. The

general data and the knowledge, attitude, and behavior in preventing COVID-19 in the communities of the VHVs were analyzed by descriptive statistics: frequency, percentage, mean, standard deviation, max, and min. The levels of knowledge, attitude, and behavior in preventing COVID-19 in the communities of the VHVs were analyzed by descriptive statistics: mean and standard deviation. The mean scores of knowledge, attitude, and behavior in preventing COVID-19 in the communities of the VHVs before and after the development of the model were compared by inferential statistics: paired samples t-test.

## 3. RESULTS AND DISCUSSION

### 3.1. Results of the model development and evaluation

Based on the study of the contexts, problems, and capacity of VHVs in the prevention and control of COVID-19 in the communities in Nam Khun District. The following issues were found and must be improved: i) the collaboration was in the form of an inefficient network; ii) the VHVs lacked skills in using digital technology/applications to facilitate the operation; iii) the resource management in the network was inefficient; iv) the VHVs lacked up-to-date knowledge about COVID-19; v) the VHVs did not have health literacy; vi) the network partners lacked unity and teamwork; vii) the VHVs were unaware of fast, correct, up-to-date news and information. Therefore, from the meeting resolution, the issues that needed to be developed were considered in the model development plan to enhance the capacity of VHVs to prevent COVID-19 in the communities in Nam Khun District.

The development process consisted of 4 steps:

i) Step 1: Planning: The issues that needed to be developed gained from studying contexts, problems, and capacity of the VHVs were brought to the meeting for planning. The guidelines for the development of the COVID-19 prevention model were established.

ii) Step 2: Action: The activities defined in the development guidelines in the planning step were organized, including providing knowledge about COVID-19, health literacy, skills in using digital technology/applications, forming a group for news communication and a team to work together in the network, informing about the work of the network partners and managing resources together in the form of a network.

iii) Step 3: Observation: The operation was checked by observing the participation in the activities. In addition, the knowledge, attitude, and behavior in preventing COVID-19 of the VHVs were assessed.

iv) Step 4: Reflection: The development results according to the development guidelines and the lessons learned were summarized, and the information was presented to the communities.

According to the development of a model for enhancing the capacity of VHVs in preventing COVID-19 in the communities in Nam Khun District, Ubon Ratchathani, it was found that of 55 VHVs, they were predominantly female (61.80%) and Buddhists (90.90%). The marital status was married (81.80%). They mostly completed an elementary education level (38.20%) with the main occupation of agriculture/livestock (74.50%). Most received information about COVID-19 from public health officials (92.70%) and training/knowledge about COVID-19 (78.20%). They also passed the training for VHVs (specialized VHVs) (36.40%). When classified by age, the lowest age was 30, the highest generation was 74, and the average age was 51.71. The average number of responsible households was 9.93 households. Also, the average duration of work as VHVs was 14.62 years.

Before the model was developed, the knowledge about COVID-19 of the VHVs was mainly moderate (43.64%). However, after the model was created, the VHVs' knowledge about COVID-19 was exceptionally high (62.27%) as presented in Table 1. Based on the comparison of the mean scores of the VHVs' knowledge about COVID-19, it was revealed that the knowledge about COVID-19 before enhancing the capacity of the VHVs in preventing COVID-19 was at a moderate level ($\bar{x}$=10.60, S.D.=2.08). But after their ability was enhanced, their mean score of knowledge about COVID-19 was at a high level ($\bar{x}$=12.24, S.D.=1.74), which was significantly higher than that of before the development of the model (p<0.001) as presented in Table 2.

When comparing the results of mean differences in the attitude toward COVID-19 among the VHVs, it was found that before the model was developed, the attitude towards COVID-19 of the VHVs was mainly moderate (50.90%). However, after the model was developed, most of the VHVs had the correct attitude towards COVID-19 at a high level (70.91%) as presented in Table 1, which was significantly higher than that before the model development (p<0.001) as presented in Table 2.

Before the model was developed, the behavior in preventing COVID-19 in the VHVs community was moderate primarily (43.64%). However, after the model was created, the mean score of the VHVs in the prevention of COVID-19 in the community was mainly at a high level (70.01%) as presented in Table 1.

When comparing the mean scores of the behavior in preventing COVID-19 in the community of the VHVs, after the model was developed, the mean score of the behavior in preventing COVID-19 was significantly higher than that of before the model was developed (p<0.001) as presented in Table 2.

Table 1. Number and percentage of the VHVs classified by the level of knowledge, attitude, and prevention behavior for COVID-19 before and after the model development (*n*=55)

| Factors | Before | | After | |
|---|---|---|---|---|
| | Number | % | Number | % |
| Level of knowledge | | | | |
| High | 20 | 36.36 | 37 | 62.27 |
| Moderate | 24 | 43.64 | 18 | 32.23 |
| Low | 11 | 20.00 | 0 | 0.00 |
| | Mean=10.60, Min=7, Max=14 | | Mean=12.24, Min=9, Max=15 | |
| Level of attitude | | | | |
| High | 21 | 38.20 | 39 | 70.91 |
| Moderate | 28 | 50.90 | 16 | 29.09 |
| Low | 6 | 10.90 | 0 | 0.00 |
| | Mean=22.22, Min=17, Max=29 | | Mean=25.09, Min=19, Max=30 | |
| Level of prevention behavior | | | | |
| High | 23 | 41.81 | 39 | 70.01 |
| Moderate | 24 | 43.64 | 16 | 29.09 |
| Low | 8 | 14.55 | 0 | 0 |
| | Mean=45.11, Min=34, Max=58 | | Mean=50.82, Min=40, Max=60 | |

Table 2. Comparison of the mean scores of the VHVs' knowledge, attitude, and prevention behavior for COVID-19 before and after the model development

| Factors | n | $\bar{x}$ | S.D. | t | df | 95% Cl | p-value |
|---|---|---|---|---|---|---|---|
| Knowledge | | | | | | | |
| Before | 55 | 10.60 | 2.08 | 19.59 | 54 | 1.47-1.80 | <0.001 |
| After | 55 | 12.24 | 1.74 | | | | |
| Attitude | | | | | | | |
| Before | 55 | 22.22 | 3.49 | 14.40 | 54 | 2.47-3.27 | <0.001 |
| After | 55 | 25.09 | 3.10 | | | | |
| Prevention behavior | | | | | | | |
| Before | 55 | 45.11 | 7.64 | 18.04 | 54 | 5.07-6.34 | <0.001 |
| After | 55 | 50.82 | 6.38 | | | | |

The development of the model for enhancing the capacity of VHVs in preventing COVID-19 in the communities in Nam Khun District was a new model. We called it the "NAMKHUN Model." It consists of the following elements: network, application, management, knowledge, health literacy, unity, and news as presented in Figure 2.

- N=network: it is a network system, a coordinated health network in Nam Khun District, consisting of VHVs, public health officials, community leaders, people, local agencies, Tambon Health Promoting Hospital, Nam Khun Hospital, local administrative organizations, and municipality.
- A=application: it is the ability to use applications. Nowadays, applications play an essential role in the performance of VHVs, such as the VHV innovative application, which is used for operations and providing helpful knowledge for VHVs.
- M=management: it refers to effective management under the health network partner system at the district level in managing resources, budgets, personnel, materials/ equipment to achieve maximum efficiency in preventing COVID-19 in the community.
- K=knowledge: it is up-to-date knowledge. VHVs gain new academic knowledge regularly from many channels, such as public health officials, local media, online media, radio, and television, so they have an accurate and up-to-date understanding of COVID-19 prevention.
- H=health Literacy: it is an enhancement of health literacy in preventing COVID-19, consisting of: i) access to information, ii) knowledge and understanding, iii) communication skills, iv) self-management skills, v) media literacy, and vi) decision-making skills.
- U=unity: VHVs, public health officials, and community leaders coordinate and work as a team and a committee. Tambon Health Promoting Hospitals and community hospitals have unity in collaboration. Local administrative organizations also cooperate in joint operations through a network.

- N=news: it refers to fast, accurate, up-to-date news. VHVs, public health officials, and network partners have communication channels such as Line groups and telephone for prompt and up-to-date communication.
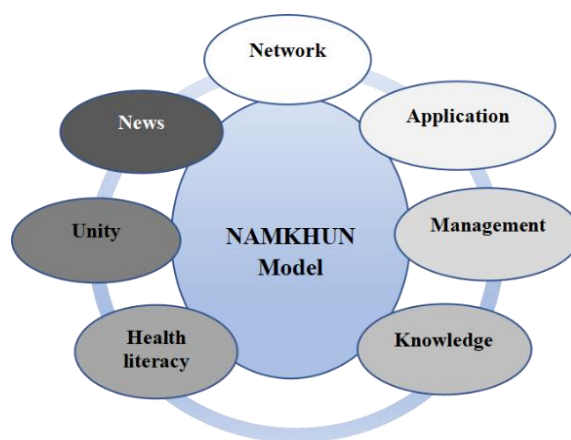
Figure 2. A model for enhancing the capacity of VHVs to prevent COVID-19
in Nam Khun District, Ubon Ratchathani

### 3.2. Discussion of the results

According to the study of the model development for enhancing the capacity of VHVs in preventing COVID-19 in the communities in Nam Khun District, Ubon Ratchathani. Action research was applied using the PAOR process as a research guideline. The results from operation in various processes can be discussed as:

a. The results of developing the model for enhancing the capacity of VHVs in preventing COVID-19 in Nam Khun District, Ubon Ratchathani.

The knowledge about COVID-19: After the development of the model, the mean score of the VHVs' knowledge significantly increased ($p<0.001$). After the model was developed, the VHVs' knowledge about COVID-19 was high. The mean knowledge score was changed because the COVID-19 knowledge training was organized. The training content consisted of providing knowledge about COVID-19, the right attitude towards COVID-19, practices and behaviors in controlling and preventing COVID-19, up-to-date news about the disease, and sharing knowledge and publicizing knowledge to the community. As a result, the VHVs had more understanding of COVID-19. This is in line with the study of Numsarapadnuk [23], who conducted action research on developing the potential of VHV home doctors in preventing COVID-19 in Nakhon Nayok Province. The knowledge, attitude, and behavior in preventing COVID-19 were assessed before and after the potential development. It was found that after the possible effect of VHV home doctors, their mean knowledge score increased from 13.70 to 18.40 points due to the organization of the training to educate about COVID-19 for VHVs. It is also consistent with the study of Siri [24], entitled "The development of a model for enhancing happiness at work in prevention and control of COVID-19 of VHVs in Nan Province". The findings indicated that before the model was developed, the knowledge of most of the VHVs was at a moderate level (62.36%). Their knowledge was mainly high after the model was developed (84.62%). This was caused by capacity building. The VHVs knew the prevention of COVID-19, so their mean knowledge score was higher than before the model's development.

The attitude towards COVID-19: After the development of the model, the VHVs' mean score on the attitude towards COVID-19 was significantly higher ($p<0.001$). After the model was developed, the perspective of the VHVs was at a high level. The mean attitude score changed due to the training activities to educate about the disease and the correct attitude towards COVID-19. This caused the VHVs to have the right attitude towards COVID-19. This is consistent with the study of Numsarapadnuk [23], who conducted action research on the development of the potential of VHV home doctors in the prevention of COVID-19 in Nakhon Nayok Province. The results showed that after developing the potential of VHV home doctors, their mean attitude score increased from 16.40 to 25.20 points. The training activities were organized to provide knowledge and a correct attitude about the disease. As a result, the mean attitude score of the VHV home doctors was higher than before the potential development.

The behavior in preventing COVID-19 in the community of the VHVs: The mean score of the VHVs' behavior in the prevention of COVID-19 in the community was significantly higher ($p<0.001$). After the development of the model, the mean score of the VHVs' behavior in the prevention of COVID-19 in the

community was at a high level (70.01%). This aligns with the study of Numsarapadnuk [23], conducting action research on developing the potential of VHV home doctors in preventing COVID-19 in Nakhon Nayok Province. It was found that after creating the potential of the VHV home doctors, their mean score of behavior for control and prevention of COVID-19 increased from 20.10 to 30.40 points. Because the VHV home doctors were regularly trained by medical and public health personnel, they had better behavior for control and prevention of COVID-19.

b.  The results of enhancing the capacity of VHVs in preventing COVID-19 in Nam Khun District, Ubon Ratchathani.

The model for enhancing the capacity of VHVs in preventing the spread of COVID-19 in the communities in Nam Khun District consisted of 3 activities: Activity 1: Assessing/analyzing the capacity of the VHVs; Activity 2: Enhancing the capacity of VHVs in preventing COVID-19 in the communities in Nam Khun District, Ubon Ratchathani, comprising four activities: i) enhancing the knowledge about COVID-19; ii) enhancing health literacy, access to information, knowledge and understanding, communication skills, self-management skills, media literacy, decision-making skills; iii) developing digital technology/application skills and iv) developing skills and practices; Activity 3: monitoring and evaluation. It can be explained that the model was developed from the analysis of the context of previous VHVs' capacity building in preventing COVID-19 in the community, together with the interviews and discussions among those involved in the surveillance, prevention, and control of COVID-19, namely public health personnel and network partners in the community. The model aims to enhance the capacity of VHVs in preventing COVID-19 in the community to make the surveillance, prevention, and control of COVID-19 more effective. After the capacity of the VHVs was enhanced, their knowledge about COVID-19, attitude towards COVID-19, and behavior preventing COVID-19 in the community was significantly improved (p<0.001). This aligns with a study on the competency development model for VHVs 4.0 [25], [26].

The findings revealed that the competency development model for VHVs 4.0 consisted of i) the analysis of VHVs 4.0's competencies, expected to have good knowledge and understanding of using digital technology, be able to access information, examine, analyze, and select correct information; ii) the curriculum for VHVs 4.0, containing curriculum objectives, behavioral objectives, characteristics and roles of learners, scope of content, teaching plans and evaluation from both inside and outside the classroom; iii) the development of VHVs 4.0, iv) the implementation of the model and v) the evaluation of the model. Based on the evaluation of the model, the samples participated in the training well. Their mean knowledge score was 9.2, with a p-value of 0.003 and a statistical significance 0.05. Regarding knowledge utilization, the VHVs 4.0 organized training to expand the results of the competency development for VHVs 4.0 in other areas. The application of knowledge from training was evaluated at a high level in all aspects. It is also consistent with a study on VHVs and community involvement in the prevention and surveillance of the COVID-19 infection in the community by using the geographic information system (GIS) [27]–[29]. The model of VHVs and community involvement in the prevention and surveillance of the COVID-19 infection consisted of enhancing the participation of VHVs and the disease prevention and surveillance approaches. The GIS used for preventing the COVID-19 infection was developed called "EpiScanCovid19." Moreover, the "CoviSainik Program" was successful in creating cadres of trained volunteers to control of COVID-19 in rural India [30].

## 4. CONCLUSION

It can be concluded that the model for enhancing the capacity of VHVs in preventing COVID-19 in the communities in Nam Khun District, Ubon Ratchathani, can strengthen the ability of the VHVs. The VHVs' knowledge, attitude, and behavior in controlling and preventing the spread of COVID-19 have increased. It is because of the critical success factor, called the NAMKHUN Model, consisting of N=network (working as a network); A=application (ability to use the application); M=management (effective management); K=knowledge (up-to-date knowledge); H=health literacy (having health literacy); U=unity (having unity) and N=news (fast, accurate and up-to-date news). A key success factor from the lessons learned was teamwork, complemented by up-to-date knowledge. These essential things will build desirable skills for handling emerging diseases that may occur in the future.

## REFERENCES

[1]    Domenico Cucinotta and Maurizio Vanelli, "WHO declares COVID-19 a pandemic," *Acta Biomedica*, vol. 91, no. 1, pp. 157–160, 2020.

[2]    J. Berglund, "Tracking COVID-19: there's an app for that," *IEEE Pulse*, vol. 11, no. 4, pp. 14–17, Jul. 2020, doi: 10.1109/MPULS.2020.3008356.

[3]    R. Ohannessian, T. A. Duong, and A. Odone, "Global telemedicine implementation and integration within health systems to fight the COVID-19 pandemic: a call to action," *JMIR Public Health and Surveillance*, vol. 6, no. 2, p. e18810, Apr. 2020, doi: 10.2196/18810.

[4]    M. R. Azarpazhooh *et al.*, "COVID-19 pandemic and burden of non-communicable diseases: an ecological study on data of 185 countries," *Journal of Stroke and Cerebrovascular Diseases*, vol. 29, no. 9, p. 105089, Sep. 2020, doi: 10.1016/j.jstrokecerebrovasdis.2020.105089.

[5]    S. Hinjoy *et al.*, "Self-assessment of the thai department of disease control's communication for international response to COVID-19 in the early phase," *International Journal of Infectious Diseases*, vol. 96, pp. 205–210, Jul. 2020, doi: 10.1016/j.ijid.2020.04.042.

[6]    Y.-C. Wu, C.-S. Chen, and Y.-J. Chan, "The outbreak of COVID-19: An overview," *Journal of the Chinese Medical Association*, vol. 83, no. 3, pp. 217–220, Mar. 2020, doi: 10.1097/JCMA.0000000000000270.

[7]    R. Yorsaeng *et al.*, "The impact of COVID-19 and control measures on public health in Thailand, 2020," *PeerJ*, vol. 10, p. e12960, Feb. 2022, doi: 10.7717/peerj.12960.

[8]    Department of Disease Control, "Report of the situation of Coronavirus disease 2019 (COVID-19)," *Emergency Operations Center. Department of Disease Control, Ministry of Public Health*. 2020. [Online]. Available: https://ddc.moph.go.th/viralpneumonia/index.php

[9]    COVID-19 Central Information Center, "Situation report of COVID-19." 2020. [Online]. Available: https://shorturl.asia/j1VJs

[10]   K. O'Flaherty *et al.*, "Community-based molecular and serological surveillance of subclinical malaria in Myanmar," *BMC Medicine*, vol. 19, no. 1, p. 121, Dec. 2021, doi: 10.1186/s12916-021-01993-8.

[11]   P. Jiaviriyaboonya, "Anthropological study of village health volunteers' (VHVs') socio-political network in minimizing risk and managing the crisis during COVID-19," *Heliyon*, vol. 8, no. 1, p. e08654, Jan. 2022, doi: 10.1016/j.heliyon.2021.e08654.

[12]   N. Kaweenuttayanon, R. Pattanarattanamolee, N. Sorncha, and S. Nakahara, "Community surveillance of COVID-19 by village health volunteers, Thailand," *Bulletin of the World Health Organization*, vol. 99, no. 5, pp. 393–397, May 2021, doi: 10.2471/BLT.20.274308.

[13]   T. Krassanairawiwong, C. Suvannit, K. Pongpirul, and K. Tungsanga, "Roles of subdistrict health office personnel and village health volunteers in Thailand during the COVID-19 pandemic," *BMJ Case Reports*, vol. 14, no. 9, p. e244765, Sep. 2021, doi: 10.1136/bcr-2021-244765.

[14]   S. Sangpoom, F. Adesina, J. Saetang, N. Thammachot, K. Jeenmuang, and C. Suwanbamrung, "Health workers' capability, opportunity, motivation, and behavior to prevent and control COVID-19 in a high-risk district in Thailand," *Roczniki Państwowego Zakładu Higieny*, vol. 74, no. 1, pp. 71–81, Mar. 2023, doi: 10.32394/rpzh.2023.0245.

[15]   W. Chinnabutr and N. Phakdisorawit, "The role of village health volunteers (Vhvs) in preventing the coronavirus 2019 (Covid-19) outbreak according to government policy of Mueang district suphanburi province," *Journal of Social Science and Buddhistic Anthropology*, vol. 6, no. 2, pp. 304–318, 2021.

[16]   M. P. Kate *et al.*, "Community health volunteer for blood pressure control in rural people with stroke in India: Pilot randomised trial," *Journal of Stroke and Cerebrovascular Diseases*, vol. 32, no. 6, p. 107107, Jun. 2023, doi: 10.1016/j.jstrokecerebrovasdis.2023.107107.

[17]   K. Pitchalard, K. Moonpanane, P. Wimolphan, O. Singkhorn, and S. Wongsuraprakit, "Implementation and evaluation of the peer-training program for village health volunteers to improve chronic disease management among older adults in rural Thailand," *International Journal of Nursing Sciences*, vol. 9, no. 3, pp. 328–333, Jul. 2022, doi: 10.1016/j.ijnss.2022.06.011.

[18]   N. Songserm, S. Woradet, O. Bureelerd, C. Thongchai, S. Thongprung, and A. Ali, "Effectiveness of leader village health volunteers training program on preventing cholangiocarcinoma in Thailand: advantages for high-risk area with limited public health personnel," *Journal of Cancer Education*, vol. 36, no. 6, pp. 1306–1315, Dec. 2021, doi: 10.1007/s13187-020-01768-4.

[19]   N. Songserm *et al.*, "Effectiveness of village health volunteer parallel program for proactive action to reduce risk factors for cholangiocarcinoma in two high-risk countries in the greater mekong subregion," *Nutrition and Cancer*, vol. 74, no. 5, pp. 1724–1733, May 2022, doi: 10.1080/01635581.2021.1957949.

[20]   O. Bunkarn and K. Kusol, "The relationship between perceived self-efficacy and cervical cancer screening among village health volunteers in suratthani province, Thailand," *Asian Pacific Journal of Cancer Prevention*, vol. 22, no. 1, pp. 179–183, Jan. 2021, doi: 10.31557/APJCP.2021.22.1.179.

[21]   S. Kemmis and R. McTaggart, *The Action Research Planer*, 3rd ed. Deakin University, 1988.

[22]   N. Songserm, P. Korsura, S. Woradet, and A. Ali, "Risk communication through health beliefs for preventing opisthorchiasis-linked cholangiocarcinoma: A community- based intervention in multicultural areas of Thailand," *Asian Pacific Journal of Cancer Prevention*, vol. 22, no. 10, pp. 3181–3187, Oct. 2021, doi: 10.31557/APJCP.2021.22.10.3181.

[23]   R. Numsarapannuek, "Potential development of village health volunteer home doctor for control and prevention Coronavirus Disease 19, Nakhon Nayok Province," *Singburi Hospital Journal*, vol. 31, no. 2, pp. 118–130, 2022.

[24]   N. Siri, "The enhancement of happiness at work model for COVID-19 prevention and control of village health volunteers, Nan Province," *Multidisciplinary Journal for Health*, vol. 3, no. 2, pp. 18–31, 2021.

[25]   P. Thotet, "A study of the competency development model for village health volunteers 4.0 North Region, 2018," *Journal of Human Societ*, vol. 10, no. 1, pp. 34–44, 2021.

[26]   N. Rukchart *et al.*, "Prevalence and determinants of COVID-19 vaccine acceptance among vulnerable populations in Thailand: An application of the health belief model," *Heliyon*, vol. 10, no. 4, p. e26043, Feb. 2024, doi: 10.1016/j.heliyon.2024.e26043.

[27]   J. Nawamawat, V. Sittisart, K. Lekphet, and P. Thianthawon, *The village health volunteers and community involvement in the prevention and surveillance of the COVID-19 infection in the community by using the Geographic Information System*. Health Systems Research Institute (HSRI), Thailand: Siamsilp Printing House.

[28]   M. S. Aboalyem and M. T. Ismail, "Mapping the pandemic: a review of geographical information systems-based spatial modeling of Covid-19," *Journal of Public Health in Africa*, vol. 14, no. 11, p. 2767, Nov. 2023, doi: 10.4081/jphia.2023.2767.

[29]   M. Mousavi Aghdam and Q. Crowley, "Application of GIS and spatiotemporal analyses in viral infection modelling using multiple datasets – A case study on the SARS-CoV-2 epidemic," *Medicina de Familia. SEMERGEN*, vol. 50, no. 4, p. 102159, May 2024, doi: 10.1016/j.semerg.2023.102159.

[30]  R. Sabale, G. Velhal, V. Sonawane, and S. Gupta, "'CoviSainik Program' – A Novel Public Private Partnership Initiative in the Control of COVID-19 in Rural India," *Indian Journal of Community Medicine*, vol. 48, no. 6, pp. 894–901, 2023, doi: 10.4103/ijcm.ijcm_139_23.

## BIOGRAPHIES OF AUTHORS

**Punnatorn Nawan** is a public health officer and pharmacist working at the Nam Khun Hospital, a community hospital in Nam Khun District, Ubon Ratchathani, Thailand. He uses his knowledge and ability to reach out to communities well, especially the health of people in rural areas, including using VHVs as a base for managing people's health. He can be contacted at email: punnatorn.ng63@ubru.ac.th.

**Monthicha Raksilp** is a lecturer and researcher of public health at the Department of Health Sciences, Faculty of Public Health, Ubon Ratchathani Rajabhat University (UBRU), Ubon Ratchathani, Thailand. She is the Deputy Director of the Community Academic Services Office at UBRU. She used her knowledge of public health and her experience in community-academic services to apply in conducting research in the community. Her research focuses on community health, public health, and community mental health. She can be contacted at email: monthicha.r@ubru.ac.th.

**Waratip Kankarn** is a lecturer and researcher of nursing at the Faculty of Nursing, Ubon Ratchathani Rajabhat University (UBRU), Ubon Ratchathani, Thailand. She has research experience in the community, especially in adult nursing, health care for chronically ill patients, and collaboration with community health personnel. Now, she is a Dean of the Faculty of Nursing at UBRU, Thailand. She can be contacted at email: waratip.k@ubru.ac.th.

**Nopparat Songserm** is a lecturer and researcher of public health. He has over 20 years of experience teaching graduate and undergraduate students at Ubon Ratchathani Rajabhat University (UBRU), Ubon Ratchathani, Thailand. In the summer of 2010, he got a scholarship from the UICC Yamagiwa-Yoshida Memorial International Cancer Study Grant to research at the Clinical Trial Service and Epidemiological Studies Unit, University of Oxford, United Kingdom. Now, he is a head of Ph.D. Program in Health Sciences in Faculty of Public Health, UBRU, Thailand. His research focuses on epidemiology, community health, and public health. He is the author of several peer-reviewed scientific articles in major international journals. He can be contacted at email: nopparat.s@ubru.ac.th.