A Confirmatory Factor Analysis of Adaptive Leadership of Village Health Volunteers in Prevention and Control of New Emerging Infectious Diseases in Communities, Thailand.
泰国社区健康第七区村庄公共卫生志愿者在预防和控制新发传染病方面的适应性领导力验证性因素分析。

Somroeg Kabklang[1], Chulaporn Sota[*2] Kasom Chanawongse[3], Orasa Kongtal[4] Prasong Toochoot[5]

[1] Ph.D Candidate Philosophy program on Leadership Innovation, College of Asian Scholars, Thailand.

[2] Assoc.Prof. Dr:Philosophy program on Leadership Innovation .College of Asian Scholars, Thailand.

[3] Assit.Prof. Dr . :Philosophy program on Leadership Innovation .College of Asian Scholars, Thailand.

[4] Assit.Prof. Dr . : Nursing Science, Khon Kaen University, Thailand.

[5],Lecturers Faculty of Education and Liberal Arts. College of Asian Scholars, Thailand.

*Corresponding author.
Email: chulaporn@cas.ac.th (Chulaporn Sota) Tel : +66862389779

Abstract

This study aimed to analyze the components of adaptive leadership among Village Health Volunteers (VHVs). The research sample comprised 497 VHVs from Health Region 7, Thailand, selected using a stratified random sampling method. The research instrument was a five-point Likert scale questionnaire, consisting of four sections: cultural competence, general management skills, knowledge management, and vision. The reliability coefficients for these sections were 0.970, 0.988, 0.990, and 0.976, respectively. Data were analyzed using descriptive statistics (mean and standard deviation) and second-order confirmatory factor analysis.

The findings revealed that the overall adaptive leadership of VHVs in Health Region 7 was at a good level (mean = 3.78, SD = 1.01). When considering each component, general management skills had the highest mean score (mean = 3.87, SD = 1.14), followed by knowledge management (mean = 3.79, SD = 1.06), vision (mean = 3.78, SD = 1.07), and cultural competence (mean = 3.61, SD = 1.01). The confirmatory factor analysis indicated that the model of adaptive leadership components among VHVs in Health Region 7 was consistent with the empirical data χ^2 = 72.343, df = 57, p-value = .083, CFI = .998, TLI = .997, RMSEA = .023, SRMR = .011).Therefore, the variable is strongly recommended to measure the level of adaptive leadership of village health volunteers in prevention and control of new emerging infectious diseases in communities.

Keywords: adaptive leadership, confirmatory factor analysis, village health volunteers, emerging disease, Covid 19.

本研究旨在分析村庄卫生志愿者（VHV）的适应性领导力构成要素。研究样本为来自泰国第七卫生区的497名村庄卫生志愿者，采用分层随机抽样法选取。本研究使用的工具为五点李克特量表问卷，包括四个部分：文化能力、一般管理技能、知识管理和愿景。这些部分的信度系数分别为0.970、0.988、0.990和0.976。数据采用描述性统计（均值和标准差）及二阶验证性因素分析进行分析。

研究结果显示，第七卫生区村庄卫生志愿者的整体适应性领导力处于良好水平（均值 = 3.78，标准差 = 1.01）。从各个组成部分来看，一般管理技能的平均得分最高（平均值 = 3.87，标准差 = 1.14），其次是知识管理（平均值 = 3.79，标准差 = 1.06）、愿景（平均值 = 3.78，标准差 = 1.07）和文化能力（平均值 = 3.61，标准差 = 1.01）。验证性因素分析表明，第七卫生区村庄卫生志愿者适应性领导力组成模型与实证数据相符（χ^2 = 72.343，df = 57，p 值 = 0.083，CFI = 0.998，TLI = 0.997，RMSEA = 0.023，SRMR = 0.011）。因此，强烈建议使用该变量来衡量村庄卫生志愿者在社区新发传染病防控中的适应性领导力水平。

关键词：适应性领导力、验证性因素分析、村庄卫生志愿者、新发疾病、COVID-19。

1.INTRODUCTION

The borderless world is changing in every aspect, from changes in technology, people's behavior, business model replacement, international trade wars, and the rapid changes in the current economic environment. It is a volatile world (VUCA World), which means that the operating environment of the current world is constantly changing, fast, and unpredictable. There are four types of volatility: 1) Volatility is a situation or environment that changes rapidly, abruptly, and is difficult to predict or predict. 2) Uncertainty is a highly uncertain state. The information for decision-making is unclear, resulting in disorderly changes. 3) Complexity is a systematic complexity. There are many factors that complicate decisions. 4) Ambiguity is the unclearness of various phenomena that occur in terms of cause and effect. It may cause feelings and perceptions to conflict. It is impossible to predict the results that will occur. [1,2,3]

The Covid-19 pandemic is an example of an emerging infectious disease that has impacted the world situation of disruptiveness. Emerging infectious diseases are new infectious diseases that have never occurred before. They are infectious diseases caused by new pathogens (New infectious disease), infectious diseases found in new geographical areas (New geographical areas), or re-emerging infectious diseases (Re-emerging infectious disease), pathogens that are resistant to antimicrobial agents (Antimicrobial resistant organisms), and intentional human actions with biological agents [4] Most emerging infectious diseases are complex and difficult to manage. If there is a lack of effective disease prevention and control systems and tools, these diseases may cause loss of life and health of the public and may have a huge impact on society and the economy [5] Over the past three decades, emerging infectious diseases have tended to increase in number and severity. Currently, there are still many important emerging infectious diseases that need to be controlled and closely monitored (Strategy and Planning Division, Office of the Permanent Secretary, [6,7,8] In the past, the

world and Thailand have experienced many new emerging diseases, such as SARS, bird flu, influenza, Ebola virus, Zika virus, and COVID-19, which is the latest emerging disease that people around the world are currently dealing with. [9]

[9.1] Awad, A. (2023). Study comparison between Egypt and the UAE (United Arab Emirates) in measuring the effects of the ministry of health organizational learning on proactive behavior during the COVID -19 pandemic, found that The results indicated that organizational learning had a positive impact on proactive behaviors. Study for paradigm shift of prevention is the most important.

Adaptive leadership theory is a leadership theory that refers to the ability to adapt quickly. Must be able to assess, grasp issues and solve problems promptly. Have the ability to quickly adapt to deal with problems Consists of having vision (Vision), understanding (Understanding), clarity (Clarity) and agility (Agility) [2, 10]

Responding to uncertainty requires transformative leadership, which means the ability to anticipate future needs (Anticipation), articulate those needs (Articulation) to build support and understanding, adapt responses based on continuous learning, and demonstrate accountability through transparency in decision-making processes. Leaders are faced with unpredictability, incomplete information, many unknowns, and the need to quickly identify crises' responses [11]. Meanwhile [12]Toubat, H. S., & Udwan, N. F. (2023).Study The impact of measures taken to confront COVID 19 on rights and freedoms : A case study of Jordan. Found that international standards allow for the restriction of rights and freedoms to the extent necessary to maintain health threatened by the Corona virus for effective control and concern about economic as well.

Adaptive leadership has become an essential skill for health system leaders in responding to the COVID-19 pandemic as new knowledge emerges and patient numbers rise, fall, and rise again. This leadership approach has been described as an iterative process of looking at the big picture, interpreting the meaning of incoming data from multiple directions, and acting in real time. This is due to the government's public health policy to develop and upgrade the knowledge of village health volunteers (VHVs) to become family doctors, along with the use of medical communication technology, and increasing the efficiency of community public health services through the development of telemedicine systems, along with increasing the role of VHVs to reduce diseases and health problems, and promote people's self-reliance. Currently, there is a network of more than 1,040,000 VHVs, who represent people who volunteer and sacrifice to take part in caring for their own health, their families, and their communities, and have been recognized by society[13]

And the implementation guidelines of the national strategic plan for readiness, prevention and resolution of emerging infectious diseases (2017-2021) in the 5th strategy emphasizes enhancing participation from civil society and private sectors in prevention and control of emerging infectious diseases [14] However, the performance of the role of VHWs in primary health care in disease prevention and control will only be the prevention of endemic infectious diseases, namely dengue fever. The routine activities are surveying and destroying mosquito breeding sites. Therefore, developing VHWs to have appropriate leadership and skills in prevention and control of emerging infectious diseases is necessary. The researcher is therefore interested in choosing the adaptive leadership theory as a conceptual framework for developing an appropriate program model to develop adaptive leadership of village health volunteers (VHWs) in controlling and preventing emerging infectious diseases in the community.

2. RESEARCH OBJECTIVES

To analyze and confirm the components of adaptive leadership among Village Health Volunteers (VHVs)

3. RESEARCH METHODOLOGY

A cross-sectional study was carried out in 4 provinces region 7 in The Northeast of Thailand.

3.1 Population and sample.

The population is the village health volunteer presidents in Health Region 7 (Roi Et, Khon Kaen, Maha Sarakham and Kalasin) totaling 8,310 people [15](strategic and Planning Division, 2021).https://spd.moph.go.th/public-health-statistics/)

The sample is the village health volunteer presidents at the sub-district level in Health Region 7, totaling 500 people. The appropriate sample size for the confirmation factor analysis should be between 10-20 times the parameter [16] The sample group was selected by stratified random sampling according to the province.

3.2 Research instruments used for data collection: Compost of 5 parts as follow.

Part 1 was a questionnaire regarding general information of the respondents. It was in the form of a checklist regarding gender, age, occupation, education level, income, and length of time as a village health volunteer.

Part 2 was a five-level rating scale questionnaire regarding the components of transformative leadership of village health volunteers, including: 1) cultural competence, 2) management skills, 3) knowledge management, and 4) having a vision.

Construction and quality of instruments:

Study concepts and related research works, construct instruments, and then have the questionnaires examined by experts in order to find the validity of the instruments by finding the CVI (Content Validity Index) value from 7 experts using the I-CVI $\geq$ 0.78 criterion (Lynn, 1986). The questions were considered appropriate with 56 items. The revised questionnaires were tested (Try out) with a non-sample population of 30 people to find the quality of the questionnaires by finding the reliability value of .995.

3.4 DATA COLLECTION

The researchers collected 500 copies of data using an online questionnaire and checked the completeness of the questionnaire. There were 497 complete responses, accounting for 99.40 percent.

3.5 DATA ANALYSIS

1.Basic statistics Average by using descriptive statistics for comparing the average value with the criteria using the evaluation and interpretation criteria [17] as follows:

Average score 4.51-5.00 means the highest level

Average score 3.51-4.50 means high level

Average score 2.51-3.50 means moderate level

Average score 1.51-2.50 means low level

Average score 1.00-1.50 means the lowest level

Standard deviation (SD) Percentage Frequency

2.Statistics used in the analysis of the quality of the instrument include calculating the reliability (Content validity) and reliability by finding the Cronbach's alpha coefficient after try out among 30 VHV in the other area.

3.Confirmatory Factor Analysis for explore the reasons behind the gap between adaptive leadership and emerging disease as COVID 19 in community[18] by using MPlus program.[19]

3.6 RESEARCH ETHICS

Certification This research has been certified for human research ethics by the Human Research Ethics Committee, Asia Graduate School, No. CASHE670002, with a certification period from February 15, 2024 to July 17, 2025

4. RESEARCH RESULTS

1.General Data. The results of the study found that most of the village health volunteers were from Roi Et Province, 147 people, followed by Khon Kaen Province, 140 people, Maha Sarakham Province, 115 people, and Kalasin Province, 95 people, accounting for 29.60, 28.20, 23.10, and 19.10 percent, respectively. Most of them belonged to the sub-district health promotion hospital, 440 people, followed by the medical center/community health center, 38 people, and the public health center (municipality), 19 people, accounting for 88.50, 7.60, and 3.80 percent, respectively. The majority of the sample was female, 346 people, accounting for 69.60 percent, and 242 people, accounting for 48.70 percent, were aged between 51 and 60 years. Their educational level was high school/vocational certificate. 263 people, or 52.90 percent, had the majority of their income between 5,001 - 10,000 baht/month, 227 people, or 45.7 percent, most of whom were farmers, 360 people, or 72.4 percent, and had worked as village health volunteers for more than 20 years, 285 people, or 57.30 percent

2. **The results of the study on the level of leadership in the transformation of village health volunteers** showed that the overall mean was at a good level ($\bar{}$= 3.78, SD = 1.01). When considering each aspect, it was found that general management skills had the highest mean at a good level ($\bar{}$= 3.86, SD = 1.14), followed by knowledge management at a good level ($\bar{}$= 3.79, SD = 1.06), having a vision at a good level ($\bar{}$= 3.78, SD = 1.07), and cultural competence at a good level ($\bar{}$= 3.61, SD = 1.01), respectively, as shown in Table 1.

Table 1 Mean and standard deviation of transformational leadership components of village health volunteers in the control and prevention of emerging infectious diseases

Adaptive leadership	$\bar{x}$	S.D.	Interpretation	Rank
1. cultural competence skill	3.61	1.01	Good	4
2. general management skill	3.86	1.14	Good	1
3. knowledge management	3.79	1.06	Good	2
4. Vision	3.78	1.07	Good	3
Total	3.78	1.01	Good	

The second-order confirmatory factor analysis of the adaptive leadership of village health volunteers in controlling and preventing emerging infectious diseases found that the model was consistent with the empirical data as seen from the chi-square value χ^2 = 72.343, df = 57, relative χ^2 = 1.269, P-value = 0.083, CFI = 0.998, TLI = 0.997, RMSEA = 0.023 and SRMR = 0.011, indicating that the model was consistent with the empirical data.

When considering the adaptive leadership of village health volunteers in controlling and preventing emerging infectious diseases, each component showed that the variable with the highest importance weight was general management skills with a value of .994, followed by knowledge management with a value of .953, vision with a value of .917 and cultural .750 as table 2

Table 2 Confirmatory Factor Analysis Results of Adaptive Leadership of Village Health Volunteers in Emerging Infectious Disease Control and Prevention

Components	Component Weight(β)	S.E.	z	R^2
1. cultural competence skill	.750	.024	31.310	.563
2. general management skill	.994	.010	96.448	.987
3. knowledge management	.953	.012	82.622	.908
4. Vision	.917	.014	66.973	.840
Suitability Test Results Chi-square (χ^2) = 72.343, df = 57, relative χ^2= 1.269, P-value = 0.083, CFI = 0.998, TLI = 0.997, RMSEA = 0.023 and SRMR = 0.011				

When considering the weights of the four latent variables, from the standardized coefficient scores of the weights, it appears that the general management skills (GMS) component is the most important, followed by the knowledge management component (KNO), visionary component (VIS), and cultural competence (CCO), with standardized coefficient scores of .994, .953, .917, and .750, respectively. The importance of each observable variable can be ranked as follows: Cultural competence (CCO) is measured by three observable variables, where awareness of the importance of culture (Y1) is the most important, followed by understanding cultural differences (Y2), and cultural appreciation (Y3), with standardized coefficient scores of .921, .838, and .836, respectively. The general management skills (GMS) component is measured by four observable variables, where change management (Y7) is the most important, followed by Conflict management (Y6),

planning (Y5), and communication (Y4), respectively, with standardized coefficient scores of weights of .896, .895, .884, and .895, respectively.

The component of knowledge management (KNO) was measured by 4 observable variables, where knowledge creation (Y9) was the most important, followed by knowledge sharing (Y10), knowledge seeking (Y8), and knowledge application (Y11), respectively, with standard coefficient scores of weights of .938, .914, .896, and .885, respectively. The component of vision (VIS) was measured by 3 observable variables, where risk-taking (Y12) was the most important, followed by imagination (Y14), and innovator (Y13), respectively, with standard coefficient scores of weights of .914, .908, and .901, respectively, as shown in Figure 1

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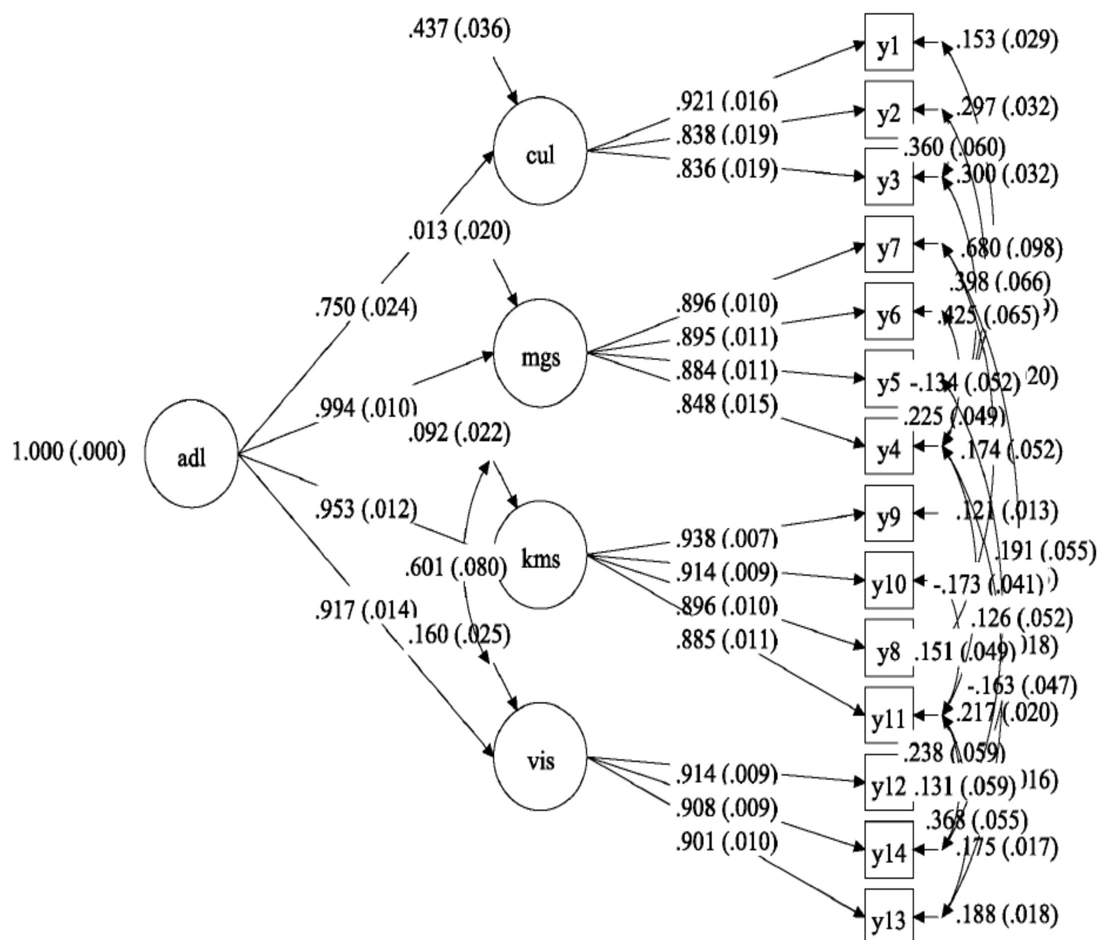

Figure 1. Standardized solution values in the second-order confirmatory factor analysis.

5. DISCUSSION

The Importance of general management skills.by applying adaptive leadership for studying factor effecting emerging disease control and prevention found that.

The results of the study found that general management skills had the highest component weight (β = .994) and the highest level of practice (mean = 3.86), reflecting the importance of management in working of VHWs, especially change management, which is an important skill in dealing with the situation of emerging infectious diseases with high uncertainty. This is relevance with the study of [2] who stated that the current global is volatile, uncertain, complex, and ambiguous, which requires leaders with skills for managing rapid and agile changes (Agility) in various management. The fact that VHWs have good general management skills demonstrates their potential to be change leaders in the community. This is consistent with the study of World Health Organization, (2020)[20] which found that VHWs are important personnel who have a role in effectively controlling the spread of COVID-19 in Thailand. VHWs play an important role in disease control and prevention using the community as a base, including risk communication, home health promotion, disease screening, disease control, and disease surveillance in the community. and the study of [21] Kaweenuttayanon, N., Pattanarattanamolee, R., Sorncha, N., & Nakahara, S,(2021). found that VHWs are involved in the surveillance and control of the spread of COVID-19 in Thailand by playing an important role in screening returnees from high-risk areas, promoting home quarantine of patients, and reporting COVID-19-related symptoms. The participation of VHWs has enabled Thailand to control the spread of the virus without the need for a nationwide lockdown. Relevance with the study by[22] A.G.O. Wisnumurti, (2025) found that the government need to improve sustainability strategic by strongly management.

Knowledge management and coping with emerging infectious diseases. The knowledge management component has the second-highest weight (β = .953)1, reflecting the importance of the process of creating, seeking, sharing, and applying knowledge in the work of VHWs in an era where information about emerging infectious diseases changes rapidly. The fact that VHWs have good knowledge management skills (mean = 3.79)1 is an important strength in coping with the outbreak situation, especially knowledge creation, which has the highest weight in this component (β = .938).1 This shows that VHWs are not only recipients of knowledge from public health personnel, but can also create and develop knowledge that is appropriate for the community context, which is an important characteristic of adaptive leadership that can create continuous learning in response to uncertainty [2]Adaptive leaders must learn all the time and adapt to empirical data or evidence, be open to new information, and dare to admit mistakes in order to cope with unpredictable challenges. This is especially important in crisis situations with high uncertainty[8]

Vision and change leadership Vision is another important component of the adaptive leadership of VHWs (β = .917)1, especially risk-taking, which is the variable with the highest weight in this component (β = .914)1, indicating that VHWs have the courage to make decisions and take action in situations of high uncertainty , which are essential characteristics for dealing with emerging infectious diseases with incomplete information and requiring rapid response. The results of this study are consistent with the theory of transformative leadership, which describes the ability to adapt quickly, consisting of vision, understanding, clarity, and agility [2] The fact that VHWs have a good level of vision (mean = 3.78)1 is an important foundation for anticipating future needs (Anticipation) and adjusting responses (Adaptation) appropriately.[23] and relevance study of [24]Nen, S., Ibrahim, F., Akhir, N. M., Sarnon, N., & Abdullah, H. (2024). study social interactions and compliance of Malasians during the COVID 19 MCO period .found that a majority of the public (59.45%) exhibited high compliance with

government procedures, obedience to authority (78%), and open-mindedness (68.5%). Social behaviors such as social stigma (45.6%) and aggressive behavior (88.1%) were well-controlled. Significant links (p>0.01) were found between compliance with authority, obedience to government procedures, aggressive behaviors, and open-mindedness during the MCO period. The findings of this study not only highlight the effectiveness of Malaysian government measures in managing the COVID-19 pandemic and offer valuable insights for other countries.

Cultural competence and community context Although cultural competence had the lowest component weight (β = .750),1 it is still considered important in the work of VHWs, especially in areas with cultural diversity. VHWs' awareness of the importance of culture (β = .921)1 will help them communicate and work effectively with people with diverse backgrounds[24] Cultural competence is a component that helps VHWs reach out to and build cooperation with people in the community more easily. This is because VHWs are people from the same community as the people. They understand the culture, beliefs, and ways of life of the people in the community. Therefore, they can apply disease prevention and control measures that are consistent with the community context [25, [26]

These finding relevance of the studies by[27] Tossapon Chamnankit, Parichat Ong-Artborirak, Waraporn Boonchieng, Niwat Songsin, Wanwimon Mekwimon kingkaew, Sureewan Siladlao, Kanokporn Somporn,2023) The Village health volunteers (VHVs) play crucial leadership roles in promoting health behavior changes including searching for controlling, and preventing the spread of COVID 19 within their communities can be utilized to further enhance health literacy among VHVs including relevance with [28] Surachai Phimha, Nakarin Prasit, Nopparat Senahad, Krissana Aunthakot, Chanaporn Pinsuwan, Kittipong Sornlorm, Nuttaporn Nidthumsakul, Natnapa Heebkaew Padhasuwan, 2024) ،summarize that community leaders in Thailand play an important role in preventing and controlling infectious diseases, especially during the COVID-19 pandemic. Hence, risk perception and adequate health literacy among these leaders influence the population. Found that the incorporation of health literacy and risk perception, especially in dimensions of leaders such as access, understanding, perceived susceptibility, and perceived severity, is essential for leaders to possess strong skills in community health development, particularly during crises such as the COVID-19 pandemic.On the other hand relevance with [29] Muhammed Ashraful Alam, Md. Nazmul Haque, Shuvashis Saha, Faiza Farheen, Suphawadee ,Panthumas, J.A. Zuenkova, 2023) studies The causal model of the COVID-19 prevention behaviors was assessed and justified through SEM. The model fits well with the empirical data (Intention significantly influenced COVID-19 prevention behavior directly. The variance for COVID-19 preventive behaviors. Adequate knowledge, a positive attitude, proper motivation, and positive intention can encourage rural adults to adopt healthy behaviors against COVID-19. The theoretical model of the study effectively explained COVID-19 preventive behaviors rationally and provided a roadmap for policy-makers to formulate strategies to combat COVID-19 and any future similar pandemic.

6. RECOMMENDATION

6.1 RECOMMENDATION FOR RESEARCH APPLYING.

1. Relevant agencies should develop training courses to enhance adaptive leadership for village health volunteers (VHVs), focusing on the development of the 4 main components discovered from this research, especially general management skills, which are of most importance.

2. Policy formation to support the development of VHVs to become leaders in controlling and preventing emerging infectious diseases in the community systematically, according to the national strategic plan for preparing, preventing, and solving emerging infectious diseases.

3. There should be a strengthening of the VHV network in monitoring and controlling emerging infectious diseases by supporting a knowledge management system and knowledge exchange between VHVs in various areas.

6.2 RECOMMEDATION FOR FURTHER RESEARCH

1. Research should be conducted development program to enhance the adaptive leadership of village health volunteers (VHVs) .

2. Qualitative research should be conducted to gain an in-depth understanding of the process of developing adaptive leadership of village health volunteers who are successful in controlling emerging infectious diseases.

2.3 Comparative research should be conducted on the adaptive leadership of village health volunteers in each region of Thailand to study the differences and factors affecting leadership development in different contexts.

7.CONCLUSION

This research has provided important knowledge about the components of adaptive leadership of village health volunteers, which consist of 4 main components that can be used to develop the potential of village health volunteers to be leaders in controlling and preventing emerging infectious diseases in the community effectively, in line with the current rapidly changing global situation. The confirmatory factor analysis indicated that the model of adaptive leadership components among VHVs in Health Region 7 was consistent with the empirical data χ^2 = 72.343, df = 57, p-value = .083, CFI = .998, TLI = .997, RMSEA = .023, SRMR = .011). All variable are strongly recommended to measure the level of adaptive leadership of village health volunteers in prevention and control of new emerging infectious diseases in community.

8.CONFLICT INTEREST

The authors declare that is no conflict of interest.

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