

# Development of Systems and Mechanisms for Managing the Coronavirus Disease 2019 Crisis in Det Udom District, Ubon Ratchathani Province, Thailand

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## Abstract

*This action research endeavored to develop systems and mechanisms for managing the coronavirus disease 2019 (COVID-19) crisis in Ubon Ratchathani Province, focusing on district and sub-district levels. A structured tool served as a guideline for questions during group discussions. Data analysis encompassed frequency and percentage calculations for quantitative data, along with content analysis for qualitative data. The findings indicate that district and sub-district departments have established cooperation systems alongside comprehensive guidelines. Clear guidelines are outlined in the disease control manual, and infectious waste management practices were observed to be appropriate. Budget plans have been formulated by municipal and sub-district administrative organizations to prepare for disease control in the upcoming year. Additionally, there is a plan to utilize funds from the Community Health Security Fund to adequately address disease control within sub-districts. Kham Khrang sub-district has devised a local health charter to bolster operational readiness and address potential crises from other infectious diseases. These study results can serve as a model for budgetary support from local government organizations, facilitating the incorporation of disease control budgets into strategic plans supported by the Community Health Security Fund. This approach enables the measurement of budget administration success and encourages the use of information for continuous learning, assessment, and improvement of fund disbursement processes to sustainably support COVID-19 control and prevention efforts.*

**Keywords:** Coronavirus Disease 2019 Crisis, COVID-19, Systems and Mechanisms, Ubon Ratchathani

## 1. Introduction

COVID-19 constitutes a significant global health crisis, originating in Wuhan, Hubei Province, in December 2019, and has resulted in widespread illness and considerable loss [1]. By December 2021, global excess mortality attributed to COVID-19 had reached 14.91 million deaths [2]. Thailand initially managed to contain the pandemic relatively successfully throughout much of 2020 but has since faced an uncontrolled resurgence of outbreaks since April 2021 [3]. In Ubon Ratchathani Province, 15 confirmed cases of COVID-19 were reported, stemming from various groups: (1) Muay Thai trainers, (2) government officials, (3) taxi drivers, (4) club service staff from Bangkok, (5) travelers from the United Kingdom, (6) Thai massage therapists from Phuket Province, and (7) coffee shop staff from Bangkok. Upon district analysis, 4 cases were

detected in Buntharik, 3 in Mueang, 2 in Phibun Mangsahan, and 1 each in Khong Chiam, Trakan Phuet Phon, Na Chaluai, Warin Chamrap, and Khemarat [4].

Risk Factors for the Outbreak in Ubon Ratchathani Province, encompassing urban, semi-urban, and rural areas, consist of two components: internal and external risk factors. Within the province, significant risk points include crowded venues such as shopping centers, flea markets, and pedestrian streets in Ubon Ratchathani Municipality. Additionally, numerous primary and secondary schools contribute to the risk within the province. Communication regarding risks online faces issues of data management and misinformation. Reporting systems lack clarity from the province to the village level.

Public compliance with health measures requires social enforcement. Border control lacks coordination, and waste management, especially regarding mask disposal, is deficient. The budget for disease prevention is inadequate. Some health facilities lack engineers, hindering coordination. Pandemic management lacks systemization, joint planning, repeatable practices, outcome measurement, and readiness for new outbreaks, with unclear roles and no unified action plan.

Det Udom District, located 45 kilometers away from the provincial capital in Ubon Ratchathani Province, comprises 16 sub-districts and 183 villages. Researchers aimed to study the district-level systems and mechanisms, including the District Health Boards (DHBs) and sub-district administration. The district encompasses three distinct areas: urban areas, including Mueang Det Sub-district with 26 villages; semi-urban areas, including Tha Pho Si Sub-district with 9 villages; and rural areas, including Kham khrang Sub-District with 10 villages. These areas consist of sub-district administrative organizations, Tambon Administrative Organizations, and Tambon Health Promoting Hospitals. The objective is to develop clear planning, process management, performance evaluation, and responsibility assignment to establish effective practices and policies for disease prevention and control.

## 2. Methods

### 2.1 Study Area

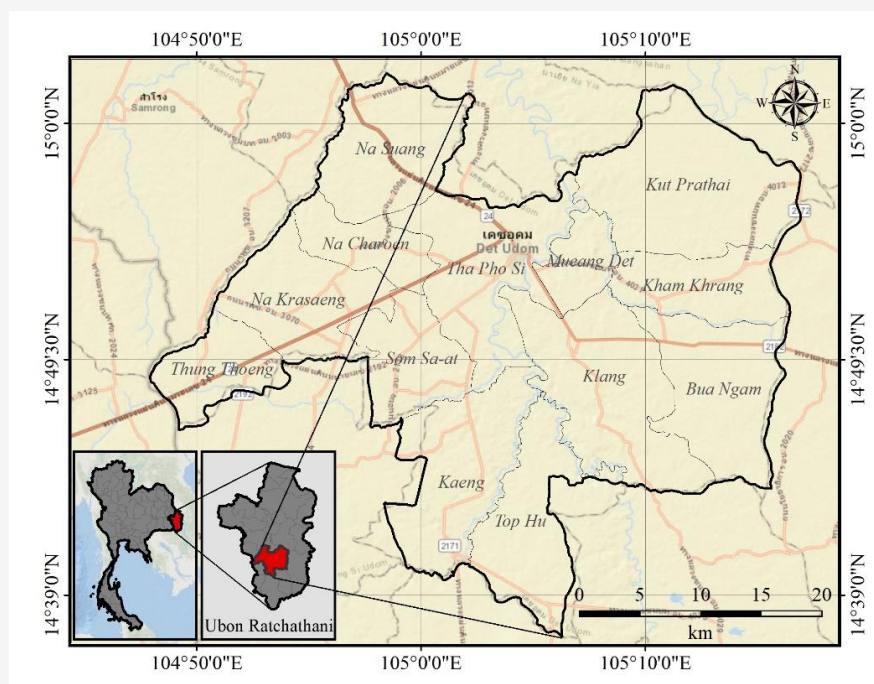
Ubon Ratchathani, a large province in the northeastern region of Thailand, known as Isaan, serves as a vital hub in the country's transportation network. The major northeastern highway, Route 205, divides its governance into 25 districts, 219 sub-districts, and 2,704 villages. Det Udom District (Figure 1), situated approximately 45 kilometers away from the provincial capital within Ubon Ratchathani province, consists of 16 sub-districts and 183 villages, encompassing urban, semi-urban, and rural areas. Moreover, it hosts a significant number of foreign laborers from Laos and Cambodia. Researchers have selected Det Udom District as their research area, concentrating on its urban area, including the sub-district of Mueang Det, a semi-urban area, featuring the sub-district of Tha Pho Si, and rural area, incorporating the sub-district of Kham Khrang.

### 2.2 Research Objectives

The objective of this study is to develop systems and mechanisms for managing the COVID-19 crisis in Det Udom District, Ubon Ratchathani Province.

### 2.3 Research Design

This study adopts the Action Research methodology, applying the research principles proposed by Kemmis and McTaggart [5].



**Figure 1:** Det Udom district, Ubon Ratchathani Province, Thailand

### 2.3.1 Population and representative sample

The population comprised agencies involved in managing the COVID-19 crisis in Det Udom District, Ubon Ratchathani Province. The sample or stakeholders included the following:

- 1) District Health Boards (DHBs) - 21 members
- 2) District Chief Executive Officer of Det Udom District - 1 person
- 3) Representatives from Somdet Phra Yupparat Hospital Det Udom - 2 people
- 4) Det Udom District Public Health Office - 1 person
- 5) Representatives from Tha Pho Si and Kham Khrang Sub-district Administrative Organizations (Sub-District Headmen and Public Health Officers) - 1 person each, totaling 2 people
- 6) Representatives from Ban Tha Pho Si and Kham Khrang Tambon Health Promoting Hospitals - 1 person each, totaling 2 people
- 7) President of Det Udom District Village Health Volunteer Club - 1 person
- 8) Community leaders, 1 person each from various villages, totaling 45 people
- 9) Village Health Volunteers in Mueang Det sub-district - 327 people, Tha Pho Si sub-district - 140 people, and Kham Khrang sub-district - 114 people, totaling 656 people.

### 2.3.2 Research instruments

The tools used included questionnaires, interview questionnaires for group discussions, and interview questionnaires for in-depth interviews. Quantitative data were analyzed using numerical values, frequencies, and percentages. Qualitative data encompassed systems, mechanisms, processes, and success factors, employing content analysis methodology. This analysis involved data from questionnaires, group interviews, and in-depth interviews to assess the presence of systems for preventing and controlling COVID-19. Criteria such as clarity of guidelines, repeatability of procedures, measurability of outcomes, predictability through data utilization for learning or improvement, and the presence of clearly defined mechanisms, processes, activities, and responsible parties were utilized.

Furthermore, there will be an evaluation of processes contributing to systematic development, including collaborative planning processes, command processes, both managerial and academic service support processes, local administrative organization operational processes, data utilization, and communication processes. Also included are Village Health Volunteers operational processes such as patient screening activities, contact tracing, disease control in communities, risk communication, and

data management. Efficient processes will lead to the establishment of effective systems, resulting in systematic/non-systematic outcomes, efficient/inefficient processes, and clear or unclear assignment of responsibilities. These outcomes will guide the development of processes and activities, leading to the establishment of effective systems.

## 3. Results

### 3.1 General Information of the Research Participants

The general information of the participants was collected using questionnaires, and the information was summarized and presented in Table 1. This table presents an overview of the demographic profile, educational background, marital status, occupational roles, and exposure to COVID-19 control and prevention training among the participants from the specified sub-districts. Notably, the majority were female (86.3%) with a mean age of 41.8 years. The data reveal diverse educational achievements, ranging from no formal education to postgraduate degrees. A significant proportion of the participants were married (79.2%), and the vast majority were engaged as Village Health Volunteers (VHVs), representing 88.6% of the total. Additionally, a substantial majority (82.1%) had attended training, or meetings aimed at the control and prevention of COVID-19, indicating a high level of community involvement in the public health response.

### 3.2 Investigation of Systems and Mechanisms

At the district level, the District Health Boards of Det Udom District convened meetings (Figure 2) to clarify the objectives of the initiative and to gather data on the systems and mechanisms in place for controlling and preventing the spread of Coronavirus Disease 2019 (COVID-19). This compilation was achieved through interviews with committee members, including comprehensive interviews with the District Chief (Chair of the Committee), the District Public Health Officer, and the Director of Somdet Phra Yupparat Det Udom Hospital. The operations of Det Udom in the fiscal year 2021 highlighted five key areas of focus:

- 1) Sub-district management of quality of life and the creation of well-being.
- 2) Care for the elderly, disabled, disadvantaged, and vulnerable populations.
- 3) Execution of the "Miracle of a Thousand Days" initiative for developmental progress in children.
- 4) Control and prevention of COVID-19.
- 5) Drug abuse prevention and resolution.

Regarding the control and prevention of COVID-19, district-level strategies encompassed:

- 1) Establishment of a District COVID-19 Prevention and Surveillance Operations Center.
- 2) Creation of a District Emergency Operations Center (EOC) for continuous dissemination of guidelines and understanding regarding COVID-19 control and prevention measures.
- 3) Procurement and adequate stockpiling of necessary equipment for disease control operations.
- 4) Oversight, monitoring, and provision of recommendations to ensure sub-district and village community operational units adhere to disease prevention and control measures.

**Table 1:** General demographic characteristics of the participants

<b>Demographic Characteristics</b>	<b>Numbers</b>	<b>Percentage (%)</b>
<b>Gender</b>		
Male	106	13.7
Female	667	86.3
<b>Age</b>		
Mean = 41.8		
Standard Deviation (SD) = 9.2		
Maximum = 52		
Minimum = 25		
<b>Educational Level</b>		
Uneducated	5	0.6
Primary education	294	38.0
Lower secondary education	188	24.3
Upper secondary education/Vocational level	202	26.1
Associate degree/Higher vocational level	28	3.6
Bachelor's degree	46	6.0
Postgraduate degrees	10	1.3
<b>Marital Status</b>		
Single	61	7.9
Married	612	79.2
Separated	12	1.6
Divorced	34	4.4
Widowed	54	6.9
<b>Occupation</b>		
Registered Nurse	4	0.5
Public Health Scholar	5	1.0
Public Health Officer	5	0.5
Pharmacy Officer	2	0.2
Village Head	17	2.2
Sub-district Head	2	0.2
Community President	25	3.2
Assistant Village Head	6	1.0
School Director	2	0.2
Teacher	17	2.2
Chairperson of the Sub-district Administrative Organization	2	0.2
Member of the Sub-district Administrative Organization	1	0.1
Village Health Volunteer	685	88.6
<b>Received Training/Meetings for COVID-19 Control and Prevention</b>		
Yes	635	82.1
No	138	17.9



**Figure 2:** Meeting of the district health boards

Continuous public awareness campaigns through all media channels within the district to educate on disease prevention measures for sub-district level implementation, directives included:

- 1) Establishment of Sub-district COVID-19 Prevention and Surveillance Operations Centers.
- 2) Utilization of health charters for establishing agreements or measures at the sub-district and village levels, blending state measures into easily comprehensible practices to encourage public participation and fit local contexts.
- 3) Continuous support for activities such as educational public awareness campaigns, rehearsal of COVID-19 prevention and control plans, and "Big Cleaning" environmental sanitation activities.
- 4) Development of a sub-district level COVID-19 countermeasure project to support the operational needs of the Sub-district COVID-19 Prevention and Surveillance Operations Center, with budget proposals submitted to the local health insurance fund.

These sections detail the systematic and multi-layered response strategies implemented at both district and sub-district levels to mitigate and manage the impact of COVID-19, demonstrating a collaborative approach to engage the community and tailor responses to local needs. The operations in Det Udom District commence with receiving policies from the Provincial Emergency Operations Center (EOC). Subsequently, meetings are organized to disseminate operational guidelines to the sub-district level through an online system, as illustrated in Figure 3.

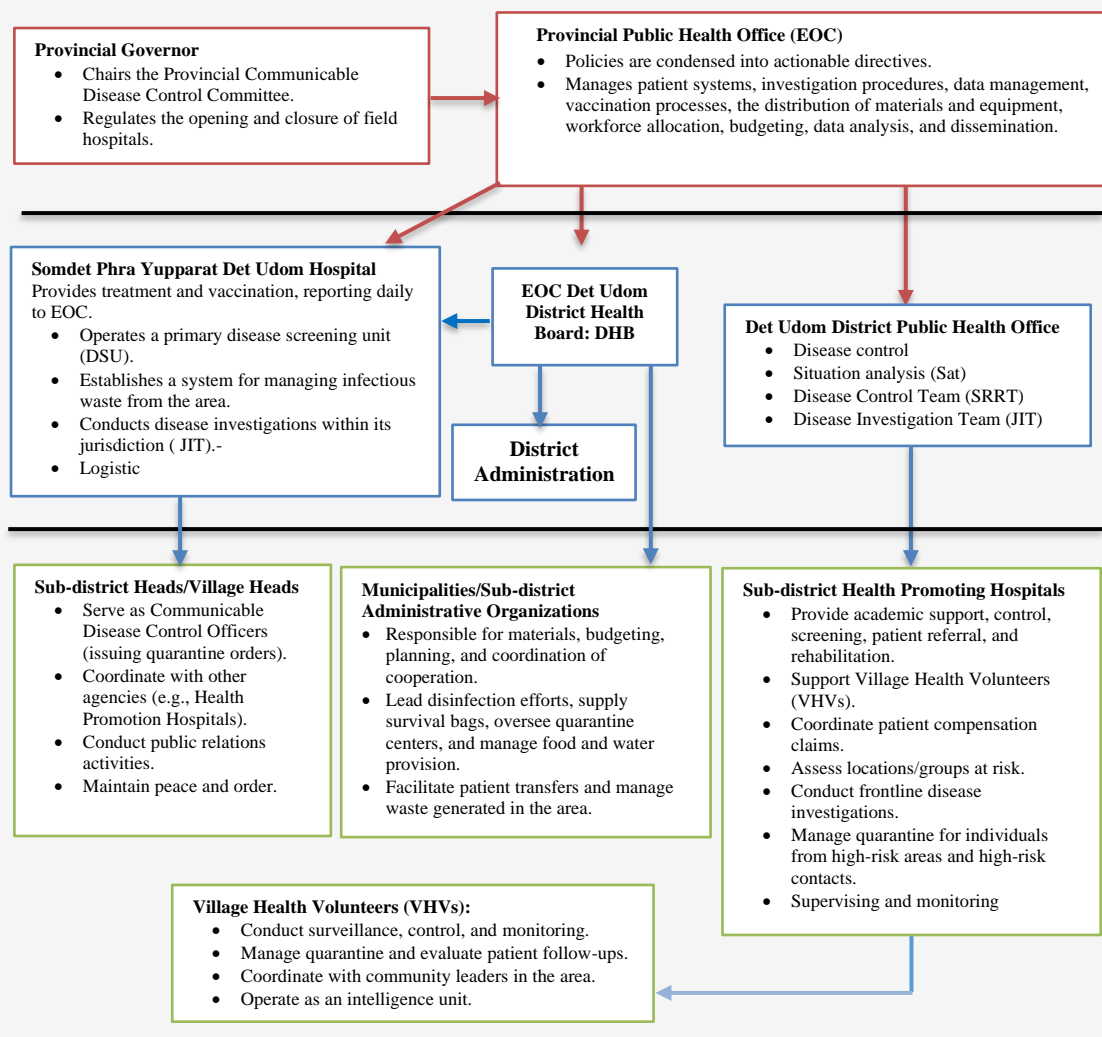
Additional interviews revealed that municipalities/sub-district administrative organizations (SAOs) are unclear about the quantity of materials and medical supplies needed and

whether procurement should be hospital or local government organization (LGO) led, with insufficient information for decision-making. Occasionally, local entities do not participate in Emergency Operations Center (EOC) meetings, which are understood to be under the purview of the district chief, the hospital director, and the district public health director, who make decisions based on the available information. Roles and Responsibilities of District-Level Agencies in Collaborating to Prevent and Control the Spread of Coronavirus Disease 2019 (COVID-19):

District Administration, led by the district secretary responsible for prevention and suppression, acts as the district chief's secretary in issuing various control and prevention orders, such as opening or closing service establishments and schools following the provincial EOC's recommendations. This role includes advising community leaders on complying with orders or the intent of announcements from the national COVID-19 response center.

Somdet Phra Yupparat Det Udom Hospital is tasked with promptly and accurately caring for infected individuals within the district, preventing new infections, and halting the transmission of the disease from infected individuals to others within families, communities, and the district.

The Det Udom District Public Health Office, located in Ubon Ratchathani Province, serves as a regional public health administrative unit under the Ministry of Public Health's Secretariat, representing the ministry at the district level. It directly reports to the district chief and is led by the district public health director. The office is responsible for the administration, promotion, support, control, supervision, monitoring, evaluation, and assessment of the performance of 25 Tambon Health Promoting Hospitals.



**Figure 3:** Original operational flowchart of Det Udom district

Local Government Organizations play a crucial role in supporting materials, equipment, and budgets for disease management, such as procuring medical equipment and essentials for self-protection, including Personal Protective Equipment (PPE), surgical masks, protective goggles, sprayers, and disinfectants. However, issues have been identified regarding the support for compensation for Village Health Volunteers (VHVs) and medical personnel in field hospitals, quarantine centers, and home quarantine.

### 3.3 Assessment of Systems and Mechanisms at the Sub-District Level

**Kham Khrang Sub-district:** The Tambon Health Promoting Hospital in Kham Khrang Sub-district plays a pivotal role in disease control and prevention. It receives operational guidelines and measures from

the Det Udom District Public Health Office (via the District Health Boards meetings), which, in turn, are informed by the Provincial Public Health Office (EOC). Directions are then communicated to the Sub-district Administrative Organization (SAO), schools, community leaders, and Village Health Volunteers. Readiness of related units: The SAO utilizes its regular local budget for expenses like food and allowances for local personnel, supporting the provision of temperature scanners and alcohol gel. Community forums are conducted to educate the public on preventive behaviors and restrictions. The development of a sub-district health charter is in stage five, aiming to enhance public awareness about COVID-19 prevention. The SAO supports food and water for individuals in 14-day quarantine, funded by the local central budget (without utilizing the sub-district health insurance fund).

Community leaders (Sub-district Heads/Village Heads) disseminate information via public address systems to inform residents about the COVID-19 situation, prevention methods, and quarantine protocols every morning. Meetings are held among community leaders, VHV's, and the SAO to prepare for the return of residents from Bangkok, employing mechanisms such as Line groups, telephone, and Facebook for communication.

Challenges include: A lack of a written joint operational plan among the SAO, Tambon Health Promoting Hospitals, schools, and communities. The SAO has no plan for utilizing the local health insurance fund for disease prevention/control. Infectious waste management lacks clear guidelines.

Evaluation results: There is no written guideline for joint operations among the District Health Board, community leaders, Tambon Health Promoting Hospitals, SAO, and schools, with only Health Promotion Hospitals acting on policies from the Det Udom district communicable disease control committee.

Tha Pho Si Sub-district: The sub-district has a disease control committee utilizing Line groups for new patient information and disease status within the sub-district. The Tha Pho Si SAO is responsible for procuring materials, equipment, masks, and alcohol gel but cannot fully support the community, although donations of alcohol gel and masks have been received from shops. Other disinfectants are insufficient. Community leaders receive policies from the district chief and organize meetings with Sub-district Heads/Village Heads in every sub-district/village to explain disease control measures and prepare quarantine facilities. New arrivals from risk areas must notify VHV's/Tambon Health Promoting Hospitals or community leaders beforehand to prepare countermeasures. Challenges include non-cooperation from residents, such as escaping quarantine before completing 14 days without notifying officials, making quarantine ineffective due to household members interacting with quarantined individuals. Parents conceal travel history from other provinces, and there is no community forum or health charter, unclear authority of leaders to issue control documents, lack of waste management system with each household disposing of waste independently, such as by burning. VHV's follow guidelines from Tambon Health Promoting Hospital staff to door-knock, providing education, masks, or alcohol gel, facing issues with inadequate compensation not commensurate with the risks of contracting COVID-19.

Mueang Det Sub-district: COVID-19 prevention operations in Mueang Det Sub-district follow the

District Health Boards structure, chaired by the district chief with a committee including the director of Somdet Phra Yupparat Det Udom Hospital, the district public health officer, and relevant units. Daily meetings and care teams are organized by the committee. Care system is divided into groups at risk with a linked system acting as an intermediary between hospitals and the community, with VHV's overseeing, requiring swab tests, and communicating with VHV's for prepared quarantine areas. Field hospital establishment and post-illness care coordination in the community are within the committee's structure.

Challenges and Obstacles: Individuals in quarantine centers face a lack of food, with some patients not having relatives to provide meals. Leaders and Village Health Volunteers (VHV's) who are on duty often have to pay for meals themselves, unsure of whom to contact regarding hospital and municipality responsibilities for provisioning food, especially if discharged from the hospital before completing a 14-day period. The provision of care and assistance is delayed for those who are sick and for individuals in quarantine. Achieving community understanding is challenging, as people are generally unresponsive. The responsibility for electricity bills in field hospitals located in schools remains unclear. Government response is slow due to the novel nature of the disease, affecting the availability of tools and equipment. There are issues in motivating people to get vaccinated and in raising awareness for self-prevention. Excessive fear within the community leads to a refusal to accept individuals returning from high-risk areas. This issue is compounded by the novelty of the situation, with local administrations struggling to keep pace. Commands are not clearly communicated, sometimes leading to delays. Preparedness in the area is lacking, with no provision of food or water for patients. There is a need for better education about infectious waste management among the public, necessitating the development of suitable media strategies.

According to Table 2, it is observed that the operational approaches and procedures for the prevention and control of Coronavirus Disease 2019 (COVID-19) in the district are defined by adapting guidelines from the provincial disease control center. However, the operational mechanisms remain unclear, such as the specific roles of community leaders, including Sub-district Heads, Village Heads, and Assistant Village Heads, whose responsibilities are not well-defined. This lack of clarity affects the continuity and repeatability of operations, especially when terms of office expire or other circumstances arise.

**Table 2:** Summary of systems and mechanisms for the prevention and control of coronavirus disease 2019

Agency	Approach to Operation (Definable)	Repetition (Repeatable)	Measurement (Measurable)	Predictability (Predictable)
Det Udom District Health Boards	✓	☒	✓	☒
District Administration	✓	☒	✓	☒
Det Udom Municipality/Sub-district Administrative Organizations (Kham Khrang, Tha Pho Si)	✓	☒	✓	☒
Det Udom District Public Health Office	✓	☒	✓	☒
Somdet Phra Yupparat Det Udom Hospital	✓	☒	✓	☒
Health Promotion Hospitals	✓	☒	✓	☒
Village Health Volunteers	✓	☒	✓	☒
Schools/Child Development Centers	✓	☒	✓	☒

Furthermore, during electoral periods for local government organizations (LGOs), there is no provision for acting representatives. Key performance indicators of the operation can be measured, including the number of infections, risk groups, and resource allocation. The ambiguity in assigning responsibilities leads to an inability to predict the effectiveness of disease control measures.

### 3.4 Summary of System and Mechanism Assessment Results

**District Level:** The operational guidelines for controlling Coronavirus Disease 2019 (COVID-19) at the district level are derived from the Provincial Communicable Disease Control Committee (EOC) meetings. These guidelines are disseminated and clarified to the District Disease Control Committee via an online system daily during periods of increased patient reports. **Sub-district Level:** Sub-district Disease Control Committees are chaired by the Mayor/SAO President, with the Health Promotion Hospital Director acting as secretary. Village Health Volunteers (VHVs), community leaders from each village, and school directors within the area serve as members. They receive guidelines from the District Disease Control Committee.

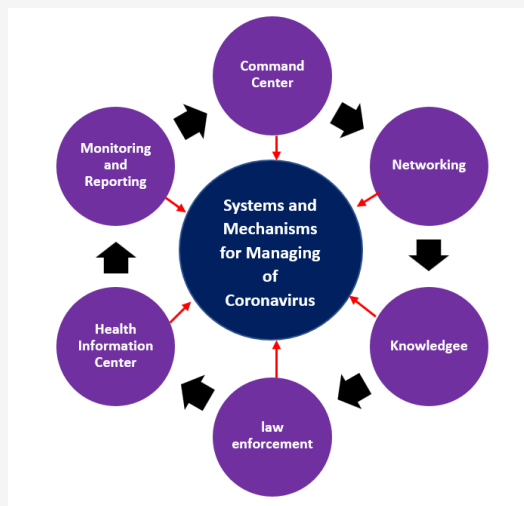
**Systems and Operational Mechanisms:** There are clear operational guidelines, but they cannot yet be standardized for repetition due to the novel nature of the disease and evolving strategies. The process is measurable and predictable. However, due to the large number of committee members at the sub-district level, meetings often do not achieve full attendance. VHVs primarily facilitate further dissemination to community leaders.

### 3.5 Feedback on System and Mechanism Study/Co-Design of a New System

District and sub-district data from various sectors were gathered for a meeting of sub-district representatives, including district public health officials or their delegates, Somdet Phra Yupparat Det Udom Hospital, SAO Presidents, health personnel, VHVs, teachers, and childcare center caretakers from all three sub-districts. The purpose of this meeting was to summarize operational issues at the sub-district level in crisis preparedness and collaboratively design a new system.

Activities in Feedback Provision and New Mechanism System Design: A review of operational processes, particularly at the district and sub-district levels, revealed unclear roles for community leaders and each unit's responsibilities in various scenarios. Discussions led to clarifying roles, including empowering community leaders to issue quarantine certifications, specifying quarantine durations, and completing a 14-day quarantine certificate or according to measures ordered by the COVID-19 Response Center (CRC), and permitting traditional events such as weddings, funerals, and ordinations. Roles were adjusted to enable coordination and linkage among all relevant units, including municipalities/SAOs, Health Promotion Hospitals, community leaders, VHVs, and teachers, in a comprehensive system of surveillance, disease control, vaccination, reporting, and information systems. Municipalities/SAOs are to prepare budgets for disease control and prevention within their plans, establish guidelines for infectious waste management in municipalities/SAOs/communities, and ensure VHVs monitor, follow up, and report on illegal entries along natural paths. Schools are advised to address student transportation issues and lunch breaks to prevent overcrowding in cafeterias and maintain social distancing. Operational practice manuals for personnel in each unit are recommended.



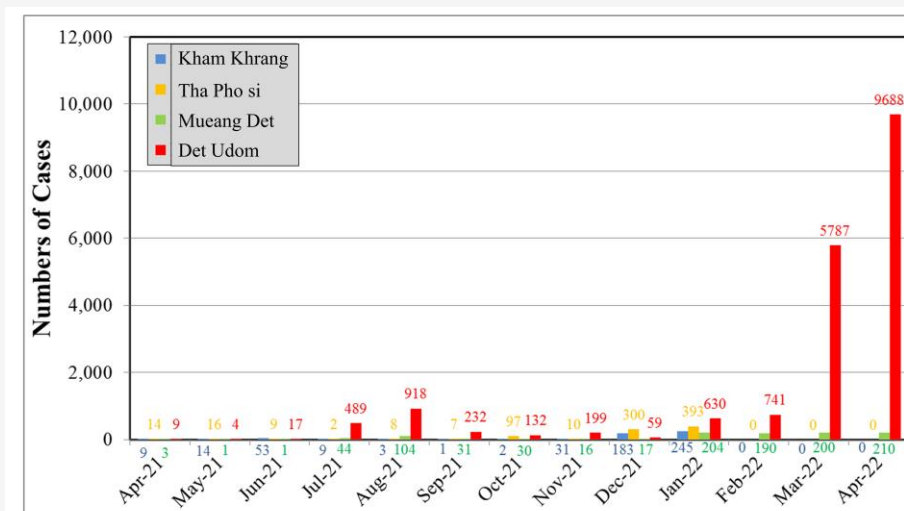


**Figure 4:** Systems and mechanisms for Crisis of COVID-19 infection management model

### 3.6 Summary of the Model from the Research

The development of systems and mechanisms for managing the crisis of Coronavirus Disease 2019 (COVID-19) in Ubon Ratchathani Province, through the Participatory Action Operational Research (PAOR) process, comprises four stages: planning, acting, observing, and reflecting. This process has established the following systems and mechanisms for crisis management of COVID-19 in Ubon Ratchathani Province (Figure 4):

- **Command Center:** This refers to the necessity of having a coordination and command center for controlling the COVID-19 infection, including an operational committee from all sectors with clearly defined roles and responsibilities. There must be a system for rapid, timely, consistent, and continuous meeting tracking, along with both vertical and horizontal coordination. Clear policies and directives for the operation of prevention and control of COVID-19 are essential, such as the Provincial and District Level Emergency Operation Centers (EOC).
- **Coordinating and Networking:** This entails coordination among all related groups to create a partnership network for jointly managing the COVID-19 outbreak. This includes information, communication, surveillance, screening, and mutual monitoring to manage the situation comprehensively and cover area management by all units, including the Ministry of Public Health, Local Government Organizations, the Ministry of Interior, the National Health Security Office, leaders at all levels, and operational workers at the ground level. It involves integrated support from all units, coordinated with external agencies for operational efficiency at all levels.
- **Knowledge:** This means the communication and dissemination of knowledge about COVID-19 to create awareness and understanding among the population, health volunteers, community leaders, officials, and personnel at all levels. This aims to ensure up-to-date and accurate knowledge of COVID-19, as many aspects of the knowledge are still unclear or inconclusive.
- **Law Enforcement:** This refers to the enforcement measures in cases of non-compliance with the rules, regulations, and laws of the Communicable Disease Act 2015, including area measures as per the situation, such as sub-district/village health charters. It involves creating cooperation and joint responsibility, including monitoring adherence to the announcements of the Health Emergency Operation Center.
- **Health Information Center:** This signifies an integrated, efficient communication system delivering accurate, rapid, and reliable information to the public, fostering knowledge, understanding, and participation in disease prevention and control. This includes risk communication, disseminating true, clear, and unambiguous information through the provincial, district, sub-district, and community-level Risk Communication Committees, providing access to information for the public at all levels, verifying news authenticity, and communicating through multiple channels consistently. It facilitates risk communication forums to address misunderstandings in unusual events.



**Figure 5:** Comparison of COVID-19 case numbers

**Table 3:** Comparison of operational outcomes before and after project implementation

Aspect	Pre-Implementation	Post-Implementation
<b>System/Mechanisms</b>	No clear assignment of roles and responsibilities in writing. Key stakeholders and risk communication protocols undefined. No strategies for information sharing or budgeting for epidemics.	Organized comprehensive meetings with all related stakeholders at district and sub-district levels, leading to the creation of an operational manual detailing roles, responsibilities, and information sharing protocols, updated regularly to reflect the current situation.
<b>Best Practices</b>	Lack of formally documented operational procedures.	Development of operational manuals through community consensus, ensuring continuity of operations despite staff changes.
<b>Infectious Waste Management</b>	Community guidelines for disposing of used face masks and ATK test kits were impractical; no specific disposal mechanisms in place.	Implemented appropriate strategies for the management of used face masks and ATK test kits within the community, tailored to local needs.
<b>Funding for Issue Management</b>	Insufficient budget allocation for community/home isolation and necessary supplies.	Increased funding avenues from local health insurance funds, supported by guidelines from the Regional Health Insurance Office.
<b>Stakeholder Awareness/Engagement</b>	Main responsibilities fell on key institutions like hospitals.	Enhanced role awareness among all relevant agencies, with the Emergency Operations Center (EOC) ensuring continuity. Introduced efficient information coordination through LINE and Google Data Studio.
<b>Operational Model</b>	No established operational model.	Developed the CCKKU model (Command Center Coordinating and Networking Knowledge Health Information Center Monitoring and Reporting) for streamlined operations.
<b>Primary Health Care System</b>	The system was unorganized in managing COVID-19, lacking systematic healthcare services.	More systematic approach to primary healthcare services with increased network partner participation, recognizing their roles in pandemic management.

**Monitoring and Reporting:** This involves continuous performance evaluation, operational support monitoring for any issues or obstacles, boosting morale of officers at all levels, and reporting the sequence of operations clearly, indicating successes and operational challenges. This aims to facilitate rapid and timely executive decision-making at various levels, responding to problem-solving and enhancing operational efficiency.

Figure 5 presents an epidemiological overview of COVID-19 cases within specific locales of Tambon Kham Khrang, Tha Pho Si, Mueang Det, and the aggregated regions within the Det Udom District. The progression and distribution of case numbers reveal noteworthy epidemiological trends, underscoring the dynamic nature of the virus's spread across the observed regions.

In Tambon Kham Khrang, a gradual increase in cases is observed, peaking significantly before a decrease, indicating a wave-like pattern of infection spread. This is characterized by initial low numbers, a sharp increase to a peak of 245 cases, followed by an unreported decline, suggesting a potential containment or reduction in transmission rates. The Pho Si's data illustrates a more abrupt escalation, with case numbers rapidly ascending to 393, indicating a faster spread or possibly a delayed onset of significant community transmission compared to Tambon Kham Krang. Mueang Det exhibits a unique pattern with sporadic fluctuations in case numbers, including an extreme surge to 2108 cases. This could indicate multiple waves of infection or variations in testing and reporting practices. The aggregated data for the Det Udom District shows an alarming increase in cases, peaking at 9688, which might reflect cumulative reporting from multiple areas or a significant outbreak within the district. This data underscores the importance of regional surveillance and targeted interventions to mitigate the spread of COVID-19. The temporal and spatial distribution of COVID-19 cases in this dataset provides critical insights into the epidemiological characteristics of the virus's spread within these regions, highlighting the necessity for ongoing monitoring, responsive healthcare strategies, and public health preparedness to address fluctuating case numbers.

Table 3 summarizes the transformative effects of the project implementation on operational efficiency, waste management, funding, stakeholder engagement, and the primary healthcare system's response to the COVID-19 pandemic. It highlights the transition towards more structured and effective management practices.

#### 4. Discussion

The crisis management system and mechanism developed for COVID-19 in Ubon Ratchathani Province adhere to the principles of DRMP, which stands for Defined, Repeatable, Measurable, and Predictable. Over the past year, a coordinated system has been established through the participation of various stakeholders, including the District Health Boards (DHBs), local authorities such as municipalities and sub-district administrative organizations, community leaders, village health volunteers, school administrators, and teachers from early childhood development centers. Despite changes in district leadership or public health officers, the operations for controlling and preventing COVID-19 have continued seamlessly, supported by established guidelines and practices.

Volunteers in public health play a crucial role in effectively implementing disease control and prevention measures, as well as coordinating with local and district-level agencies, in line with the findings of Piyawat Tungkhasopa and colleagues' study (2019) [6]. They studied the surveillance, prevention, and control of COVID-19 in communities by regular public health volunteers nationwide and found that the majority of volunteers and community members exhibit self-protective behaviors, such as wearing masks, maintaining personal hygiene, washing hands, practicing social distancing, and avoiding crowded places during both lockdown and relaxation periods. Their knowledge and abilities in disease control and prevention were rated at a good level (76.7%), which is consistent with [7] on the role of volunteers in preventing and controlling COVID-19 in Thailand [7]. In line with the mechanisms of the Chinese government's efforts to fight COVID-19, which integrate top-down interventions and local governance, although there may be directives from the central government, local governments differ and require non-profit organizations to assist in managing local-level issues [8].

During the COVID-19 pandemic, volunteers played a significant role in successful prevention and control efforts by applying public health principles. Moving forward, it is essential for volunteers to leverage appropriate communication technologies to effectively manage outbreaks. Their responsibilities encompass providing information, promoting health self-care practices, supporting surveillance systems through proactive screening, timely reporting of cases, monitoring high-risk groups under home quarantine, and collaborating with local health authorities. Additionally, they mitigate the risk of exposure by offering innovative services such as "Grab Drug" or "Volunteer Delivery" and manage community resources to aid healthcare workers in preventing and controlling COVID-19.

The operational processes of volunteers are well-defined at a high level (42.6%), aligning with the previous study focused on Thailand's response to the COVID-19 pandemic. The results found that their active involvement significantly contributes to the success of controlling COVID-19 in communities, with volunteers' participation being a key factor [9]. The investigation into the success factors and effectiveness comparison of controlling the COVID-19 virus among community volunteer health workers in Thailand was conducted.

The results reveals that the success of controlling the COVID-19 virus in VHW communities in Thailand was at its highest level. Outstanding VHWs, varying in gender, education, length of service, and recognition, exhibited statistically significant differences in controlling the COVID-19 virus in communities [10]. The participation of volunteer health workers and communities in preventing and monitoring COVID-19 using geographic information systems was also explored. The study discovered that participation patterns of volunteer health workers and communities included processes to enhance VHW involvement and methods to prevent and monitor the disease [11]. The geographic information system was developed into an application by the community. The effectiveness of using geographic information systems in monitoring and preventing COVID-19 demonstrated that VHWs identified risks promptly and provided advice to the public, transmitted risk data to local hospitals swiftly, monitored VHWs' activities, and received information on risk situations in the area. Both VHWs and local hospitals expressed higher satisfaction levels with the application, with 85% of community outcomes. VHWs could swiftly identify infected or exposed individuals and contain the virus's spread in the area.

When comparing the number of patients, it is evident that there continues to be an increasing trend, mirroring the trends observed at the provincial and district levels. This suggests that despite efforts to develop systems and mechanisms, disease transmission persists due to various factors such as changes in pathogen types, population behavior, and movement patterns. Therefore, in the long term, identifying the root causes of the problem is essential for enhancing the effectiveness of the system.

The research outcomes have proven beneficial for disease surveillance, control, and prevention, as well as for adapting relaxation measures at the local level within the district to align with the evolving situation of the COVID-19 pandemic and changing population behaviors over time. The research findings have been disseminated and translated into policy recommendations for policymakers at the district level, particularly the District Health Boards, where the District Chief serves as the chairman and the District Public Health Officer as the secretary. Additionally, representatives from various sectors within the district, including community networks, participate as committee members alongside the District Emergency Operations Committee (EOC). This committee is responsible for compiling data on disease and academic situations periodically to provide decision-making insights for the EOC committee's daily policy decisions.

The research findings have been translated into easily understandable public media for the community, enabling them to comprehend and take action within households and communities. Additionally, these findings have been disseminated and extended to other sub-districts within the Det Udom District. For instance, methods for handling infectious waste, such as used face masks and ATK testing kits, have been compiled into informational pamphlets distributed to every household. Furthermore, community leaders and local administrative organizations have utilized this information for public communication through various media outlets. The information system for COVID-19 infection, developed and tested as part of the research findings, has been employed as a tool for communication, reporting, monitoring, and evaluation in the efforts to control and prevent COVID-19 by LAOs and health personnel, including systems like online vaccine reservation systems. The research outcomes have served as a model for fostering community participation and networking at all levels: governmental (local authorities), academic (local hospitals and LAOs), and societal (community organizations, citizens, etc.). The resulting measures include social agreements and roles for community control and prevention of COVID-19, utilizing community mobilization processes and sub-district health regulations as mechanisms for management and resource support. The research results have also served as a template for budget support from local administrative organizations, including municipalities and sub-district administrative organizations (TAOs), facilitating budget planning for disease control and prevention by incorporating them into the organizations' plans, using funds from the Community Health Security Fund. Clear guidelines and processes have been established for budget support, enabling the measurement of success in fund utilization for various projects funded by the LHIF. Moreover, data and information utilization have facilitated continuous and sustainable learning, evaluation, and improvement in budget allocation processes to support ongoing and sustainable efforts in controlling and preventing COVID-19.

The differences in development processes across the three area-rural, semi-urban, and urban reveal that in rural and semi-urban areas, there is more collaboration and joint meetings, both formally and informally, compared to urban areas. Urban areas may have readiness in terms of infectious waste management systems, such as the ability to refer waste for disposal through hospitals.

However, all areas still express concerns about inadequate motivational benefits in the workplace after development. Additionally, there are issues with budgeting and acquiring equipment/materials for operations. The budget expenditure plan is not fully implemented within the designated time frame, and the process of budget approval from each Local Health Insurance Fund or Sub-district Fund varies.

## 5. Conclusion

Development of Systems and Mechanisms for Managing the Crisis of COVID-19 in Ubon Ratchathani Province by District and Subdistrict Level Organizations. The study analyzed the systems and mechanisms for controlling and preventing COVID-19 at the district and subdistrict levels in Ubon Ratchathani Province. The involved organizations included the District Health Boards, administrative departments, Village Health Volunteers, Local Administrative Organizations, community hospitals, district health offices, and Tambon Health Promoting Hospitals. The tools used were group interview questionnaires, statistical analysis for quantitative data, and content analysis for qualitative data. It was found that the related organizations at the district and subdistrict levels had systems and mechanisms for controlling and preventing COVID-19. There were coordinated efforts with distinctive cooperation guidelines, clear disease control measures with manuals, appropriate infectious waste management, and budget planning by municipalities and subdistrict administrative organizations to prepare for future disease control issues.

Furthermore, budgets from subdistrict funds were allocated to ensure sufficient disease control at the subdistrict level. Subdistrict regulations were developed to strengthen operational practices. A communication system for COVID-19 information was established, starting from successful pilot implementation at certain subdistricts and expanding to cover all subdistricts in the Det Udom District. Additionally, readiness to respond to crises from other infectious diseases was ensured. The results of this study can serve as a model for budget support from local administrative organizations, facilitating budget preparation for disease control by incorporating it into organizational plans. This utilizes funds from the Local Health Security Fund with clear guidelines and processes for supporting budget allocations, which can measure success in fund utilization for various projects. Moreover, data and information were used for learning, assessing, and improving budget allocation processes to support COVID-19 control and prevention continuously and sustainably.

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