

# Policy Brief - Logistics and Supply Chain Management Strategy to Support Patient Home Isolation During the COVID-19 Pandemic in Thailand

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Recently, the pandemic of coronavirus 2019 (COVID-19) raised number of patients who needed hospitalization higher than the existing medical resources and personnel. An increase of hospital occupancy rate caused an inadequate availability of COVID-19 beds in sanatoriums, hospitals, or field hospitals.

Inaccessible medical care caused patients to delay treatment. Thus, home isolation or self-quarantine was an option for reducing hospital workload for patients with mild symptoms. In addition, Pribta Clinic was established as a center for distributing drug to home isolation patients as fast and accurately as possible. Researchers had an opportunity to join as volunteers in the Pribta Clinic for care of home isolation patients and had seen some gaps in care. The exploration of workflow and gap analysis were planned and executed after the pandemic reduced in magnitude.

The research team had conducted a logistics and supply chain management gap analysis of self-quarantine in Thailand in four perspectives that included Information management and information technology management, Material planning and inventory management, Distribution management, and Leadership and governance, reflected on the problems and barriers of home isolation services that required improvement for better administration. The research team would like to present a Strategic Policy Framework. It contains seven elements including supply allocation, supply network nodes, supply network links, inventory policy, IT infrastructure, logistics working group, and cost/budget plan for improving quality and effectiveness of home isolation services and satisfying the patient and medical personnel needs.

**Keywords:** Home Isolation; COVID-19 pandemic; Strategy and Policy management; Thailand

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The pandemic of coronavirus 2019 (COVID-19) since December 2019 was a public health emergency that spread to countries around the world including Thailand. It affected healthcare, social gathering, and economy of Thailand as same as other countries. Moreover, the virus continuously changed and mutated from the previous COVID-19 waves. The

number of daily infected patients rose, and the severity increased as it easily spread. It was worrisome that Thailand would face a difficult situation stemming from COVID-19 for a period of time. It caused an increase of COVID-19 patients and unavailability of COVID-19 beds in sanatoriums, hospitals, and field hospitals. The medical resources such as healthcare personnel, beds, drug, and medical supply or life support equipment were also inadequate for the demand.

The data from the Ministry of Public Health (Figure 1)<sup>(1)</sup> and World Health Organization, Thailand (Figure 2)<sup>(2)</sup> showed a significant increase of COVID-19 infected people in June and July 2021. The trend was rising in July and August with over 20,000 community-transmitted cases per day. The spread of the new delta variant caused inadequate COVID-19 beds. It was related with the data of occupancy rate in Bangkok Metropolitan, top epidemic areas. The data from June 4 to July 4, 2021, showed 28,247

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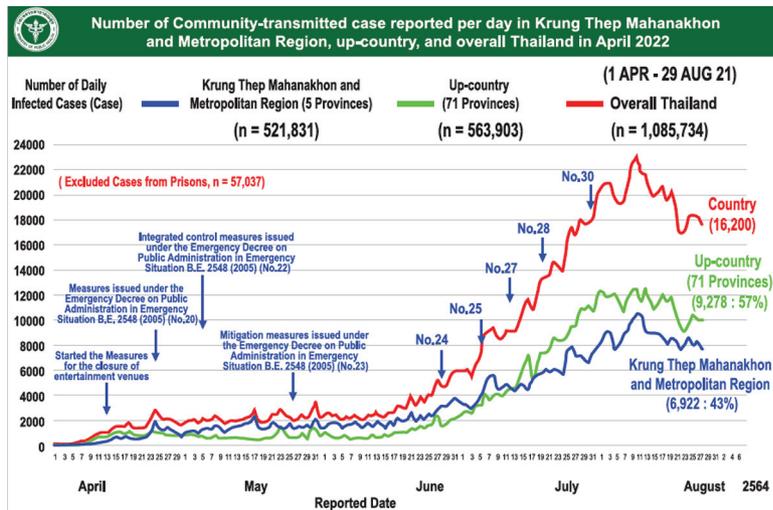
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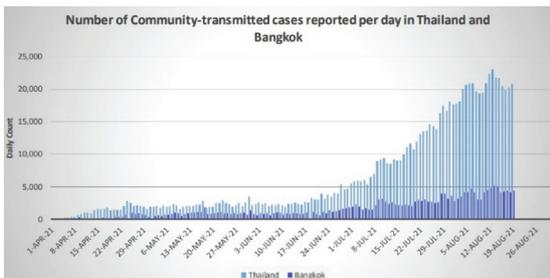
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**Figure 1.** Number of community-transmitted case reported per day in Krung Thep Mahanakhon and Metropolitan Region, up-country, and overall Thailand in April 2021.



**Figure 2.** Number of community-transmitted case reported per day in April to August 2021 (Source: World Health Organization, Thailand).

occupied beds. It had increased 8,817 beds from 19,430 beds and increased in every severity level. Furthermore, the number of intensive care unit (ICU) patients doubly increased from 657 to 1,139 cases<sup>(3)</sup>. Moreover, COVID-19 Bed Availability Status in Bangkok Metropolitan (Figure 3) exhibited the occupancy rate of cohort negative pressure rooms and modified airborne infection isolation rooms (AIIRs) for COVID-19 patients was higher than normal. The demand of private rooms and general rooms was also higher than their availability. For the shared ICU wards, there was only four beds available. The available beds of hospitals and field hospitals were 1,268 and 296, respectively. Therefore, bed availability was insufficient, and an occupancy rate was 100%<sup>(4)</sup>.

Therefore, the concept of “Home Isolation” was an alternative solution that would remedy this situation. It was also a strategy that would promote

a self-care treatment and lessen the illness severity to COVID-19 patients. The definition of Home Isolation described by the Ministry of Public Health in 2021 addressed that “Home Isolation was a service provided by healthcare providers. When a patient had been tested positive for COVID-19 and the doctor considered that such patient could be appropriately and safely treated by self-isolation services within his/her residence with consent of the patient and residence owner”. It also included stepdown patients who were discharged from sanitarium and continued self-isolation at his/her residence until completing the duration of quarantine. However, it had to comply with the guideline of the Ministry of Public Health. The home isolation was divided into two categories as follows:

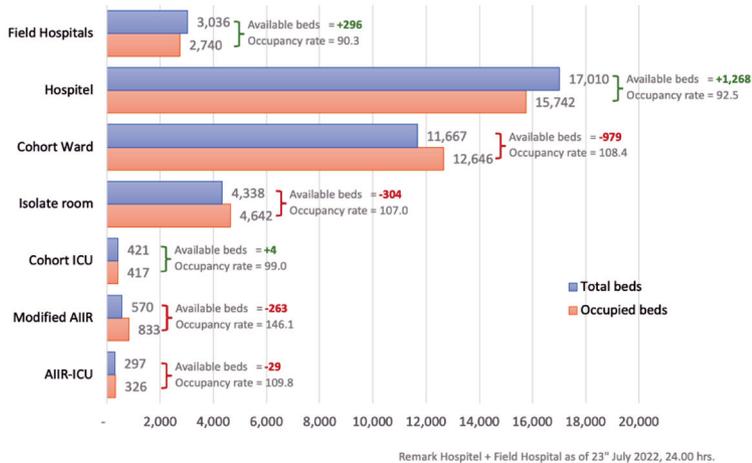
1) New COVID-19 patients that his/her conditions in line with the guideline and doctor agreed on home isolation treatment plan. The guideline stated that the patient had mild or no symptoms with good conditions. They possibly had comorbidity but under doctor controlled. The patient was younger than 75 years old and agreed for self-isolation at his/her residence.

2) Stepdown patients were the one after they recovered from their crisis situation and had been hospitalized in government sanitarium or hospital for at least seven days then discharged for home isolation<sup>(5)</sup>.

These patients were required to closely monitor their physical conditions such as measuring their body temperature and oxygen saturation every day. If the

### COVID-19 Bed Availability Status in Krung Thep Mahanakhon and Metropolitan Region

Link : <https://co-ward.moph.co.th/>



**Figure 3.** COVID-19 bed availability status in Krung Thep Mahanakhon and Metropolitan Region (Source: Department of Medical Services, Ministry of Public Health)

condition worsened such as body temperature over 39 degrees Celsius or difficult breathing, the patient should go back to hospital in their private car or call for ambulance service. However, the standard of care should be determined for controlling the effectiveness of home isolation services, easing medical personnel workload, increasing availability of critical care beds, reducing length of stay of mild COVID-19 patients, and decreasing the risk for hospital-acquired infection.

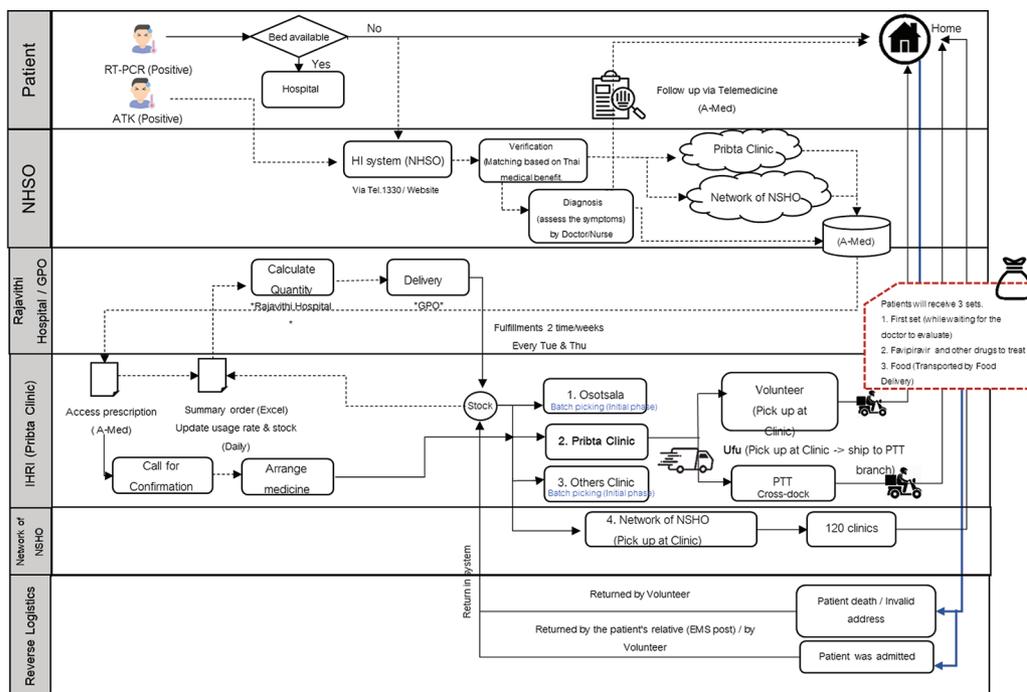
Recently, countries around the world including UK, Italy, and USA applied this concept for mild COVID-19 patients for easing the burden on the healthcare system. The governments supported their people on home isolation services. For example, a COVID-19 patient in UK could contact the medical volunteer for the support of commodity, food, drug, and prescription. They were eligible for sick leave or special leave from their employers. They also contacted their government for COVID-19 subsidy if their employer did not pay for their sick leave. In USA, the quarantine patients were entitled for their compensation for a maximum of two weeks or 80 hours, or the patients were eligible for two third of their compensation if they took leave during such period<sup>(6)</sup>.

For Thailand, Home Isolation was a new challenge in management system of the healthcare sector. The allocation of drug, supply, food, and tele-consultation from doctor and nurse was difficult because the lifestyle and culture of Thai people did not support the concept to make the services effective and available. Therefore, home isolation was not initially

accepted. However, when the COVID-19 situation significantly worsened, some mild COVID-19 patients had a shorter hospitalization and could return home for recovery. Thus, Home Isolation started in June 2021. The practice guidelines were formally announced. All experiences from the previous waves were studied for improving home isolation services for higher quality and more effectiveness.

The continuous increase of home isolation cases resulted in the increase of registered cases in the National Health Security office (NHSO) system to receive services. The increase caused an insufficiency of medical personnel and delay in drug allocation to home isolation patients. Therefore, doctors and nurses dedicated themselves to volunteer work to increase the access of healthcare and to relieve the problems of inaccessibility of drug.

In Thailand, the Institute of HIV Research and Innovation (IHRI), Chamchuri Square Building, was firstly used as an operation center of Pribta Clinic. It was a center of COVID-19 drug allocation for home isolation patients. After a COVID-19 patient was detected and there were no hospital beds available or after the patient had antigen test kit (ATK) result positive, they had to register in the NHSO system first. NHSO would verify their medical eligibility and coordinated with the responsible organization. At the same time, the patient would receive a primary set of drugs for healing the initial symptoms. Meanwhile, the volunteer nurse will screen the initial symptoms and refer to the doctor by tele-consultation or video call. After the doctor evaluated the patient, necessary



NHSO : National Health Security Office / GPO : The Government Pharmaceutical Organization  
 IHRI : Institute of HIV Research and Innovation (Pribta Clinic)

**Figure 4.** Medicine allocation process of Home Isolation services of Pribta Clinic (Designed by researchers).

drugs and medical supply would be prescribed through online clinic platform (A-Med) such as favipiravir, symptomatic drugs, karyiat, oxygen saturation, and digital thermometer. This order would be submitted to the inventory unit and the staff would call the patient to confirm all patient’s information before forwarding to the pharmacist to prepare the medicine. The logistics was initially rendered by volunteer riders then changed to private logistics agent as Platform of UFU Cargo. The distribution process used PTT stations as a sub-distribution center. Moreover, the patients also received three meals a day for 14 days, delivered by food delivery service.

In the part of inventory, the administration process started from Rajavithi Hospital, a reserved unit of the government that offered some quota stock and allowed for replenishment after usage. All drugs prescribed through A-Med were summarized and linked to the Government Pharmaceutical Organization (GPO). After that, Rajavithi Hospital would calculate the total quantity for drug replenishment and submit to GPO for delivering to Pribta Clinic twice a week, every Tuesday and Thursday. Pribta Clinic also had a responsibility for reporting volume of drug usage and remaining stock into the system every day. After

Pribta Clinic received the replenishment, the drug would be divided into two parts. The first part would be used within Pribta Clinic. The clinic had three dispensaries that were Osotsala, Pribta Clinic, and a clinic at On-nut. However, Osotsala and clinic at On-nut were used at the beginning period only. They received drug on a lot-by-lot basis for distributing to patients or the patients could pick up drug at the clinic directly. For the second part, it was distributed to 120 other clinics under NHSO. For this part, each clinic would pick up drug at Pribta Clinic then distribute it to the patient’s home. It reduced work process and workload of the hospital and the patients could receive the drug faster. If the number of mild COVID-19 patients decreased, the frontline hospital would better serve the critical patients. The overall community-transmitted cases also decreased during that time (Figure 4).

Home isolation or home quarantine was well accepted in many countries because it reduced the number of mild COVID-19 patients. The patients could be discharged, and they recovered at home with medicine and food delivery services. In Thailand, the concept of home isolation was different and had gaps for improvement. The model of home isolation

management was developed by the collaboration of both government and private parties as well as volunteers for running its services such as physicians, nurses, logistic operators, and stakeholders involved in prescription drug supply chains. While the number of COVID-19 patients in Thailand rapidly increased, the demand of home isolation also increased. It made the current model of home isolation and available resources unable to support the continuous increase of patients. To drive this system into a better standard and make it successful, the research team was part of the initial volunteer team at the beginning of project. It was through the establishment of nomination committee, but without the support from the government. The research team realized the difficulties and wanted to overcome the problems, improve the effectiveness of drug management system, and develop the model of policy of logistic management in Thailand. This was done by analyzing the gaps and recommending the strategy for improving home isolation to increase effectiveness and quality.

The present article is structured with Part 1 as the introduction. Part 2 is a literature review of the overseas situations in managing and controlling COVID-19 and the lesson of the logistic and the pharmaceutical supply chain management in pandemic situation. Part 3 is the method and process of data acquisition and data synthesis. Part 4 is the gap analysis and proposal of strategic policy on logistics and supply chain management strategy to support patient home isolation during the COVID-19 pandemic in Thailand. And Part 5 is a conclusion that reflected the problems and led to strategic policy framework with seven elements.

## Literature reviews

### The overseas situations in managing and controlling COVID-19

From the situations of managing and controlling COVID-19, the number of COVID-19 patients rapidly and widely increased, affecting the healthcare system, which could not satisfactorily serve all patients. Thus, home isolation was where patients were cared for separately instead of being in the hospital. This played a key role in both Thailand and other countries such as Australia, China, Hong Kong, India, Philippine, Vietnam, and Germany. This strategy could reduce COVID-19 beds occupancy and risk of hospital-acquired infection. The core services of home isolation included tele-medicine that the medical professional approached patients via electronic tool to conduct remote diagnosis and medical consultation.

After that, the information would be referred to the logistic team for delivering of necessary drugs, supplies, and equipment to COVID-19 patients. For example, in Australia, after the patient was evaluated through tele-medicine, an electronic prescription would be sent to the patient mobile phone. The patient could forward the electronic prescription to the drug store for drug services. This reduced the hospital workload. Then, the medicine would be delivered to the drug store based on the electronic prescription by postal services<sup>(7)</sup>. In China, the Chinese government had developed internet plus drug delivery (IHDD) system. The physician would evaluate the condition of the patient and order medication via online application such as WeDoctor and Alibaba Health<sup>(8)</sup>. Then, the patient could select to receive the medicine from a logistic agent or to pick up at the pharmacy of the hospital<sup>(9)</sup>. In Hong Kong, the government provided a hotline number for medicine delivery by government delivery agency or domestic volunteers to home isolation patients or those who were waiting for COVID-19 bed availability<sup>(10)</sup>. India had the second-highest number of confirmed COVID-19 positive cases in the world. Project StepOne was an online platform established by a non-profit organization. It was an effort of more than 7,000 volunteers to provide medical consultation and to deliver drug and medical equipment to COVID-19 patients. In Hyderabad, its distribution strategy for COVID-19 treatment was managed by the Greater Hyderabad Municipal Corporation (GHMC). There were 30 circles across six zones in GHMC to improve patient access for healthcare. In Philippine, the essential medical equipment for monitoring COVID-19 were thermometer, blood pressure meter, and pulse oximeter. In Germany, they supplied a remote patient monitoring systems to monitor oxygen saturation, respiratory rate, heart rate, and temperature that were specific patient information for treatment<sup>(11)</sup>.

### The lesson of the logistic and the pharmaceutical supply chain management in pandemic situation

COVID-19 was an emerging infectious disease that caused severe clinical symptoms, life-threatening illness, and spread around the world in more than 124 countries. It resulted to an insufficiency of non-pharmaceutical supply because of an increasing demand, a panic purchase and hoarding, and an imbalance of demand and non-pharmaceutical supply, affecting the patient's quality of life. Supply chain management is a crucial factor that the government should manage and control its equilibrium. If the

**Table 1.** Roles and responsibilities for healing COVID-19 patients during home isolation

Office	Roles and responsibilities were involved with resource management for healing COVID-19 patients during home isolation
Department of Medical Services	Regulated the management of drug supply in Krung Thep Mahanakhon and Metropolitan Region and issued a guideline for drug use.
National Health Security office (NHSO)	A government agency that coordinated and set policies for home isolation
Pribta Clinic of Institute of HIV Research and Innovation	Responsible for distributing drugs to subunits and patients
Shipping company	Responsible for delivering drugs from the hub to the patients
National Science and Technology Development Agency (NSTDA)	A government agency that supports IT systems for home isolation

authors looked backward, the lesson of H1N1 pandemic response in 2009 and the Ebola responsive measures in 2014 indicated that a strong collaboration among government parties and private parties in supply sourcing and utilization is essential<sup>(12)</sup>. This resulted to an increase of effectiveness toward outbreak response<sup>(13)</sup>. A supply management had been proposed with the following strategies. The usage and distribution of supply had been monitored by a system that was developed for maximizing an effectiveness of tracking on procurement, usage, and distribution. The centralized visibility was developed for monitoring all purchasing orders so the manufacturers and distributors could track actual demand variation and made more effective plan on production and distribution. The sharing of supply among hospitals in nearby areas should be promoted. The Just-In-Time supply system should be improved to be more flexible and respond to the fluctuation in the demand of supply during pandemic as well as to enhance the production capability to be more flexible toward demand variation and to promote information exchange and communication among regularly involved parties.

## Materials and Methods

The present study collected data by qualitative methods including document study, literature review, and specialist interview. Eight specialists worked in the offices and involved with resource management including drug and equipment for healing COVID-19 patients during home isolation in Thailand as shown in Table 1.

All gathered data was used to analyze the gaps (Gap analysis) between expectation, perception, and problems that occurred within the supply chain management and logistics management framework. The analyses were conducted in four perspectives for satisfying both operative aspect and policy aspect, including Information management and information technology, Material planning and

inventory management, Distribution management, and Leadership and governance.

## Results

The outcome of the gap analysis between expectation, perception, and problem could be applied for satisfying both operative aspect and policy aspect and could be promoted for increasing the effectiveness of supply chain management and logistics management. The analyses were conducted in four perspectives for satisfying both operative aspect and policy aspect, including Information management and information technology, Material planning and inventory management, Distribution management, and Leadership and governance.

### Information management and information technology

From Table 2, an effective information management system and useful information technology truly enhance the effectiveness of resource utilization because it can visualize the overall information. The linkage of data eases the data access and data monitoring. An analysis of the current situation showed that after the patients' medical coverage and UCEP had been verified, their information would be added in the system. Each clinic would receive the name lists and drug prescriptions from A-Med and summarized the data of total volume to Rajavithi Hospital and GPO for drugs. In the meantime, each office/clinic separately uploaded its daily usage and stock balance in an excel file form into GPO system. Therefore, the possibility of data incompleteness might occur that would result in the inaccurate quantity of drug allocation.

In the part of receiving and dispatching drug, clinic did not have a system to manage inbound and outbound inventory or an inventory management system, to link for monitoring stock balance or to track the drug usage of network clinics. Therefore, the decision maker or policy determiner could not easily

**Table 2.** Gap analysis

Issue	Question	AS-IS	Expectation (TO-BE)
Information management and information technology	<ul style="list-style-type: none"> <li>- Did they have an information system for stock management? If so, was it linked to other relevant systems for coordination and planning?</li> <li>- What was the expectation of stock management systems?</li> </ul>	<ul style="list-style-type: none"> <li>- There was no system for receiving and dispatch.</li> <li>- Data invisibility (Warehouse - Point of use)</li> <li>- There was no system for track and traceability. Therefore, it was difficult to verify when patient received package sets.</li> <li>- Manual system (mostly)</li> </ul>	<ul style="list-style-type: none"> <li>- Stock management and data visibility</li> <li>- Track and traceability</li> </ul>
Material planning and inventory management	<ul style="list-style-type: none"> <li>- How was the distribution currently planned? Moreover, what were the criteria for considering?</li> <li>- What was the expectation regarding material planning and inventory management?</li> </ul>	<ul style="list-style-type: none"> <li>- Unable to promptly arrange and deliver drugs to patients</li> <li>- No data for the actual dispensing at clinic</li> </ul>	<ul style="list-style-type: none"> <li>- Inventory management system</li> <li>- Data visibility (stock/usage rate/ number of cases)</li> <li>- Easy and convenient to plan</li> </ul>
Distribution management	<ul style="list-style-type: none"> <li>- How were the transportation and distribution arrangements currently being carried out?</li> <li>- What were the hitches for transportation and distribution?</li> </ul>	<ul style="list-style-type: none"> <li>- Delayed shipment</li> <li>- Volunteers were unfamiliar with routes so it might increase transportation costs</li> <li>- Unable to plan and forecast the number of volunteers</li> </ul>	<ul style="list-style-type: none"> <li>- Fast delivery when the no. of patient increase</li> <li>- Cost reduction for transportation.</li> <li>- Able to properly plan resource and predict the number of volunteers</li> </ul>
Leadership and governance	<ul style="list-style-type: none"> <li>- What were departments currently acting as leaders and governance? And what were problems they are facing?</li> <li>- What was the expectation about Leadership and Governance?</li> </ul>	<ul style="list-style-type: none"> <li>- Lack of a clear host agency</li> <li>- Lack of human resource</li> <li>- No information system and IT</li> <li>- Budget allocation does not cover logistics costs</li> </ul>	<ul style="list-style-type: none"> <li>- The responsibilities and duties of each part were clearly defined</li> <li>- There was enough resource allocation to meet the needs of human resources, technology and budget</li> <li>- Could be easily monitored and evaluated</li> </ul>

decide. In addition, there was no system for tracking and traceability to confirm that the drug had been delivered to patient. The confirmation was done via phone only. This method could not prevent the loss of drug in case that the patient had fully recovered or entered into the hospital treatment process. Moreover, the prescription would be terminated from the system after dispensing, therefore, the doctor could not trace back the medication history.

### Material planning and inventory management

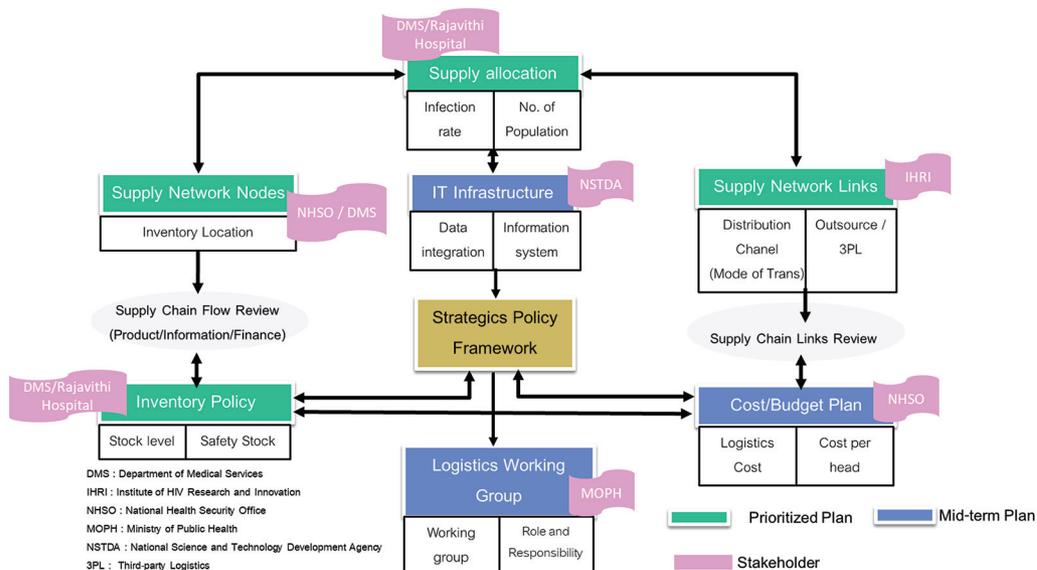
During a high demand of drug such as a pandemic, the volume of patient increased more than expected. Planning of medication stock should be made to enable a faster response and more availability of drug. An electronic system that had been used for recording information and overall quantity of patient's drug usage would enhance the effectiveness of drug allocation. Based on the analysis of the current situation, favipiravira was a special controlled drug and was managed by the vendor managed inventory (VMI) technique of GPO. Rajavithi Hospital and GPO determined the quota of drug. A quota volume of drug was allocated, and its replenishment was based on total volume from all prescriptions.

However, there was another gap of Material

planning and inventory management. When the demand of drug had increased from the higher number of COVID-19 patients, Pribta Clinic could not allocate and dispatch drug to patients promptly. While the clinic requested the drug periodically or when the patient volume was higher, the headquarters clinic could not trace actual drug dispensing from its network clinics. It was realized that current system had lacked inventory management system, inventory visibility, and case visibility, which would be difficult for supply planning.

### Distribution management

The speed of drug delivery was another factor that could reduce overall volume of patients. It was necessary to have several distribution centers and speedy dispatch system. The analysis of current situation revealed that the logistics and dispatch at the beginning period were done by volunteer riders. They took drug from Pribta Clinic at Chamchuri Square and distributed to the nearest network office of each patient. Due to the limited number of volunteer riders, the increase of patients caused the delay of drug delivery. Thus, the private logistics (WUFU Cargo platform) was applied for distributing drug to 17 PTT gas stations, then local volunteer riders would



**Figure 5.** Policy Strategy Framework.

take the drug from there to save time driving to the headquarters and could deliver to patient faster.

However, there were barriers and problems such as ineffective logistics, high logistics cost, delayed shipment, and delayed response time. The volunteer riders were unfamiliar with directions. It was difficult to manage or plan for workforce of volunteer riders.

### Leadership and governance (a host agency for managing)

The leader responsible for overseeing overall services of home isolation was a key success factor for making this project smoother. The leader would make decisions on the critical and urgent issues. The analysis of current situation revealed that a major problem of Leadership and governance issue was a lack of direct host agency. Home isolation services was a new concept in Thailand. The responsible parties of each section had faced problems such as inadequate workforce, lack of information technology (IT) system support, and insufficient budget in term of logistics, which was a hidden cost or an invisible cost that affected to overall administrative costs. Recently, NHTSO was the responsible party that approved lump sum payment such as 1,000 THB per patient for drug and supply. The lump sum payment did not include logistics cost so it could not reflect in the actual cost. This was a major issue that should be promptly resolved. The lack of leadership to make decision caused a vagueness of work and an excessive cost in long run.

The gap analysis visualized an opportunity for improving the working process of home isolation in the issues of the Information management and information technology, the Material planning and inventory management, the Distribution management, and the Leadership and governance that inspired a proposal of policy strategy framework for closing the gaps and driving home isolation service to success.

### Discussion

The gap analysis on the results of interviewing the eight specialists who had worked in the office and involved with management process was performed. The problems from four perspectives were reflected in the seven elements of strategic policy framework on logistics. The problems of planning and managing stock were reflected the first element, supply allocation and the fourth element, inventory policy. The problems of logistic and distribution were reflected the third element, supply network links. The problems of data and IT management were reflected the fifth element, IT infrastructure. Lastly, the problems of leadership and monitoring were reflected the sixth element, logistics working group and the seventh element, cost and budget plan. The framework and major elements were exhibited in priority and expectation, as shown in Figure 5.

#### First element: supply allocation

For the direction of supply allocation, the institute involved and responsible was the Department of

Medicine Services, Rajavithi Hospital. They should have a plan for reserving sufficient drug toward public demands. The drug and supply were allocated from GPO, under a determination of the Department of Medicine Services, Rajavithi Hospital, and distributed to hub hospitals, Pribta Clinic, or other offices based on the calculation from statistic model of infection rate, transmission rate, population in risk areas or infected areas, and other parameters. The determined information also included inventory and storage management. If the stock balance was low whereas the predicted volume of COVID-19 infected patients tended to increase, the allocation of drug and supply should be set as first priority, especially in the situation that drugs were limited.

### **Second element: supply network nodes**

For supply network nodes, the institutes that were involved and responsible for it was the Department of Medicine Services and NHSO. They should determine the appropriate locations, establish the distribution network near by the infected patients, and settle on the number of layers in the distribution network. The management in the pandemic situation needed the strong network for providing the rapid response to patients in timely manner. Thus, there was an idea of adding dispensing units such as drug stores under NHSO network that had qualified pharmacists. However, the system for verifying patients and drug administration was a concern.

### **Third element: supply network links**

For supply network links, the institute involved and responsible for it was Pribta Clinic. In addition to the volunteer riders, it should design the network for distributing drug and supply effectively for rapid response with appropriate cost. It should also consider the patient's locations or areas, including appropriate facility locations and distribution channel selection. It also should consider the transportation decision in each layer in the inventory decision. The strategy of hub-and-spoke was applied for shipment based on demand from each location. The appropriate spokes were established for collecting all orders and delivering to the end destinations. This strategy could reduce cost and save delivery time. The delivery model such as milk-run and delivery zoning should also be considered. Moreover, the outsource logistics providers or third-party logistics providers in corporation with government office such as Thailand Post (THP) or Thailandpost Distribution Company Limited should be added for delivering

drug and supply from Pribta Clinic to patient's home. These strategies could respond to the patient needs faster, reduce cost of logistics, and maximize current resource utilization.

### **Fourth element: inventory policy**

For inventory policy, the institute that was involved and responsible for it was the Department of Medicine Services, Rajavithi Hospital. It should determine the adequate quantity of stock and safety stock and appropriate cycle time for replenishing drug to manage the fluctuation of demand such as when the patient volume increased, especially during the brief period that demand was rapidly rising. The inventory visibility is particularly important. The executive should accept some ordering cost and logistics cost that might not be the best way for cost controlling but the drug allocation could be done every day and patients could access to drug easier. During the pandemic, the literature review of international research revealed that the stock remaining should be for at least one month or 14 days, depending on lead time. In addition, the concept of VMI should be applied for the center of drug allocation (GPO) and network clinics for an appropriate drug replenishment timeframe. This method could reduce inventory cost and stock quantity and could increase effectiveness of inventory management.

### **Fifth element: IT infrastructure**

For IT infrastructure, the institute that was involved and responsible for it was the National Science and Technology Development Agency (NSTDA). It should determine and develop patient medical record system for recording symptoms and drug history. The system should be able to track the remaining stock and status of drug dispensation. The system should also have an electronic platform for monitoring and tracing back medication history. Moreover, the information system should be linked with network for sharing information. In addition, the system should have a program for demand supply planning based on the information of infection rate, bed availability, and other factors. This information could be used for determining a plan of drug and medical supply and responding to potential future demand. An integration of information and data analysis system could forecast and visualize trend of patients and support the decision-making process. The integration of inventory management system could show the stock balance and usage of network clinics. The delivery tracking system could trace back

and ensure that the patient really received drug with no duplicated dispensation. The effective electronic system could evaluate, forecast, and help decide correctly.

#### **Sixth element: logistics working group**

For logistics working group, the institute involved and responsible was the Ministry of Public Health. All working groups should set up its organization structure or specific working team to take a role as the host for monitoring, administering, and solving the problems related with home isolation services. It should also determine the clear roles and responsibilities, financial mechanism, fund, budget, and others for an effective outcome evaluation and a prompt response to patient needs.

#### **Seventh element: cost/budget plan**

For cost/budget plan, the institute involved and responsible was the NHSO. They should be concerned with the logistics cost including drug administration cost, storing cost, and transportation cost generated by the home isolation to reflect on the actual total costs.

Beside the seven elements, the public relation and medical education about home isolation to people through public channels such as radio, television, billboard should be produced in an easy and reliable tool such as short video clips, infographics, podcasts, and other social medias. These tools can easily reach people of all ages. They should be attractive enough to lead people to understand the best practices of home isolation.

In conclusion, Policy Strategy Framework was the key factor for enhancing the effectiveness and success of home isolation. It helped resolved the problems of insufficient resources in hospitals and overflow patients. It closed the gap between expectation and actual situations. Moreover, it improved the overall COVID-19 situation in Thailand.

#### **Conclusion**

The pandemic of COVID-19 was inflicted all over the world and in Thailand, it was a great concern. Its mutation caused a dramatically increase of patients and insufficiency of medical resources. Countries implemented home isolation or home quarantine for decreasing workload of hospitals, responding to the needs of mild COVID-19 patients. In Thailand, home isolation started in June 2021. The Department of Medicine Services developed a guideline and instruction of home isolation for practicing in the same standard. Pribta Clinic was

established as a center for allocating drug to home isolation patients in a timely and accurate manner. However, home isolation services in Thailand had challenges such as ineffectiveness of information management system and information technology, no integration and tracking system for planning and a deficient stock management of drug, delay of drug allocation and shipment, and unclear direction from the responsible organization. Thus, it is necessary to develop a Strategic Policy Framework to improve areas including interrelated network designed for allocating drug and supply, speedy logistics, adequate and appropriate inventory management, information technology system that could integrate and retrieve data effectively, nominating a responsible person, and having budget to cover the logistics cost. An important thing is the public relation to gain attention and understanding about home isolation concept for the best quality and effectiveness as well as satisfy the need of patients and medical personnel accordingly.

#### **What is already known on this topic?**

This study has applied the basic knowledge of logistics and supply chain management as a framework for research. Supply chain management is a concept that links together multiple processes to achieve a competitive advantage, while logistics refers to the movement, storage, and flow of goods, services, and information within the overall supply chain. The authors' research team analyzed the gaps and addressed strategies for improving home isolation services based on this knowledge.

#### **What this study adds?**

The research team proposed the Strategic Policy Framework for improving home isolation services with seven elements, including supply allocation, supply network nodes, supply network links, inventory policy, IT infrastructure, logistics working group, and cost and budget plan for use as a guideline for preparing and responding to future pandemics.

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#### **Conflicts of interest**

The authors declare no conflict of interest.

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