

Taiwan's Experience with Emergency Distribution of Masks during COVID-19 Pandemic

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Abstract—At the start of the COVID-19 pandemic, Taiwan's government quickly implemented a name-based mask rationing policy. Moreover, to quickly respond to the public demand for face masks during the pandemic, the public and private sectors collaborated to implement emergency delivery operations. Accordingly, Taiwan managed to control the domestic spread of COVID-19 in 2020, and its pandemic prevention performance was praised worldwide. This exploratory study examined Taiwan's experience in the emergency distribution of face masks during the COVID-19 pandemic, and a model for emergency mask distribution was developed to address the literature gap in emergency logistics. The results indicated that the key factors for the emergency distribution of masks include a holistic legal foundation, the requisition of masks from suppliers, a prevalent postal network distribution system, intensive retail channels, and the National Health Insurance's Information System. The findings of this study have practical implications for emergency logistics.

Keywords—COVID-19, emergency distribution, public health, face masks for anti-pandemic purposes, name-based system

I. INTRODUCTION

At the end of 2019, the Coronavirus-19 (COVID-19) pandemic broke out and spread rapidly worldwide. To avoid cluster infections, the governments of several countries launched anti-pandemic measures such as the temporary closure of factories and the imposition of citywide lockdowns and closure of national borders. The spread of the pandemic severely impacted the global economy. Drawing from its epidemic prevention experience, including its handling of the severe acute respiratory syndrome (SARS) outbreak in 2003, Taiwan proactively implemented pandemic prevention measures shortly after the outbreak of COVID-19 pandemic. To strengthen its pandemic prevention framework, Taiwan

announced the implementation of a name-based mask rationing policy on February 6, 2020. This policy enabled Taiwan to control the situation effectively throughout 2020 and prevent the disease from spreading rapidly. Subsequently, Taiwan's prevention measures were recognized and affirmed globally.

A key challenge in managing the COVID-19 pandemic crisis is maintaining the supply and delivery of the correct types and quantities of pandemic prevention supplies [1]. To effectively combat the pandemic, governments and policymakers must prioritize the provision of adequate personal protective equipment and ensure staff safety [2]. A highly effective method for reducing the spread of the COVID-19 virus is mask wearing. Preventing the spread of the virus and avoiding contact with sources of infection can reduce the risk of the pandemic causing a medical collapse [3]. Masks are a key pandemic prevention supply. During the peak of the COVID-19 pandemic, governments and relevant agencies had to focus on how they could quickly collect, deliver, and distribute face masks to the people who needed them.

During the 2020 COVID-19 outbreak in Taiwan, the Central Epidemic Command Center (CECC) implemented a mask requisition and export restriction policy. Emergency mask distribution was conducted with the support of logistics companies and the name-based mask rationing policy implemented through the Information System of the National Health Insurance, thereby ensuring public access to masks for anti-pandemic purposes. Exploring and understanding the 3-month emergency mask distribution experience is necessary for clarifying how Taiwan implemented the emergency distribution of pandemic prevention supplies. By exploring how emergency logistics mechanisms can

be applied in the distribution of face masks, the present study can address a literature gap and provide references for pandemic management authorities worldwide.

II. LITERATURE REVIEW A

Implication and scope of emergency logistics:

Emergency logistics is a series of processes and methods that involve the efficient gathering, distribution, storage, and transportation of disaster relief supplies, equipment, and personnel to disaster-stricken areas for the purpose of supporting disaster relief operations [4]. Over the course of an emergency event, emergency logistics can be divided into three stages, namely the preparedness, response, and recovery/reconstruction stages [5].

Emergency logistics conforms to the philosophy and definition of logistics established by the Council of Logistics Management Professionals, which aims to efficiently and effectively manage the circulation and storage of goods, services, and information between origin and destination points through planning, execution, and control measures [6]. The core activities of emergency logistics include procurement, transportation, warehousing and distribution, and customer management [7].

Emergency logistics is implemented to meet the urgent needs of the people who are affected during an emergency. Given that “urgency” is the central tenet of emergency logistics, the main objective of emergency logistics is to maximize time efficiency and minimize disaster losses [8]. Therefore, emergency logistics involves the use of a logistics distribution system designed to address emergencies, and it can overcome the geographical and time constraints of general commercial logistics, increase the flexibility of logistics distribution within a given geographical range, and provide more time and space for supply collection and distribution.

Emergency logistics in public health:

Since 2020, the focus in domestic and international emergency logistics research has been predominantly related to the COVID-19 pandemic. The implementation of emergency logistics in a public health setting is characterized by the unpredictability of schedules,

locations, scale, trends, and losses; the uncertain demand for disaster relief supplies; weak economic efficiency; time pressure; multi-party participation in disaster relief; and government–market coordination for coping with supply shortages [9].

To address the demand for timely and safe quarantine-related emergency logistics in a public health setting, scholars have proposed robot operating systems with interactive and autonomous navigation capabilities, which are designed to conduct disinfection operations for emergency logistics at COVID-19 health-care treatment centers [10]. Additionally, during a pandemic, the public and private sectors should work together to ensure the timely delivery of supplies to those who need it. The private sector has logistical communication networks and supply channels. Therefore, the public and private sectors should establish an emergency logistics framework [11].

Two studies have examined the supply distribution and logistics during the SARS outbreak in Taiwan in 2003. The first study discussed the panic buying of masks by the Taiwanese people, which involved unscrupulous businessmen hoarding masks and increasing prices unreasonably, leading to a nationwide mask shortage. To address this mask shortage, the Taiwan Medical Association had to conduct the emergency procurement of masks from the United States [12]. The second study investigated several strategies for personal protective equipment preparation (e.g., storage, distribution, and maintenance of adequate supply) that were implemented before and during the outbreak of SARS. It discussed the standard procedure established by Taiwan’s Department of Health for the distribution of disease prevention supplies and the straightforward logistical structure for civilian-use masks. However, to date, no study has discussed how the fair and timely emergency distribution of pandemic prevention supplies can be achieved to ensure that every citizen can obtain them quickly.

III. RESEARCH DESIGN

Taiwan has effectively managed the COVID-19 situation, achieving outstanding success in pandemic prevention and earning worldwide recognition and admiration. The emergency distribution of face masks combined with the implementation of the name-based mask rationing policy was a key factor to this success.

Agency	Interviewee	Question(s)
Centers for Disease Control, Ministry of Health and Welfare, Executive Yuan	Senior executive responsible for epidemic management and procurement of supplies	What problems and tasks are involved in the purchase and distribution of masks through distribution channels such as pharmacies?
CDC, Ministry of Health and Welfare, Executive Yuan	Senior executive responsible for planning	1. How does the government take inventory of resources and assign units under its jurisdiction to conduct emergency logistics operations pertaining to the distribution of face masks? 2. What is the key to the policy change regarding the distribution of masks through pharmacies?
Chunghwa Post	Head of a logistics department	1. What are the logistical processes and problems related to the distribution of face masks?
Pharmacy	Store manager	What is the process of selling face masks through pharmacies?

Table 1. Interviewee profiles and interview questions.

The present study aimed to explore the response measures implemented by Taiwan's government to ensure that everyone had masks for anti-pandemic purposes during the beginning of the pandemic outbreak, which was a time-sensitive situation. The emergency

distribution measures implemented by the government included those pertaining to supply procurement, warehousing and distribution, and retail distribution management.

In accordance with the recommendations of Babatunde et al [13], who conducted a study on emergency logistics, the present study focused on examining the sources of mask supply and procurement, warehousing and distribution, and consumer management among retailers. The research structure of the present study is presented in Fig. 1. The present study aimed to answer the following questions through in-depth interviews and text analysis.

How is the emergency distribution of masks from suppliers to retailers conducted?

How do retailers sell masks to ensure equal access to masks for everyone?

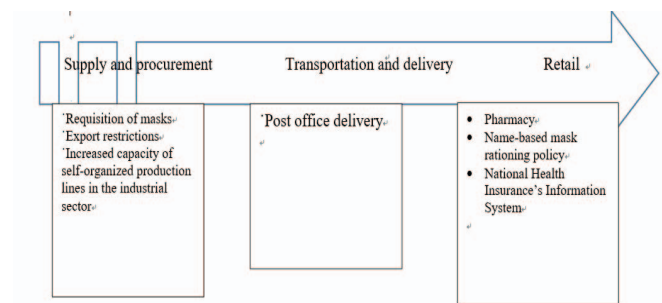


Fig. 1. Framework for emergency distribution of masks in Taiwan.

Emergency logistics refers to logistic support activities involving the provision of emergency relief supplies to those who need them [14]. The present study examined the period from the end of January 2020 (after the outbreak of the COVID-19 pandemic in Taiwan) to the lifting of the mask mandate on June 1 2020. It also explored various operations related to the delivery of face masks in Taiwan and performed semi-structured, in-depth interviews. Table 1 presents the interview plans and interview questions. The interviews were conducted between January and March 2023, and each interview lasted approximately 1.5 – 2 h.

IV. DATA ANALYSIS

Through content analysis, this study analyzed the audio recordings of the interviews by transcribing them into text, which was then analyzed and summarized to

develop an emergency mask distribution framework for Taiwan.

Supply and procurement:

In response to supply and procurement needs due to the outbreak of the COVID-19 pandemic, Taiwan activated the CECC in accordance with the Communicable Disease Control Act. Taiwan's Executive Yuan appointed the CECC's commander and deputy commander to direct, coordinate, and distribute pandemic prevention and medical resources. At the beginning of the COVID-19 outbreak in 2020, the CECC distributed masks from its reserve stockpile in accordance with the Regulations on Level 3 Security Reserve for Pandemic Prevention Supplies. In addition, the center issued a mask requisition order and assigned the Industrial Development Bureau and several mask manufacturers to expand their production lines to meet mask procurement needs. They also used the necessary supply approach to solve the industry's contract disruption problem due to mask requisition, thereby helping to stabilize the supply of pandemic prevention materials and reassure the public.

Transportation and distribution

The state-owned Chunghwa Post, which operates post offices spanning Taiwan and provides nationwide services, was assigned by the government to distribute masks through emergency logistics systems during the outbreak of the COVID-19 pandemic. Chunghwa Post complied with the name-based mask rationing policy; worked with retail pharmacies; and supervised the transportation, warehouse management, and delivery of masks for anti-pandemic purposes. It was designated as the provider of domestic postal communication services under the Postal Act. During the implementation of the name-based mask rationing policy, Chunghwa Post completed its assigned task through their internal mechanisms. The daily distribution logistics used to implement the name-based mask rationing policy 1.0 through pharmacies between February 6 and March 10, 2020, in Taiwan, involved the following tasks:

Collection

Chunghwa Post's 12 large branches—located close to mask factories—assigned smaller branches to conduct delivery operations to collect mask from each

mask factory. The quantity of masks collected was calculated in accordance with the instructions of the Department of Commerce, Industrial Development Bureau, Ministry of Economic Affairs. The required number of boxes, pallets, and logistics trolley carts was calculated based on the amount of goods collected, and communication was mainly conducted through emails and LINE group chats. The post offices responsible for collecting goods retained the required quantity of goods for delivery and transferred the surplus to regional mail processing centers.

Transportation

Local post offices transported the surplus to regional mail processing centers at nighttime. After receiving the goods delivered by local post offices, regional mail processing centers retained the quantity of goods required for a given jurisdictional area, sorted the goods, and then delivered the surplus to other mail processing centers that also needed the goods. These regional mail processing centers received the goods sent from within a given region, after which they sorted, tallied, and then delivered these goods to the post offices that needed them.

Warehouse management

After receiving the goods sent from within a given region, mail processing centers sorted and tallied them before delivering them to post offices on the basis of the quantity required by each post office or transferring them to other regional mail processing centers; this process is known as cross-docking. For the storage of reserved goods, the warehouse management principles of the three major mail processing centers aligned with the orders issued by the CECC (receiving goods from mask factories) and delivery orders (delivering masks to pharmacies). Scheduling was performed by Chunghwa Post, which determined whether cross-dock operations or warehouse management should be conducted. If the quantity received considerably exceeded the delivered quantity, the surplus would be put into storage. Chunghwa Post's Postal Operations Division was responsible for overall scheduling—that is, the processing and notification of mail overflows or shortages at local post offices on a daily basis.

Shipping/delivery

On the basis of their scope of responsibility, local post offices delivered goods to pharmacies or health

centers every day and collected signatures from recipients to confirm deliveries.

Retail and consumer management

Pharmacies, which are situated at the end of the logistics chain, are responsible for receiving, packaging, and selling goods. Typically, pharmacies received the masks delivered by mail carriers in the morning. After signing for the delivery, a pharmacy would separate the masks into packs of two (subsequently five pieces per pack when the supply of masks increased), and the price of masks was standardized to NT\$5 per piece. During business hours, people visited the pharmacies, and masks were usually sold out within 1 to 1.5 h.

The government's mask distribution policy initially involved the distribution of masks through convenience stores. Although each individual was only allowed to purchase a limited quantity of masks, people tended to make multiple purchases and hoard masks. Consequently, the initial policy was revised because masks were quickly sold out. After careful deliberation, the CECC launched a new policy to ensure that everyone could purchase masks. The new policy involved combining a name-based system with health insurance cards to implement mask allotment at health centers and pharmacies. Because of the name-based mask rationing policy, mask allotment data became controllable, which helped to ensure the even distribution of masks. Ensuring that the public had access to masks is a crucial component of Taiwan's success in implementing effective pandemic prevention measures.

On the retail front, the name-based mask rationing policy was enforced with the support of the National Health Insurance Pharma Cloud System, which is a name-based application software. Pharmacy clerks were required to ask each buyer to present their health insurance card, which was then inserted into a card reader. This process enabled the system to check the purchase information of each individual and ensure that they did not exceed their purchase quota. The National Health Insurance Pharma Cloud System was established in July 2013. During the COVID-19 pandemic, an easy-to-use, name-based application software was quickly developed for use by pharmacy clerks.

V. CONCLUSION AND SUGGESTIONS

The present study identified several key factors that contributed to Taiwan's success in managing the emergency logistics for implementing the name-based

mask rationing policy as a part of Taiwan's pandemic prevention efforts. The first factor is the establishment of a holistic legal foundation. On the basis of its experience with the SARS outbreak, Taiwan enacted the Communicable Disease Control Act. In addition, Taiwan's government established the CECC of the Nation Health Command Center and imposed a mask mandate in a timely manner.

The third key factor was the solidarity and cooperation among the government, enterprises, and the people. Taiwan's successful name-based mask rationing policy involved the participation of multiple parties, including mask manufacturers and equipment and raw material suppliers (supply), Chunghwa Post (logistics), and pharmacies (retail). During the COVID-19 pandemic when pandemic prevention was necessary, all the involved parties realized the spirit of solidarity and cooperation in a timely manner. The parties involved in the implementation of the name-based system were all a part of the Taiwanese National Mask Production Team, and they stood side-by-side in Taiwan's fight against the virus. This cohesiveness was a key factor for the success of the name-based system. In addition, the public's cooperation with the government's anti-pandemic policy was crucial. The name-based mask rationing policy required people to present their health insurance cards at pharmacies and to queue up to buy masks. In addition to the time cost, the process required people to remain patient while they waited in line and followed orders.

The key management findings derived from Taiwan's pandemic prevention experience pertained to the establishment and execution of goals. Because of the highly time-sensitive nature of emergency logistics, clear goals are required to ensure that pandemic prevention supplies are distributed to the public in a timely, equitable, and effective manner, and this was an objective of Taiwan's name-based mask rationing policy. Executive power lies in the implementation of advanced deployment and rolling reviews. Optimal solutions are developed by performing reviews and correction during the execution process.

The present study presented the delivery operation framework of Taiwan's name-based mask rationing plan 1.0, and this framework can be referenced by other countries that are seeking to formulate or enhance plans for emergency logistics operations or the distribution of pandemic prevention supplies during emergencies.

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