

Public-private partnerships to contain COVID-19

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Taiwan made advance preparations and initiated an early response to prevent and contain the coronavirus disease 2019 (COVID-19) outbreak. In addition to consolidating cooperation among medical and public health institutions, Taiwan has demonstrated its robust ICT capabilities and manufacturing capacity with regard to the production and distribution of epidemic prevention supplies, and brought to bear its medicine and vaccine R&D capabilities. Close cooperation between the government and private sector has been at the heart of these endeavors.

1. Private sector associations approached the government with offers of assistance, leading to the formation of a national face mask production team.

1.1. Setting up new face mask production lines

When the COVID-19 outbreak first emerged in China, Taiwan's daily production capacity for medical masks stood at approximately 1.88 million. To ensure sufficient supply of face masks and other necessities for its citizens, the Taiwan government requisitioned local manufacturers. Meanwhile, Chairman of the Taiwan Machine Tool & Accessory Builders' Association Hsu Wen-hsien brought together dozens of companies to form a national face mask production team. The government invested NT\$180 million, enabling this national team to create 60 face mask production lines within 25 days. On February 27, the government added another NT\$90 million for an extra 30 production lines. As of mid-March,

Taiwan's daily production capacity for face masks had reached over 12 million. During this period, manufacturers provided over 100 workers each day at no extra cost, while also offering components and actively supporting production lines across the country. Manufacturers' associations paid more than NT\$5 million to cover costs for workers' dormitories, salaries, and overtime compensation. By April 1, daily production capacity had exceeded 13 million. Adults are now able to purchase nine face masks every two weeks. Daily production capacity was advancing toward 19 million as of mid-May.

1.2. Face mask sales supported by convenience stores and pharmacies contracted by the National Health Insurance Administration

Prior to the implementation of the name-based rationing system for face masks, government trucks delivered face masks to distribution centers belonging to the four major convenience store chains, which assumed responsibility for logistical fees, packaging, and manpower costs. Once the name-based rationing system was launched, Chunghwa Post dispatched trucks to pick up face masks at manufacturing sites and deliver them to local public health agencies and NHI-contracted pharmacies. The government handles delivery and provides packaging materials; local public health agencies and NHI-contracted pharmacies package the face masks and cover manpower expenses. Since late April, people have been able to directly order face masks with their NHI cards at multimedia kiosks of convenience stores; they pay directly at the convenience store when placing their order and can pick up their face masks during a designated period at the same store.

1.3. Support from the ICT sector

As face mask production capacity was beginning to be increased, the

Central Epidemic Command Center (CECC) released several million face masks for sale to the general public at convenience stores. At the same time, private sector engineers, with the help of Google Maps and location search and payment services, designed a mask search map app through which people could check remaining inventory levels at convenience stores. Subsequently, many other engineers also got involved and developed different maps showing face mask availability, thereby dispersing search volumes. However, these were still unable to satisfy demand. In addition, close attention was being paid in society to whether resources were distributed in an equitable manner. In response, the engineers who developed the first mask search map app teamed up with Digital Minister Audrey Tang to create the name-based rationing system based on data from the NHI Administration, with people's purchases recorded on their NHI cards. This system was launched on February 6, and about a month later a mechanism was added allowing people to order face masks online and collect them at convenience stores. The number of face masks made available per person was increased from three per week to nine every two weeks. Once the third iteration of the name-based rationing system went into effect in late April, people could collect their orders and place new ones at the multimedia kiosks of convenience stores, and even order face masks for family members using their NHI cards.

2. Increasing ethanol production capacity to ensure steady supply

To meet demand for ethanol during the COVID-19 pandemic, the Executive Yuan instructed state-run companies Taiwan Tobacco and Liquor and Taiwan Sugar to increase production of 75% ethanol solutions for distribution through major channels in 350 ml bottles,

with a fair price of NT\$45 per bottle. From early February to late April, Taiwan Tobacco and Liquor produced more than 15 million bottles, achieving a weekly output of over one million. Taiwan Sugar showed even more innovation and commissioned the manufacturing of alcohol wipes at a weekly production level of 60,000 packs, with 10 wipes per pack. These are easy to carry and have been very popular. Taiwan Tobacco and Liquor and Taiwan Sugar both possess the capability to produce raw materials for ethanol. Even in the event of insufficient imports of such raw materials from overseas, ethanol production in Taiwan will not be affected.

3. Private enterprises and the government joined hands to quickly upscale production of protective and isolation gowns and toilet paper, as well as donate supplies.

3.1. To protect frontline personnel, private enterprises suspended their own production operations and rushed into the manufacturing of protective and isolation gowns. They also donated more than 10 million items including ambulances, emergency vehicles, protective gowns, goggles, face shields, and infrared thermal imaging cameras to ensure the safety of the Taiwanese people. Private enterprises and charitable organizations contributed goody bags for frontline police officers, medical personnel, social workers, and people in home quarantine and isolation.

3.2. In coordination with the government, domestic toilet paper and instant noodle manufacturers pledged to run manufacturing operations 24 hours a day for a two-week period to ensure supplies and ease people's minds. Supermarkets including Carrefour, A-Mart, Costco, RT-Mart, and PX Mart complied with government policy by limiting toilet paper sales to one pack per person.

4. Academia Sinica, National Health Research Institutes, and Development Center of Biotechnology are actively conducting R&D on synthesis of potential treatment drugs, vaccines, and test kits.

4.1. Treatment drugs

Currently regarded as the most promising drugs to treat COVID-19 are the antimalarial drug hydroxychloroquine, remdesivir (still in the clinical trial stage), and favipiravir (a second-line drug used to treat influenza). Taiwan is an exporter of the main raw materials needed for hydroxychloroquine, and the Ministry of Health and Welfare has stored sufficient inventory. Following 14 days of research, Academia Sinica completed the synthesis of remdesivir at the 100 mg level with a 97 percent level of purity. The National Health Research Institutes, the most prominent medical research center in Taiwan, has synthesized remdesivir at the gram level. In emergency scenarios, these drugs can be produced domestically through government mandates. The National Health Research Institutes also identified a protease inhibitor of COVID-19, 10 times stronger than current inhibitors. The Development Center of Biotechnology announced in early March that it had completed lab synthesis of the potential drug favilavir. In the future, the government will work with domestic pharmaceutical companies to provide sufficient amounts of antiviral drugs for COVID-19 patients. Taiwan's goal in conducting this R&D and synthesizing potential drugs is to ensure self-sufficiency in the event of a supply shortage from foreign sources and if possible to provide such drugs to other countries.

4.2. Vaccine R&D

Taiwan's Medigen Vaccine Biologics Corp. signed an agreement

with the US National Institutes of Health in mid-February for the joint development of a COVID-19 vaccine. Animal testing is expected to be completed in the first half of 2020, with clinical trials on humans to take place in the second half of the year. The National Health Research Institutes has recently also cooperated with Adimmune Corporation, which boasts mass production capabilities for vaccines, to accelerate related efforts. At the earliest, potential vaccines will emerge in June. In addition to investing in vaccine R&D, the Development Center of Biotechnology has also used its database of antibody genes to develop antibody drugs for the treatment of COVID-19.

4.3. Test kits

In early March, a research team at Academia Sinica announced that it had successfully developed a key reagent for rapid test kits that can show within 15 to 20 minutes whether a person is infected with COVID-19. Trials began in April to optimize mass production, and nine companies have obtained technology transfer rights from Academia Sinica. The goal is to commence mass production in the near future. Meanwhile, the Institute of Medical Device and Imaging of National Taiwan University's College of Medicine developed a rapid screening device for COVID-19 in late March. This handheld, noninvasive device is able to detect within 30 seconds whether a person has pulmonary infiltrates or edema. In the future, this could be used for screening large numbers of passengers at airports to enhance epidemic control efforts. The National Health Research Institutes developed a new generation of infrared thermal imaging cameras in April that boast four key functions: immediate detection of human face contours through artificial intelligence; simultaneous temperature readings for large numbers of people who are standing

in close proximity to one another; immediate notifications of temperature alerts; and identification document sensors. With advanced functionality and competitive prices, these cameras are poised to become another important tool in the fight against COVID-19.

5. The government coordinated with taxi and rental car companies to roll out convenient services for passengers requiring transportation from airport to home quarantine location.

To minimize risks associated with arriving travelers who have been ordered to undergo home quarantine and have to get from the airport to their home or other quarantine location, the government came up with a special program to arrange transportation services for these people, offering point-to-point services with the help of taxi and rental car companies. This program has not only reduced taxi waiting times at airports but also eliminated an avenue through which the virus could possibly spread. Epidemic monitoring management has thus been strengthened as a result.

6. Public-private partnerships to ensure that students can continue to learn even if schools are closed

6.1. To assist schools at the senior high school level and below with ensuring a high quality of learning and adopting online schooling mechanisms, the Ministry of Education has released reference guidelines for online classes and learning so that special municipality, city, and county governments and the schools they supervise can make appropriate preparations. The government is managing and allocating IT resources, purchasing mobile equipment and 4G cards, and coordinating with the five major telecom

operators in Taiwan to provide disadvantaged families with free internet accounts in the event of school closures and other families with preferential rates.

6.2. Through public-private partnerships, resources and services required for online classes are being delivered. With the support of private enterprises, videoconferencing solutions from Microsoft Teams and Cisco WebEx and software from textbook publishers are being made available free of charge to teachers and students nationwide.

7. Close cooperation between the central government and local authorities to contain the pandemic

7.1. Special epidemic prevention hotels were designated across the country to minimize the risk of transmission.

Since March 19, all passengers arriving in Taiwan have been required to undergo a 14-day period of home quarantine. To further consolidate barriers to disease transmission and prevent situations in which people are refused accommodation because of pandemic fears and subsequently have to search far and wide for a place to stay, the Taipei City government in mid-February began exploring ways of providing accommodation for people required to undergo home quarantine. The city government approached licensed hotel operators willing to cooperate in establishing an epidemic control hotel network in order to create a comprehensive management system to stop the spread of the disease and prevent community transmission. Two epidemic prevention hotels began offering services at the end of February. The Taipei City government also posted the standard operating procedures it used for this initiative online for reference by other cities and counties in Taiwan, as well as hotel operators. By the end of April, the number of epidemic prevention hotels across

Taiwan had reached approximately 150, offering accommodation to about 7,000 people.

7.2. Providing care to the pets of confirmed COVID-19 patients and protecting the health and welfare of animals

To protect the welfare of animals and reduce concern among residents, local governments developed programs to care for the pets of people diagnosed with COVID-19 based on suggestions provided by the Bureau of Animal and Plant Health Inspection and Quarantine of the Council of Agriculture. As part of these programs, local governments work with animal hospitals to quarantine and care for animals, dispatch personnel to visit the homes of patients together with police officers and borough chiefs to feed animals, and transport them to designated shelters for quarantine, so as to jointly protect the health of both humans and animals.

