The Republic of Korea's First 70 Days of Responding to the COVID-19 Outbreak

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Introduction

The COVID-19 pandemic has become a daunting global crisis with profound health, economic, and social impacts felt across the world. As of April 9, 2020, more than 1.5 million positive cases had been confirmed and nearly 90,000 people had died as a result of the virus.[1] As the disease continues to spread, governments are tackling this crisis in different ways, and their efforts are yielding varying results, with some countries continuing to experience increasing numbers of new cases daily and others starting to see a flattening of the growth curve.

The Republic of Korea was one of the first countries to respond to COVID-19. The first positive case was identified on January 20, 2020, and daily confirmed cases peaked at 813 on February 29. Since then, the number of new cases has declined until reaching about 100 per day in mid-March (figure 1). Although it remains uncertain how the crisis will play out over the longer term, Korea's approach has been effective in slowing the spread of COVID-19. Policy makers and practitioners are asking how Korea has been able to achieve this encouraging outcome while many other countries continue to experience exponential growth in their number of new cases. This case study provides an overview of how Korea responded to the outbreak and how it achieved positive results in containing the disease.

As was the case in many countries, the basic elements of Korea's response to COVID-19 combined using diagnostic testing, tracing contacts, isolating confirmed and suspected cases, providing treatment, and encouraging social distancing. Korea's sense of urgency, strong implementation capacity, and effective communication and public outreach strategy have distinguished the country's approach and contributed to its effectiveness. Although Korea's approach may hold lessons for other countries, it is important to note that some elements may not be directly transferable due to contextual factors including differences in information technology infrastructure, data privacy standards, and health care systems. This case study describes how Korea has undertaken prevention efforts, developed testing kits, tested thousands of people, implemented epidemiological investigations, treated patients, and built the institutional capacity needed to respond to this crisis.
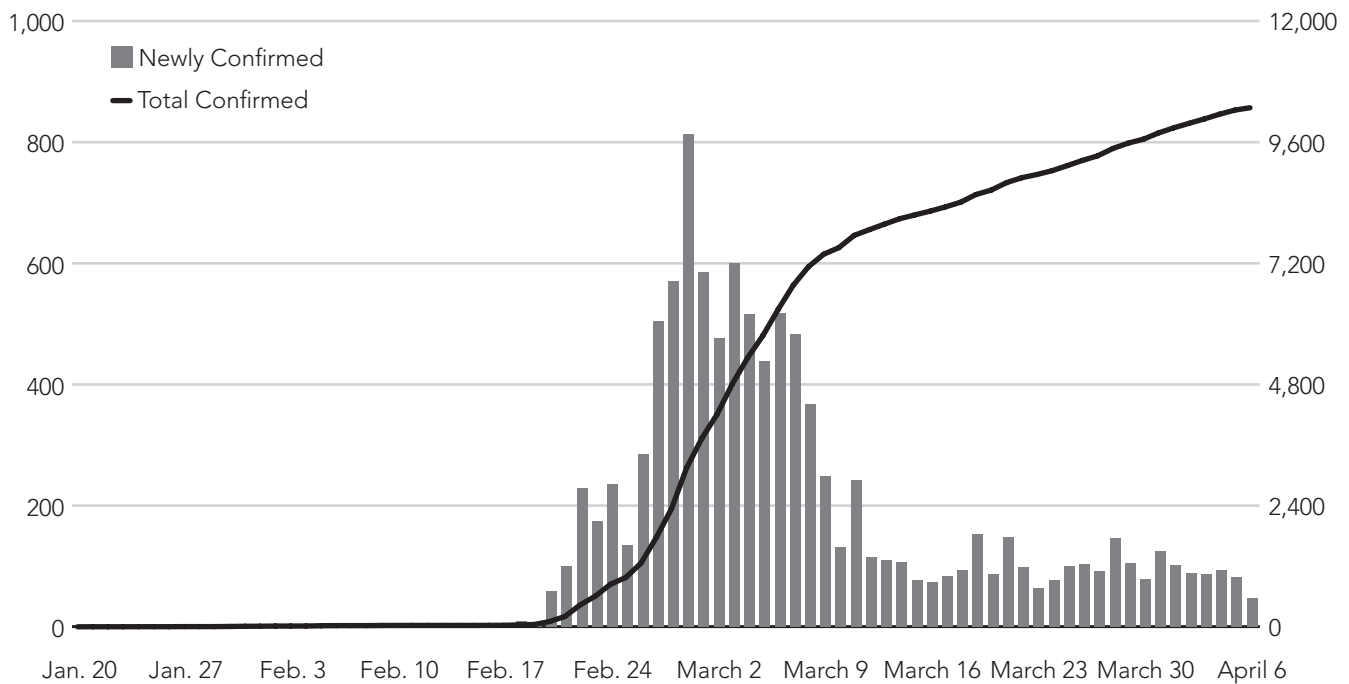
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1   Data from the Johns Hopkins University Coronavirus Resource Center, available at https://coronavirus.jhu.edu/.

FIGURE 1. COVID-19 CASES IN REPUBLIC OF KOREA

Source: Korea Centers for Disease Control and Prevention.

Preventing Transmissions of the Virus

Although many countries have closed their borders and imposed lockdown measures to control the spread of COVID-19, Korea has avoided sealing off the country or introducing sweeping stay-at-home orders. Instead, the government relied on a strong public outreach and communication strategy, social distancing, targeted isolations, and special entry procedures for incoming travelers.

Public Outreach and Communication

Korea's response to preventing the spread of COVID-19 recognized that providing easy access to up-to-date, accurate information could counter widespread panic and help ensure public cooperation, which is essential to curbing transmissions. "During a health crisis which can trigger public anxiety, disseminating information quickly and transparently is also part of the quarantine efforts," Go Jae-yeong, crisis management communication team chief at the Central Disease Control Headquarters, explained in a video released by the Korean government. "Conveying essential information in detail, such as

the outbreak status of an emerging infectious disease, the government's response measures, and the disease prevention regulations enables the public to understand the situation and trust what the government is doing" (Republic of Korea 2020).

In addition to regular website updates, targeted alerts through text messages, and mobile applications, the Korea Centers for Disease Prevention and Control (KCDC) has provided press briefings at least twice daily. Jung Eun-kyeong, the current director of KCDC, has been leading daily press briefings throughout the crisis. Her calm, consistent, clear, data-driven messages have been praised by the media and the public for delivering trustworthy and reliable information throughout the crisis. The government's commitment to information sharing and transparency has been noteworthy, especially because such openness was lacking during a 2015 outbreak of Middle East Respiratory Syndrome (MERS) in the country (S. Lee 2015).

The KCDC's 1339 Call Center is an important part of Korea's public information strategy. The call center answers questions, provides the public with emergency medical information, and guides callers to the appropriate health center or hospital, depending on their needs and the availability of services at different facilities. The call

center also has the capacity to communicate and provide guidance by text message, including to Koreans who are overseas (Republic of Korea 2020).

The 1339 Call Center, established in 1997, was staffed by 40 health care consultants when the COVID-19 crisis began. Together these consultants answered roughly 850 calls per day. Hyeon Su-ji, the call center team chief, reported in the government's video that at the height of Korea's outbreak, "the number of daily inquiries skyrocketed to around 70,000" (Republic of Korea 2020). The call center responded to the higher demand by increasing the number of health care consultants answering the phones. Now more than 300 consultants provide information and advice to 10,000 to 20,000 callers per day (Republic of Korea 2020; Office for Government Policy Coordination 2020).

Social Distancing

The importance of social distancing has been a consistent message throughout the crisis, especially as the number of new cases increased drastically during the third week of February, from 1 case per day to 235 new cases in less than a week. Following the Korean Society for Preventive Medicine's recommendation to increase social distancing efforts (Byun 2020), the Seoul metropolitan government implemented measures such as staggering commuting hours for civil servants and prohibiting organized gatherings at Gwanghwamun Square, a place in central Seoul that is usually populated with activists, petitioners, and protestors (S. Yoon 2020). The government's calls for social distancing intensified toward the last week of February, when the number of new cases jumped to more than 800. The Central Disaster and Safety Countermeasures Headquarters, a committee under the Ministry of the Interior and Safety, asked the public to refrain from attending religious and social events, to avoid large crowds, and to stay home if experiencing symptoms (D. Lee and C. Lee 2020). Schools have remained closed. The spring term, which was scheduled to begin on March 2, has been postponed three times, by a total of five weeks (Kwak 2020). On April 9, students started online classes with significant government investments to support this initiative (J. Park, J. Noh, and D. Park 2020).

Although the Korean government has not imposed a strict lockdown, on March 22 it called for an initial two-week period of intensive social distancing, urging citizens to avoid social events and to remain home as much as possible. The government strongly recommended that the public refrain from attending religious or other social gatherings, sporting events, indoor sports facilities, and entertainment venues, such as nightclubs (*Yonhap News* 2020). This initial period of intensive social distancing was extended for an additional two weeks on the basis of the same recommendations. The objective of these measures was to reduce the number of new cases to 50 per day, which is considered a manageable rate in line with available health care infrastructure and hospital beds (Chang 2020). The government also aims to bring the percentage of cases with unknown transmission routes to under 5 percent. As a result of these efforts, April 6 and 7 saw fewer than 50 new cases each day, the lowest numbers recorded since the outbreak took off in late February. The government credited this success to the first week of intensive social distancing (S. Shin 2020).

However, the government remains concerned that social distancing efforts could be losing momentum. Analysis of data from mobile phone base stations and subway use in Seoul indicates an increase in movement among the public (Chang 2020). The spring cherry blossoms attracted crowds, and some churches resumed services (J. Lee, K. Lee, and J. Park 2020). Also, despite its strong information technology infrastructure and connectivity, Korea does not have a widespread culture of working remotely. Some of Korea's large corporations initially introduced home-based work, but many have started transitioning back to office-based work, with employees working on flexible timetables and taking shifts between working at home and working in the office (Lim, Kim, and Lee 2020).

Special Entry Procedures for Incoming Travelers

As domestic transmissions continued to decline, Korea put measures in place to prevent the spread of new infections from incoming travelers. Soon after the first case was announced, the public expressed concern about Chinese immigrants returning to Korea after traveling home for the lunar new year. Despite some public pressure, the government did not issue blanket restrictions on inbound travelers (B. Kim 2020; Heo 2020). However, by mid to late March, positive cases among international travelers accounted for approximately 5 percent of Korea's total cases (J. Chung 2020). At that point, the government instituted new arrival procedures to identify infected passengers, including temperature

checks and health questionnaires that required inbound passengers to report any suspicious symptoms and provide contact information. Travelers were also required to download a self-diagnosis application on their mobile phones and report twice daily on their health status for a two-week quarantine period. The government reached out via phone to check the status of those who failed to self-report through the app (J. Lee 2020). On March 22, the government began testing passengers arriving from Europe.

Since the beginning of April, these protocols have grown more stringent and expansive. After deboarding, all travelers, regardless of nationality or point of departure, are taken to triage areas, where they are interviewed, have their temperatures checked, and are tested for COVID-19. Those who report or display symptoms are isolated and undergo further examinations. Others are held in temporary isolation facilities while awaiting their test results. Passengers who test positive for COVID-19 at the airport are taken to a hospital or treatment center (depending on the severity of their condition). The government mandates those testing negative to self-isolate for 14 days, during which time they are required to report to the authorities through a smartphone application, which is available in Korean, English, and Chinese. The app alerts the authorities if the user's GPS (global positioning system) position moves beyond the agreed self-isolation location (Ministry of the Interior and Safety 2020). Failure to comply with the self-isolation requirement can result in serious penalties, including fines and imprisonment (Jang 2020; Jaehyun Park 2020).

Developing Testing Kits

On January 27, one week after Korea's first case was diagnosed, KCDC officials met with representatives from 20 biotech companies specializing in diagnostic technology to request that they immediately develop COVID-19 test kits for mass production (Klingner 2020; Song 2020). The government promised an emergency use authorization to fast-track approvals and eliminate lengthy clinical trial requirements. Although there were only four confirmed cases in the country at that point, the KCDC recognized the need to move quickly. "We were very nervous. We believed that it could develop into

a pandemic," Lee Sang-won, an infectious diseases expert at the KCDC, recalled (Terhune et al. 2020).

The Emergency Use Authorization (EUA), introduced in 2015 following the MERS outbreak, provides the government flexibility in allowing the use of unapproved medical equipment or diagnostic reagents—in this case testing kits—as a rapid response to the threat of infectious disease. In January 2020, the government put the EUA into effect and assembled an emergency evaluation committee comprising experts from KCDC and the Korea Society for Laboratory Medicine. The committee assessed candidate testing kits on the basis of their technical approach, accuracy, and efficacy and requested emergency approval from the Ministry of Food and Drug Safety. Products that pass the emergency assessment can be manufactured, marketed, and used only provisionally, and they will be taken off the market and restricted from use once the emergency situation is relieved (Song 2020). In fast-tracking the test kits, the government made a strategic decision to take swift action, even though doing so meant forgoing standard clinical trials aimed at quality assurance. To address concerns about the accuracy of the tests, the Department of Laboratory Diagnosis Management at the KCDC cross-checked results on a selection of patient swabs to test their consistency across different labs (Song 2020; Terhune et al. 2020).

On February 4, just over a week after the initial meeting with private sector partners, the government approved Kogene Biotech to begin production of its testing kits. Seegene received approval a week later, and SolGent, SD Biosensor, and BioSewoom have followed since, bringing the total number of approved domestic testing kit manufacturers to five (H. Chung 2020). In one week, the two major manufacturers, Seegene and Kogen Biotech, have the capacity to produce enough testing kits to diagnose 700,000 people, and as of March 30, the majority of their products (90 percent and 70 percent, respectively) are being exported to other countries (J. Choi 2020; Watson, Jeong, and Hollingsworth 2020). In addition, 15 more testing kits manufactured by Korean companies have been approved for use by regulatory agencies outside of Korea and, since receiving approval from the Korean authorities for export, are being distributed to more than 40 countries as of April 1.

Testing People Quickly and Efficiently

Diagnostic testing to identify infected individuals is a central feature of Korea's response to COVID-19 and has helped the government flatten the curve of new cases. Korea's approach to testing stands out both for the number of tests conducted and for the innovative and efficient approaches used to deliver tests to the population while minimizing the risk of further infections, including designated screening clinics and drive-through and walk-through testing centers. As of April 9, more than 494,000 diagnostic tests had been conducted, representing 9,600 tests per million people. (Hasell et al. 2020).

The Korean government has designated more than 600 screening clinics at public health centers and health care institutions to make diagnostic testing accessible to the general public (Ministry of Health and Welfare website).[2] These screening clinics are exclusively for people with symptoms of COVID-19, such as cough or fever. To minimize the risk of further spreading the virus within health care facilities, the Ministry of Health and Welfare also designated close to 350 national safe hospitals, where wards for treating patients with respiratory symptoms are isolated from non-respiratory cases. The 1339 Call Center and a website maintained by the ministry assist people in locating the nearest screening center or safe hospital, and map applications, such as Kakao Map and NAVER Map, have also added a function to enable easier identification of the different categories of health care facilities.

Installing an outdoor drive-through testing center was first suggested by Kim Jin Yong of the Incheon Medical Center, one of the doctors who treated the first positive case. Kim found that even with proper ventilation equipment, rooms had to be ventilated for 30 minutes between patients, meaning only two tests could be conducted per hour in a given room. As demand for diagnostic testing increased, Kim presented at a conference the idea of keeping suspected patients in their vehicles during testing. Kyungpook National University's Chilgok Hospital in Daegu (the region most severely affected by COVID-19) decided to try Kim's idea, installing Korea's first COVID-19 drive-through testing center on February 23. Almost immediately, this model was replicated at Yeungnam University Medical Center,

another hospital in Daegu. Within less than a week, the cities of Goyang and Sejong followed (J. Shin 2020).

The Korean government recognized the effectiveness of this model in meeting the increasing demand for diagnostic testing and, on March 4, announced a standard operating protocol for drive-through screening centers (E. Shin 2020). As of April 1, about 80 drive-through testing centers were in operation. With less time needed for disinfection and ventilation, these testing centers have the capacity to test up to 6 samples per hour and 60 samples per day and can be operated by a minimum of four personnel. In contrast, standard indoor screening clinics can collect only 2 samples per hour and 20 samples per day. More important, drive-through testing centers do not require patients to wait in close proximity, thereby reducing the risk of infection (Jinhyung Park 2020; Central Disaster and Safety Countermeasures Headquarters 2020a).

Following the successful implementation of drive-through screening centers, another innovation emerged: walk-through screening clinics. On March 16, H+ Yangji Hospital brought this new idea into operation (B. Lee 2020). A patient enters a transparent booth similar to a telephone booth, a medical worker takes samples using long-sleeved surgical rubber gloves fixed on the wall that can be accessed from the outside, and the patient walks out. After inspection, a worker needs only to disinfect the booth and the rubber gloves on the booth. Patients and medical workers have welcomed this approach because it significantly reduces their risk of infection. The procedure minimizes contact with patients, and medical workers do not need to change their protective gear, which significantly reduces the risk of infection as well as the time required to conduct tests. The entire process takes only five minutes.

Some local governments have also made testing available through door-to-door visits. The Seoul and Daegu city municipality governments, for instance, announced in late February that they would provide home visits to collect samples from people with disabilities or reduced mobility, the elderly, and other at-risk groups. People can request home visit COVID-19 screening through the 1339 Call Center, and health care personnel from the district public health center will come to collect the samples (H. Kim 2020; Ryoo 2020).

These innovative measures for testing outside of hospitals significantly boosted the number of tests conducted. There was less risk of spreading the virus

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2   These data are from the website of the Ministry of Health and Welfare, available (in Korean) at https://www.mohw.go.kr/react/popup_200128.html.

because there were fewer potential patients in hospital waiting rooms. The measures have also saved time by eliminating the need to disinfect hospital facilities after taking samples (Ministry of Economy and Finance 2020).

Tracing the Virus

In addition to conducting extensive testing, Korea has also controlled transmissions through strong epidemiological investigations. These investigations have involved tracing patients' movements, identifying and informing individuals who may have been exposed to COVID-19, and taking measures to prevent further spread of the disease. Korea's approach in this area combines the painstaking work of a cadre of well-trained disease detectives, the innovative use of data and technology, and a transparent and timely communication and public outreach strategy.

Epidemiological investigations are carried out by local governments, with support from a team of Epidemic Intelligence Service officers at the KCDC who are deployed to investigate new outbreaks (Ministry of Economy and Finance 2020). The first step in this process is conducting interviews to create a map and timeline of an infected patient's whereabouts. Because patients may be reluctant to reveal personal information or may not recall details, information gathered through interviews is then cross-checked against a variety of data sources, including medical facility and pharmacy records, video surveillance recordings, credit card transaction records, and mobile phone GPS data. Korea's Infectious Disease Control and Prevention Act provides the legal basis for the KCDC to request and receive relevant information from the National Police Agency, the Financial Services Commission, and the National Health Insurance Corporation (KCDC 2020).

Combing through multiple data sources is a time-intensive process that presents some challenges in practice. For example, video surveillance recordings are not always clear, and mobile phone data may not provide accurate locations and will be incomplete if the patient was not carrying a mobile phone (KCDC 2020). Still, the approach has proved effective in verifying and supplementing patient-provided information and in evaluating risk exposure.

After a timeline of the patient's movement has been established and contacts have been identified, actions to mitigate the risk of further infection are taken— for example, by disinfecting areas that may have been contaminated. A critical part of this work is tracking down individuals who likely were exposed to the patient to monitor any symptoms they might develop and to impose an appropriate level of movement restriction. Beyond close contacts, text messages are sent to alert the public of new cases in their area, and the KCDC and municipalities publish detailed movement histories of infected individuals on their websites, including the general area of residence or work, the names of stores visited, and the mode of transportation used. They also publish confirmation of whether the patient wore a mask (through video surveillance footage), along with a timeline of the patient's movements when available. The websites have a search function that allows the public to check whether any patients visited their neighborhood prior to diagnosis.

Although this information is anonymized, it has raised some privacy concerns because friends and colleagues might be able to discern the identity of the patient from the information provided (Shorrock 2020). The National Human Rights Commission of Korea expressed concern that the oversharing of personal information could result in mockery, stigmatization, and hate speech (Choi, Yongae 2020). The National Police Agency has voiced concern (K. Lee 2020) that discrimination against patients could intensify the problem by discouraging individuals from identifying themselves (Y. Park 2020). There have been no official guidelines on when patient movement histories should be erased; however, to protect patient privacy, some local governments have decided to erase the movement histories of patients who have recovered (Jinho Park 2020).

An outbreak of COVID-19 among members of a religious group presented a major challenge for KCDC's epidemiological survey team. The Shincheonji Church of Jesus has a congregation of about 300,000 members, who gather in tightly packed rooms for prayer. One of the early cases of infection involved a member of the church, and after her diagnosis, the number of new cases began to increase exponentially.[3] As of early April, Shincheonji-related infections made up more than half of Korea's total COVID-19 cases.[4] The sheer number

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[3] On February 24, 2020, 129 out of the 235 cases existing at that time involved members of the Shincheonji Church.

[4] Data are from CoronaBoard, available at https://coronaboard.kr.

of Shincheonji-related infections presented a huge challenge for epidemiological surveys, but the church was not cooperative in releasing information about its members. Following heavy public scrutiny and several legal actions against it, the church began releasing names of its members and cooperating with the investigation.

Treating Patients

The Korean government established a patient management system to curb the spread of infections through isolation, while also efficiently channeling resources to ensure that patients received the level of care that they needed. Health care specialists throughout the country applied standard protocols to diagnose and classify patients on the basis of the severity of their symptoms: mild, moderate, severe, or extremely severe.

Rather than remaining home with their families and risking spread of the disease, patients with mild symptoms (80 percent of cases) are isolated at residential treatment centers (C. Lee 2020). These centers are public facilities or privately-owned lodgings designated by city and provincial governments. The centers provide patients with relief and hygiene kits, including underwear, toiletries, masks, a thermometer, and medicine. Health care workers at the centers monitor the patients twice a day and transfer them to designated health care facilities if their symptoms worsen. Patients with mild cases are permitted to return home after about three weeks if they are no longer symptomatic. "This way, those patients who require intensive care can have priority access to the specialized hospitals," Kim Won-does, a worker at a residential treatment center, said in the Korean government video (Republic of Korea 2020).

Patients showing moderate, severe, or extremely severe symptoms are immediately hospitalized at 1 of 69 government-designated national infectious disease hospitals or at another government-designated institution. Existing inpatients at these hospitals have been transferred to other hospitals to make room for COVID-19 patients. To prevent spread of the virus in health care facilities, each facility has established a triage system and put infrastructure in place to control infection within the facility. "They [the facilities] are equipped with negative-pressure systems and staffed by well-trained professionals," Kim Yeon-jae, a medical worker at a nationally designated isolation unit, explained.

"Maintaining negative-pressure units is essential for preventing the virus from escaping the room." As a result of these practices, Korea has seen relatively few cases of transmission to medical staff.[5]

A critical factor in Korea's treatment approach has been the country's capacity to mobilize skilled human resources to the right places at the right time. This effort included temporarily reassigning health care staff from one medical institution to another and hiring additional doctors and nurses. "We posted an advertisement for hiring on the Ministry of Health and Welfare homepage," Ji Ho-sik, a member of the personnel management team at Central Disaster Management Headquarters, said in the video. "The response was even better than I expected. Many people applied with a strong sense of duty. Their increased numbers are reducing the number of patients who lack access to health care providers." As of March 19, the government had dispatched more than 1,200 doctors and 1,100 nurses and nursing assistants to the Daegu–Gyeongsangbuk-do region (Republic of Korea 2020).

The low cost paid by patients has been another key factor in increasing access to testing and treatment. A photo of a hospital bill posted to the internet by a patient who had spent 19 days in a hospital recovering from COVID-19 showed that the total cost was about ₩10 million (US$8,000), of which ₩6 million (US$4,800) covered use of the negative-pressure room. The out-of-pocket expense for the patient, however, was only ₩44,000 (about US$35), with the remainder covered by the government (E. Ko 2020). Korea has a single-payer health care system, with government-provided universal health care funded through the national health insurance system. In addition, the government provides free diagnosis and treatment for infectious diseases under the Infectious Disease Control and Prevention Act. Insurance premiums, which vary depending on household income and assets, are on average ₩110,000 KRW (US$88) per month (S. Ko 2020).

Furthermore, the government provides economic relief for individuals put under isolation to compensate for loss of income. Depending on the number of dependents and family members, the government pays up to ₩1.5 million (US$1,200, an amount intended to cover the costs of isolation of 12 days or more for a household of five people). The government also compensates businesses

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5   As of April 3, there have been 120 infections and 1 death among medical workers (H. Yoon 2020).

that provide paid leave for employees in isolation up to ₩130,000 (US$104) per person per day (Central Disaster and Safety Countermeasures Headquarters 2020b).

Being Ready for the Crisis

The foundation for Korea's effective response to COVID-19 was its robust institutional capacity, built on the bitter experience of the 2015 MERS outbreak. Between May and July 2015, Korea experienced 186 confirmed cases and 38 deaths as a result of MERS. The government and health authorities were largely unprepared to deal with a novel infectious disease. It was later revealed that most of the infections were nosocomial (that is, they occurred within hospitals) and that the government withheld information from the public regarding which hospitals were affected by outbreaks. Following the MERS outbreak and the strong criticism health authorities received from citizens and public health experts, the Korean government introduced several changes that served as the foundation for the country's success in dealing with COVID-19.

In January 2016, the KCDC established the Center for Public Health Emergency Preparedness and Response.[6] In January 2019, it established (under the center's authority) the Emergency Operations Center in response to the growing demand for an organization that could provide instantaneous control and command over disease prevention and control (E. Choi 2019). The Emergency Operations Center operates 24 hours per day to collect and analyze domestic and international infectious disease information in real time. It was set up to detect emergency situations at an early phase, so an emergency reaction team could be sent out immediately to respond to and control the situation.

KCDC also established the Department of Risk Communication in January 2016 to improve risk communication and transparency (KCDC 2017).The government's failure to announce the names of the hospitals where infected people had visited or were admitted was identified by Korean and international experts as one of the major causes of the spread of MERS (Kupferschmidt 2015). The department's role is to plan risk communication activities with experts in various disciplines, to determine the scope and manner of information sharing with the public, and to immediately and transparently release relevant information when an emerging infectious disease occurs (Ministry of Health and Welfare 2015). The twice-daily press briefings by the director of the KCDC are an example of the department's efforts.

Korea's response to COVID-19 outbreak has required strong and nimble coordination among many government agencies at both the central and local levels. The KCDC has functioned as the control tower for COVID-19 response, with support from Ministry of Health and Welfare. The Ministry of the Interior and Safety led efforts to coordinate the central government and local governments nationwide. Local governments took necessary actions, including designating hospitals dedicated to COVID-19 patients. The central government helped local governments secure medical staff and supplies (Ministry of Economy and Finance 2020). In the government's video, Yang Dong-gyo, chief of the monitoring support team at the Central Disaster Management Headquarters, said that "the quarantine stations and quarantine management teams at the KCDC, our monitoring support team at the Central Disaster Management Headquarters, local government, and other relevant organizations are all working closely together" (Republic of Korea 2020).

An emergency drill helped to prepare the country for the crisis. Two dozen public health experts gathered on December 17, 2019, and conducted a drill based on a virtual scenario in which a Korean family contracted pneumonia after a trip to China, where an unidentified disease had emerged. In the drill, the disease spread rapidly to people who had contact with the family members. The KCDC team responded and developed a procedure to identify the virus and its source, as well as diagnostic methods. Only one month after the drill, the country confirmed the first positive case of COVID-19. "It was blind luck— we were speechless to see the scenario become reality," Lee Sang-won, one of the KCDC experts who led the drill, said in a Reuters article. "But the exercise helped us save much time developing testing methodology and identifying cases" (H. Shin 2020). The rapid response by Korean authorities, however, was not a coincidence. The response team was well prepared.

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6   The center's mandate includes analyzing international trends, overseeing immigration quarantine, strengthening epidemiologic investigation competencies, building a spontaneous risk response and swift diagnosis system, and promoting expansion of the related infrastructure, such as negative-pressure isolation wards. See the center's webpage at http://www.cdc.go.kr/contents.es?mid=a30109030000.

Conclusion

Although it is still too early to declare victory, as of early April Korea's immediate response to COVID-19 has been effective in controlling the spread of the disease. In reviewing the first 70 days of Korea's response, the following lessons emerge:

Strong implementation capacity allowed Korea to act swiftly, overcome delivery challenges, and achieve results. Coordination among central and local governments was critical in assessing the situation and providing necessary guidance and resources to the regions that needed assistance. Fast-track approval of testing kits using the Emergency Use Authorization protocol allowed the government to deploy testing kits quickly to respond to the crisis.

Adapting to changing conditions on the ground enabled Korea to achieve results, even in the face of serious time and resource constraints. The government's ability to adapt its approach in real time proved critical to making testing available; through the scaling up of the drive-through model; and to dispatching medical professionals to areas hardest hit by the outbreak, to staffing up the 1339 Call Center to provide guidance to citizens on how to access medical services.

Innovative information and communication technology tools strengthened Korea's response to COVID-19. Korea quickly developed and deployed technology solutions to communicate with the public and track cases. These tools have included a range of platforms to ensure that the public has real-time access to current information, to collect data from potential patients, to ensure that individuals are observing isolation requirements, and to verify information provided by patients on their movement histories.

Consistent, data-driven, and transparent communication helped foster trust between the government and citizens. Following the lessons learned from the MERS outbreak, the Korean government provided citizens with easily accessible, up-to-date, and accurate information, including through twice-a-day press briefings, text messages, regularly updated websites, and mobile applications. Those efforts have helped to counter widespread panic and to ensure public cooperation.

There are limitations to the transferability of these lessons because they are built on certain preconditions, including Korea's strong information technology infrastructure as well as its legislative framework for data sharing, and nationwide public health care system. Also, some aspects of Korea's response may raise privacy concerns, for example, the use of personal data to verify patients' movement histories. However, given the remarkable results achieved, how Korea has been able to contain COVID-19 may offer insights that could inform other countries' responses. As the situation evolves, the Global Delivery Initiative will continue to trace implementation processes of COVID-19 responses and produce further case studies.

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