Learning from the Republic of Korea

Building Health System Resilience

Huihui Wang | Inuk Hwang | Patricio V. Marquez

Korea-World Bank Partnership Trust Fund (KWPF)
Learning from the Republic of Korea

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Table of Contents

Reports in the *Pharmacovigilance and Essential Public Health Services* Series .............................................. V

Acknowledgments ................................................................ VI

Abbreviations and Acronyms ................................................. VII

Executive Summary .............................................................. 1

1. Introduction: Why are Korea’s Experiences Worth Studying? ................. 7

2. Korea’s COVID-19 Response and Key Features of Resilient Health Systems .................................................. 13
   2.1. Key features of resilient health systems ...................................... 14
   2.2. Korea’s COVID-19 response ....................................................... 14

3. Korea’s Strategic Investments to Build a Resilient Health System .............. 16
   3.1. Preparedness and response: an organizational network across government .... 17
   3.2. An effective financing system for infectious disease prevention and control ... 24
   3.3. An integrated information system for data-driven public health actions ... 27

4. Learning from the MERS Experience ........................................ 34
   4.1. System weaknesses exposed by the MERS response .................... 35
   4.2. Initiating 48 reforms for better preparedness and response .......... 36
   4.3. Optimizing governance mechanisms for effective pandemic response .................................................. 37
   4.4. Raising resource allocations for infectious disease prevention and control ... 40
   4.5. Building institutional capacity for infectious disease prevention and control ............................................ 45
   4.6. The development and timely adoption of innovation and technology ...... 46

5. Key Takeaways for the Benefit of Other Countries .............................. 48
   Health system built on lessons learned: a hallmark of the Korean experience ... 49
   Core Capacities of a Resilient Health System ........................................ 51

Annex A: Government Responses to MERS ........................................... 52
   MERS control mechanisms ............................................................... 52
   Local and central governments and the MOHW ................................. 54

Annex B: The Current National Disaster Management System .................... 56

Annex C: Financing Infectious Disease Control and Prevention .................. 61

References ..................................................................................... 62
BOXES
Box 1. Timeline of Korea’s Key Responses to COVID-19 in Early 2020 ........ 9
Box 2. The Tobacco Tax and Infectious Disease Prevention and Control in Korea .............................................................................. 26

FIGURES
Figure 1. Cumulative Confirmed COVID-19 Deaths per Million People ...... 8
Figure 2. Anthropogenic, Demographic, and Epidemiological Drivers of Population Health ................................................................. 11
Figure 3. Building Leading Institutions for Infectious Disease Prevention and Control ........................................................................ 18
Figure 4. National Infectious Disease Risk Alert Levels, Republic of Korea ... 23
Figure 5. Main Financing Mechanisms for Infectious Disease Prevention and Control ........................................................................... 25
Figure 6. The Integrated Information Support System for Infectious Disease Management ................................................................. 28
Figure 7. The SMART Quarantine System ........................................... 30
Figure A.1. The National MERS Response System .............................. 55
Figure B.1. Disaster Management System, Korea ................................. 57
TABLES

Table ES1. Planned Post-MERS Reforms in Infectious Disease Control and Prevention ............................................. 4

Table 1. Comparison of Korea's Responses to MERS and COVID-19 (Selected Highlights) ........................................ 10

Table 2. Changes at the Korea Centers for Disease Control and Prevention, 2015–19 .................................................. 19

Table 3. New Units for Infectious Disease Control and Prevention within the KDCA, 2020 .............................................. 20

Table 4. Public-Private Partnerships: Examples during the COVID-19 Response ....................................................... 24

Table 5. Planned Post-MERS Reforms in Infectious Disease Control and Prevention ................................................. 36

Table 6. Revised Response System, by Alert Level, before and after MERS .............................................................. 40

Table 7. Annual MOHW Budgets and the Share of the KCDC in MOHW Budgets, 2014–21 (US$, 1,000s) ....................... 41

Table 8. KCDC/KDCA Budgets, 2014–21 (US$, 1,000s) ................................................................. 42

Table 9. General Account, KCDC (KDCA after 2020), 2014–20 (US$, 1,000s) ......................................................... 42

Table 10. The Budget of the National Health Promotion Fund, 2014–20 (US$, 1,000s) .................................................. 44

Table 11. The Budget of the Emergency Medical Fund, 2014–20 (US$, 1,000s) .......................................................... 45

Table A.1. National Infectious Disease Risk Alert System: Countermeasures, by Level .................................................. 52

Table B.1. The Infectious Disease Response System: Countermeasures during a Serious Alert .................................... 58

Figure B.2. Organogram of the KDCA, January 2021 ................................................................. 60

Table C.1. Budgeting Process among Government Bodies, Republic of Korea ............................................................... 61

Table C.2. National Health Promotion Fund: Distributions for Infectious Disease Control (US$, 1,000s) ...................... 61

Table C.3. The Disaster and Safety Management Budget, 2015–20 (₩, trillion) ............................................................. 61
Reports in the Pharmacovigilance and Essential Public Health Services Series

Global
Synthesis Report on Pharmacovigilance: Why is the Safety of Medicines Important for Resilient Health Systems?
Positioning Report on Pharmacovigilance: The Value of Pharmacovigilance in Building Resilient Health Systems Post-COVID
Pharmacovigilance Situation Analysis Report: Safety Monitoring of Medicines and Vaccines

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Realizing a Regional Approach to Pharmacovigilance: A Review of the European Union Approach
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Country Scope
Learning from the Republic of Korea: Building Health System Resilience
Learning from Best Practices: An Overview of the Republic of Korea Pharmacovigilance System
Pharmacovigilance in Brazil: Creating an Effective System in a Diverse Country
Starting and Strengthening a National Pharmacovigilance System: The Case of Catalan Regional Activities that Propelled the Spanish Pharmacovigilance System
Ghana’s Pharmacovigilance Experience: From Vertical Program Activity to Nationwide System
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<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
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<tbody>
<tr>
<td>APQA</td>
<td>Animal and Plant Quarantine Agency</td>
</tr>
<tr>
<td>EIS</td>
<td>Epidemic intelligence service</td>
</tr>
<tr>
<td>EUA</td>
<td>Emergency use authorization</td>
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<tr>
<td>GDP</td>
<td>Gross domestic product</td>
</tr>
<tr>
<td>HIRA</td>
<td>Health Insurance Review and Assessment Service</td>
</tr>
<tr>
<td>H1N1</td>
<td>Influenza A virus subtype H1N1 (swine flu)</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and communication technology</td>
</tr>
<tr>
<td>KAERS</td>
<td>Korea Adverse Event Reporting System</td>
</tr>
<tr>
<td>KCDC</td>
<td>Korea Centers for Disease Control and Prevention</td>
</tr>
<tr>
<td>KDCA</td>
<td>Korea Disease Control and Prevention Agency</td>
</tr>
<tr>
<td>KFDA</td>
<td>Korea Food and Drug Administration</td>
</tr>
<tr>
<td>KIDS</td>
<td>Korea Institute of Drug Safety &amp; Risk Management</td>
</tr>
<tr>
<td>KRW</td>
<td>Korean won</td>
</tr>
<tr>
<td>MERS</td>
<td>Middle East respiratory syndrome</td>
</tr>
<tr>
<td>MFDS</td>
<td>Ministry of Food and Drug Safety</td>
</tr>
<tr>
<td>MOHW</td>
<td>Ministry of Health and Welfare</td>
</tr>
<tr>
<td>NHI</td>
<td>National health insurance</td>
</tr>
<tr>
<td>PPE</td>
<td>Personal protective equipment</td>
</tr>
<tr>
<td>R&amp;D</td>
<td>Research and development</td>
</tr>
<tr>
<td>SARS</td>
<td>Severe acute respiratory syndrome</td>
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Executive Summary
The response of the government of the Republic of Korea to COVID-19 has been heralded as among the most successful. In the first two years of the pandemic, the government was able to keep the size of the outbreak relatively small and the death toll relatively low.

By the end of January 2022, South Korea had 16,321 cumulative confirmed COVID-19 cases per million population, which was lower than the average for high-income countries (159,087 cumulative confirmed cases per million population) and lower than the number in the United States (218,028 cumulative confirmed cases per million population). (Our World in Data 2023).

Although the number of COVID-19 cases jumped significantly subsequently in 2022 and 2023 due to the spread of the more transmissible Omicron variant and a revamped testing regime that cast a broader net to detect infections, Korea had a much lower rate of total confirmed COVID-19 deaths per million population than other high income countries (676 in Korea, as compared to 3,379 in the United Kingdom, 3,331 in the United States, and 2,599 in France) (Our World in Data 2023).

The government achieved this relatively positive result without resorting to the highly restrictive measures that were adopted by most high-income countries, such as strictly controlling borders, shuttering businesses, or issuing severe lockdown or stay-at-home orders. Indeed, since the start of the outbreak in January 2020, the distinguishing features of the response in Korea include the government’s ability to mobilize swiftly, even in the early stages of the pandemic, to flatten the epidemic curve.

This report dissects the COVID-19 countermeasures successfully adopted in Korea. The analysis draws out insights and lessons that may be relevant to other countries as they mount responses to ongoing crises and prepare for future public health emergencies.

The recent past: a troubled encounter with outbreaks of infectious disease

The Korean government’s handling of the COVID-19 pandemic was in sharp contrast to its previous reactions to outbreaks of infectious disease. In 2015, even though the government has been challenged by other outbreaks of infectious diseases, including severe acute respiratory syndrome (SARS) in 2003 and swine flu (H1N1) in 2009, the outbreak of Middle East respiratory syndrome (MERS) quickly escalated into a national public health crisis.

The first case of MERS (the index case) in Korea involved a single patient who had arrived from Bahrain on May 4, 2015. Although the patient had traveled from the Middle East, the individual was not screened for testing or required to self-isolate. The patient visited several hospitals during the 10 days following the presentation of the first symptoms of MERS and was finally hospitalized at Samsung Hospital. The infection with MERS was confirmed at that hospital on May 20, 2015.
The initial epidemiological investigation conducted by the Korea Centers for Disease Control and Prevention (KCDC), the predecessor of the Korea Disease Control and Prevention Agency (KDCA), suggested that there were only a small number of infections deriving from the index case. A key limitation of the investigation was the narrow definition of the close contacts attributed to the superspreading event. One patient who had been at the same hospital at the same time as the index case, but was not classified as a close contact, later checked in at Samsung Hospital’s emergency room and ended up infecting 82 other people. The outbreak quickly escalated through more confirmed cases in various hospitals. Despite this rise in cases, the government initially did not disclose information on the results of the epidemiological investigation, thereby increasing the public’s confusion and fear.

The MERS outbreak in Korea occurred between May and July 2015, almost two months. MERS mainly spread through hospital infections. Of the 186 confirmed cases, 172 (92.5 percent) of the people had been exposed to the virus, MERS-CoV, in hospitals or clinics. Two major waves of MERS occurred in two hospitals, driven by superspreaders. Altogether in Korea, there were 38 deaths (20.4 percent). In addition, 16,993 individuals were under mandatory self-isolation. The economic loss associated with the outbreak has been estimated at W9.3 trillion (US$8.5 billion).

In general, much of the public health effort during the MERS outbreak was focused on absorbing the shock and adapting to the disruptions rather than responding to the disease. This resulted in an escalation of the outbreak and loss of public trust in the government’s ability to contain the impact of disease outbreaks.

The post-MERS reforms

The public health and social systems had struggled to contain the MERS outbreak. The response had clearly exposed structural weaknesses in public health and social systems. Gaps had become evident in the capacity of the government to establish health security through a timely and effective plan to address external shocks and unpredictable disruptions. Once the crisis was over, the government examined the lessons provided by its failures during the crisis. It realized its response to MERS was inadequate in at least three main respects: preparedness, absence of an early phase response, and the absence of information systems and even the suppression of information.

In terms of preparedness, although the government was aware of MERS outbreaks in the Middle East, no steps had been taken to confront a possible MERS domestic outbreak, especially nosocomial infections (infections in health care facilities). Perhaps the most visible shortcoming was the inadequately trained human resources.

During the early phase response, appropriate protocols for screening and for quarantining the infected were not available. The limited scope of early epidemiological investigations meant that the investigations were unable to detect a potential patient entering the country and ignored individuals who were in close contact with MERS patients by narrowly defining the range of the investigation.
In terms of the information system and risk communication, the lack of interagency information sharing through a designated information system and the lack of transparent public communication were notable.

After the analysis of the MERS outbreak and the government’s response was done, the government strategically invested in building and reinforcing the health system. This involved identifying and expanding relevant elements of the health system and adding new elements to public health infrastructure and processes (table ES1). The goal was to establish a flexible response system able to avert similar crises.

**Table ES1.** Planned Post-MERS Reforms in Infectious Disease Control and Prevention

<table>
<thead>
<tr>
<th>AREAS OF REFORM</th>
<th>TASKS</th>
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| Initial response to stop an outbreak of infectious disease | + A 24-hour emergency operations center will be established.  
+ In case a suspected case occurs, an immediate response team, led by the Division of Infectious Disease Control of the KCDC, will be formed and dispatched.  
+ The Department of Risk Communication will be established within KCDC.  
+ The number of epidemiologists will be increased, and a two-year epidemiology training program, the Korean equivalent of the epidemic intelligence service (EIS) programs of the US Centers for Disease Control and Prevention, will be introduced.  
+ Strengthened border quarantine measures will be implemented for all travelers from countries with a high risk of infection. |
| A specialized diagnosis and treatment system, including quarantine facilities | + Designation of beds and isolation facilities for specialized treatment of infectious disease patients.  
+ Increasing the number of negative pressure isolation rooms in local medical centers and establishing standards on negative pressure isolation rooms for hospitals with 300+ beds.  
+ Designation of temporary isolation facilities across the country.  
+ Increasing the number of laboratories to carry out diagnostic testing for infectious diseases at the Korea National Institute of Health. Designating certain diagnostic methods to private laboratories and regional institutes of health and environmental research. Ensuring prompt use of diagnostic reagents for testing or therapeutic agents that have not been approved by the Ministry of Food and Drug Safety (MFDS), upon the urgent request of the Ministry of Health and Welfare (MOHW).  
+ Interagency research and development (R&D) projects on vaccines and remedies for emerging infectious disease and for diagnostic devices. Creation of a database for clinical and diagnosis data on MERS-CoV for information technology-based analysis and R&D in medical devices and medicines. |
| Prevention of nosocomial infection | + Reform of the current emergency room system to create a process to separate patients with potential infection quickly, add negative pressure isolation rooms, and so on.  
+ Increasing the availability of negative pressure isolation rooms designated for infected patients and the number of general isolation rooms. Change in main caregivers of infected patients from family members to nurses.  
+ A system for nosocomial infection control is strengthened. More hospitals are required to build infection control rooms and raise the number of infection specialists, assessments, and incentives on nosocomial infection infrastructure and management activities, increasing the availability of personal protective equipment (PPE). |
| Adjusting governance arrangements for active response to emerging infectious disease | + Granting the KCDC the authority to supervise infection control and prevention and greater autonomy and specialization by making the head of the KCDC a vice minister, giving the KCDC authority in managing human resources, including hiring epidemiologists, and giving the KCDC the authority to control infectious disease epidemic at all stages.  
+ Reclassifying infectious diseases according to the level of risk and amending the list of authorities that are responding organizations. |

Source: MOHW 2015.
Following the 2009 H1N1 epidemic in Korea, the government had already established negative pressure isolation rooms and developed a laboratory diagnostic technique for MERS-CoV virus that was available before 2015.

Likewise, prior to the outbreak of COVID-19, the government undertook initiatives to realize a system able to recognize the early signs of a pandemic and react effectively. Quarantine monitoring techniques were strengthened. Through public-private partnerships, manufacturing capacity was secured for the production of diagnostic kits and testing technology. Legislative and regulatory reforms laid the foundation for extensive testing, contact tracing, prompt isolation, the treatment of cases, and the enhancement of public compliance and adherence to social distancing policies to control an infectious disease outbreak.

A comprehensive public-private laboratory network is distributed throughout the country. The laboratories are an essential part of the infectious disease surveillance system. They provide diagnostic services and support monitoring and inspections.

The COVID-19 onslaught

The ability to learn and transform in the aftermath of the MERS crisis allowed the government to act swiftly at the onset of the COVID-19 outbreak. The government response in the early phases illustrates the system awareness of the emerging threat and the ability to respond with agility to the changing needs of the moment and the expectations of the population.

The national infectious disease surveillance system, which includes the mandatory surveillance system and the sentinel surveillance system, had been in operation at the time of MERS. In accordance with the pertinent law, notifiable infectious diseases must be reported through the web-based national infectious disease surveillance system by public and private health care facilities. Separate information systems to monitor and control infectious diseases, including a quarantine information system, were, however, only developed following the MERS outbreak in 2015. In the initial days of the MERS outbreak, information on close contact individuals was not managed or shared among authorities in real time, but was shared by email and telephone and at meetings. Likewise, the MERS system managed information on individuals in mandatory self-isolation, including the type of isolation and daily symptoms, but the information was often incomplete and not up to date. Now, during COVID-19, these oversights were redressed.

Following the onset of the outbreak, the government was thus able to implement extensive contact tracing swiftly. This was built on improved epidemiological investigation capacities and information technology systems, with minimal risk for privacy, confidentiality, and citizen rights. To respond to the surge in patients, infectious disease hospitals were designated across the country, and living treatment centers were established where patients with mild symptoms could be isolated and monitored outside hospitals partly to prevent nosocomial infections. Prompt
disclosure of information and effective risk communication also helped create a high degree of trust among the public that contributed to compliance with government policy announcements and willingness to engage in social distancing.

Reforms had already amended the health insurance benefits package available in response to emerging communicable diseases. Through universal health coverage, all patients have access to treatments covered by National Health Insurance (NHI), including NHI services for communicable disease. Lost income because of self-isolation is offset by the government. The costs of infectious disease testing and treatment are covered by the government. Also, between March and May 2020, NHI contributions were discounted by 30 to 50 percent for individuals in lower income percentiles. Patients are therefore exempt from the obligation to make copayments for such treatments. For emerging diseases, the NHI responds by listing and pricing diagnostic tests and testing methods.

Lessons for other countries and other outbreaks of infectious disease?

The Korean experience with COVID-19 has demonstrated that five core capacities distinguish a resilient health system equipped to respond effectively during crisis and intercrises periods. These core capacities are public health functions, including monitoring the safety in the use of medicines, service delivery, community engagement and risk communication, supply chain management, and response readiness and emergency operations.

These capacities can be enhanced and mobilized through strategic investment in four interlinked, enabling domains, as follows: governance, coordination, partnership, and policies; service organization and human resources; financing; and innovation and technology. Not only are the four domains linked, that is, investment in one domain has an impact on or is reliant on concurrent investment in another domain, but the investments must also be responsive to the unique economic, political, and sociocultural context in which the health system is situated.

The coronavirus disease (COVID-19) pandemic has had an unprecedented global social and economic impact. The devastation has been untold, magnifying existing inequalities between and within countries. Perhaps the Korean experience can make it easier to grapple with outbreaks of infectious disease in the future, if it is understood that Korea’s sustained work in making decisions and taking actions—making investments, capacitating people, and building systems and institutions—have contributed to its success. Indeed, the main lesson from the Korean experience discussed in this report is that resilient health systems are the result of a dynamic ‘adopt and adapt’ process based on learning from experience, accumulated knowledge, and scientific and technological advances.
Introduction: Why are Korea's Experiences Worth Studying?
The coronavirus disease (COVID-19) pandemic has had an unprecedented global social and economic impact. The devastation has been untold, exposing structural weaknesses in public health and social systems and magnifying existing inequalities between and within countries. While the world continues to grapple with the new challenges that are emerging in this rapidly evolving situation, the pandemic has also provided a generational opportunity to build back better for a more resilient and inclusive future. Can we learn from the experiences of countries globally? Can we identify successful strategies that may be replicated and scaled up in other settings? Can we target investments to end the COVID-19 pandemic and build resilience to future crises?

The Republic of Korea’s response to COVID-19 has been heralded as one of the most successful in the world (Hong et al. 2022). During the initial period, the country was able to maintain a low case-fatality rate of 1.2 percent during the first outbreak (compared with 9.3 percent in Italy and 9.2 percent in New York City). In early 2022, although the number of COVID-19 cases had jumped significantly because of the spread of the more transmissible, but less severe Omicron variant and a rigorous testing regime, Korea exhibited a much lower rate of total confirmed COVID-19 deaths per million population than other high-income countries (Tong-Hyung 2022; WHO 2022b) (figure 1).

Figure 1. Cumulative Confirmed COVID-19 Deaths per Million People

Cumulative confirmed COVID-19 deaths per million people

Due to varying protocols and challenges in the attribution of the cause of death, the number of confirmed deaths may not accurately represent the true number of deaths caused by COVID-19.

Korea was also recognized for its effectiveness in flattening the curve without imposing a strict, large-scale lockdown and overwhelming health facilities. The distinguishing features of the response include the country’s ability to mobilize swiftly, even in the early stages of the pandemic, to flatten the epidemic curve without resorting to the highly restrictive measures that have been adopted by
most high-income countries, such as strict border controls, shuttering businesses, or issuing lockdown or stay-at-home orders at large. Box 1 lists the proactive actions and important milestones that made swift early response possible at the onset of the COVID-19 pandemic in early 2020.¹

BOX 1
TIMELINE OF KOREA’S KEY RESPONSES TO COVID-19 IN EARLY 2020

+ Jan. 3. National Infectious Disease Risk Alert level is declared to “Level 1”/Korea Centers for Disease Control and Prevention (KCDC) forms the Countermeasures Team for Unidentified Pneumonia Outbreak in Wuhan.  
+ Jan 9. COVID-19 testing method (Pan-corona testing method) is established.  
+ Jan. 20. First confirmed case in Korea is reported/National Infectious Disease Risk Alert level is raised to “Level 2”/Central Disease Control Headquarters begins operation.  
+ Jan 27. National Infectious Disease Risk Alert level is raised to “Level 3”/Central Disaster Management Headquarters begins operation/Government holds briefing session with private manufacturing companies on development of diagnostic reagents and testing kits.  
+ Jan 31. New testing method (Real-Time RT-PCR) is launched. |
| February 2020 | + Feb. 1. Central Disaster Management Headquarters is expanded and reorganized.  
+ Feb. 4. Emergency Use Authorization is granted for COVID-19 diagnostic reagents.  
+ Feb 7. Nationwide expansion of COVID-19 testing method to private medical institutions.  
+ Feb 12. Self-Check Mobile App is launched.  
+ Feb 23. National Infectious Disease Risk Alert level is raised to “Level 4 (Highest)”/Central Disaster and Safety Countermeasure Headquarters begins operation/Drive-through screening starts.  
+ Feb 29. Social distancing is introduced. |
+ Mar 5. Mask supply and demand stabilization policy is introduced to two per person per week.  
+ Mar 7. Self-Quarantine Safety Protection App is launched.  
+ Mar 9. Five-Day Rotation Face Mask Rationing System is implemented.  
+ Mar 11. WHO characterizes COVID-19 as a pandemic/.  
+ Mar 19. Special Entry Procedures and Self-Check Mobile App are extended to all arrivals.  
+ Mar 22. Mandatory testing is carried out for all arrivals from COVID-19 hot spots/Enhanced social distancing measures go into effect.  
+ Mar 26. G20 Extraordinary Virtual Leaders’ Summit is held. |


¹ COVID-19 testing is frequently performed using the polymerase chain reaction method.
Korea’s successful handling of the infectious disease outbreak during the pandemic is in sharp contrast to the country’s recent past, specifically, its response to the MERS outbreak in 2015. That outbreak quickly escalated to a public health crisis, thereby highlighting system inadequacies in mitigation, preparedness, and response. Although the government has been challenged by other public health crises resulting from infectious diseases, including severe acute respiratory syndrome (SARS) in 2003 and swine flu in 2009, its response to the MERS outbreak was inadequate and inefficient. Even if the two outbreaks varied significantly in scale, the countermeasures taken by the government during COVID-19 demonstrated much improved effectiveness and efficiency. With effective leadership by the Korea Centers for Disease Control and Prevention (KCDC), that in 2020 evolved into the Korea Disease Control and Korea Disease Control and Prevention Agency (KDCA), better collaboration with the private sector, and extensive use of data and information technology, the country was able to initiate early actions in identifying confirmed or suspected cases at the border, within health facilities, and among communities (table 1). Risk communication to the public, one of the recognized weaknesses of the MERS response, was open, effective, and transparent. A recent survey has revealed that only 29 percent of the public positively rated the government response to MERS, compared with the 76.3 percent who rated the government response to COVID-19 positively (Lee, Woo-Sung 2020).

<table>
<thead>
<tr>
<th>RESPONSE TYPE</th>
<th>MERS</th>
<th>COVID-19</th>
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<tbody>
<tr>
<td>Public feedback</td>
<td>29.0 percent of the public positively rated the government’s response</td>
<td>76.3 percent positively rated</td>
</tr>
<tr>
<td>Leadership for countermeasures</td>
<td>Initially the KCDC, then the prime minister</td>
<td>Consistently led by the KCDC/KDCA, with the final decision authorized by the prime minister in government-wide meeting</td>
</tr>
<tr>
<td>Early start of testing</td>
<td>Only the KCDC had the technique and mandate for laboratory testing, and private laboratories were not able to do the testing (WHO 2017a).</td>
<td>The KCDC/KDCA immediately transferred testing technique available nationwide (both public and private laboratories) once available</td>
</tr>
<tr>
<td>EPIDEMIOLOGY INVESTIGATION</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Contact tracing</td>
<td>Close contacts information shared through emails, phone calls and meetings (MOHW 2018).</td>
<td>Information on close contacts, travelers, and people under quarantine shared real-time through integrated information system</td>
</tr>
<tr>
<td>Number of EIOs</td>
<td>35</td>
<td>130</td>
</tr>
<tr>
<td>Detecting people with travel history to epidemic zones</td>
<td>Primarily relying on thermal cameras (detecting fever) and paper-based health questionnaires</td>
<td>Utilizing integrated data platform with information from 28 organizations including telecom and credit card companies (Kwon et al. 2020).</td>
</tr>
<tr>
<td>Preventing nosocomial infections</td>
<td>Hospital infection was found to be the most important cause of virus transmission (Lee and Wong 2015)</td>
<td>Using the integrated information system to identify individuals who had travel history to epidemic zones and presented themselves to health facilities</td>
</tr>
<tr>
<td>Risk communication</td>
<td>The government failed to disclose accurate information on testing criteria and the medical institutions hosting infected patients.</td>
<td>Open, transparent, and effective risk communication starting 10 days after the reporting of the first case</td>
</tr>
</tbody>
</table>

2 Middle East respiratory syndrome (MERS) is a viral respiratory infection caused by the Middle East respiratory syndrome–related coronavirus (MERS-CoV).
Korea’s health system and related reforms that the government implemented during the period between the MERS and COVID-19 outbreaks therefore merit careful attention. What are the features of an effective response to a public health crisis? What elements and features of a health system are essential for effective response to public health crises? Such an analysis may be able to draw insights and lessons that may be generalized to benefit other countries as they mount responses to the ongoing crisis and prepare for future public health emergencies.

This report applies the World Bank’s resilient health system framework to answer these questions through a careful, systematic dissection of the Korean health system and its experience with public health emergencies associated with infectious disease outbreaks, such as MERS and COVID-19 (figure 2).

**Figure 2. Anthropogenic, Demographic, and Epidemiological Drivers of Population Health**

The framework has three components, as follows:

Key features of resilient health systems: The framework defines resilient health systems as those prepared to avert crisis and promote and preserve human capital during crisis and intercrises periods. It reflects a recognition that such systems are aware of threats, agile to needs, absorptive of shocks, adaptive to disruptions, and able to learn to transform.
Core capacities that distinguish a resilient health system equipped to respond effectively during crisis and intercrises periods: These core capacities include public health functions, service delivery, community engagement and risk communication, supply chain management, and response readiness and emergency operations.

Enabling factors for resilient health systems: The framework argues that these core capacities can be enhanced and mobilized through strategic investment in four interlinked, enabling domains, as follows:

- Governance, coordination, partnership, and policies
- Service organization and human resources
- Financing
- Innovation and technology

The rest of the report is organized as follows: Section 2 provides a brief examination of Korea’s COVID-19 response against the key features of a resilient health system defined by the framework. Section 3 summarizes Korea’s strategic investment in the four enabling domains that have led to the country’s effective COVID-19 response. Section 4 contains a focused analysis of the reforms undertaken by the Korean government after the MERS outbreak in 2015. Section 5 offers key takeaways that may be beneficial for other countries.
Chapter 2

Korea’s COVID-19 Response and Key Features of Resilient Health Systems
Chapter 2. Korea’s COVID-19 Response and Key Features of Resilient Health Systems

2.1. Key features of resilient health systems

The framework defines resilient health systems as those systems that are prepared to avert crisis and promote and preserve human capital during crisis and intercrises periods. It recognizes that such systems reflect an awareness of threats and are agile to needs, absorptive of shocks, adaptive to disruptions, and able to learn to transform.

- **Aware of threats** refers to the ability of a system to recognize threats and shocks, including acute emergencies and chronic stressors, and to identify the resources necessary to address emerging challenges.
- **Agile to needs** refers to system responsiveness to evidence and feedback on changing population needs and expectations and on uncertainties.
- **Absorptive of shocks** refers to the ability of a system to respond to crisis and maintain core functions with the same level of resources despite the shock.
- **Adaptive to disruptions** refers to a system’s ability to self-regulate to minimize disruption and maintain functionality despite the availability of fewer or different resources.
- **Learn to transform** refers to the ability of a system to reorganize structures and operations based on lessons learned during the crisis to reduce risk and improve functionality.

2.2. Korea’s COVID-19 response

The Korean experience in building and reinforcing health system resilience after MERS and before COVID-19 can be traced to a cycle of responding to, learning from, and preparing for public health emergencies. This has involved the transformation of a system that struggled to contain the MERS outbreak to a system that has been able to recognize the early signs of a pandemic and respond effectively. Korea’s ineffective response to the MERS outbreak was characterized, retrospectively, by the lack of appropriate protocols for screening and for isolation-affected people, the limited scope of epidemiological investigations, inadequately prepared human resources and public health infrastructure, and the absence of a robust information system and transparent communication. During the MERS outbreak, much of the public health effort was focused on absorbing the shock and adapting to the disruptions. This resulted in an escalation of the outbreak and loss of public trust in the government’s ability to respond to and contain the impact of disease outbreaks.

Although the government’s response to the MERS outbreak was deemed inadequate, it exposed gaps in the health system’s capacity for establishing health security through a timely and effective response to external shocks and unpredictable disruptions, such as infectious disease outbreaks. Once the crisis was over, the government picked up on the lessons learned from the crisis and strategically
invested in transforming the system by introducing reforms to boost public health emergency preparedness. This ability to learn and transform in the aftermath of the MERS crisis allowed the government to act swiftly when the COVID-19 outbreak first occurred.

In contrast to the MERS experience, the government’s response in the early phases of the COVID-19 pandemic illustrates system awareness of emerging threats and the ability to respond with agility to the changing needs of the moment and the expectations of the population. This initiated a cycle of awareness of threats, agile response to needs, shock absorption, adaptation to disruptions, and learning to transform to new or emerging public health crises. For instance, the legislative and regulatory reforms introduced after the MERS crisis laid the foundation for extensive testing, contact tracing, prompt isolation, and the treatment of cases and enhanced public compliance and adherence to social distancing policies to control COVID-19 (Kwon 2020; Kwon et al. 2020; Yoo et al. 2021). Likewise, prior to the onset of the outbreak, the government had strengthened quarantine monitoring and secured manufacturing capacity for diagnostic kits and testing capability nationwide through public-private partnerships (ADB 2021b; FDA 2021).

The Korean health system’s preparedness or ability to absorb shock and adapt to disruptions because of COVID-19 was illustrated in the steps the government took immediately following the onset of the outbreak. The government was thus able to implement extensive contact tracing swiftly. This was built on improved epidemiological investigation capacities, information technology systems, and legislative reforms, with minimal risk for privacy, confidentiality, and citizen rights (Kwon et al. 2020). To respond to the surge in patients, infectious disease hospitals were designated across the country, and living treatment centers were established where patients with mild symptoms could be isolated and monitored outside hospitals partly to prevent nosocomial infections, that is, infections originating or acquired in hospital (Government of the Republic of Korea 2020, ADB 2021b). Prompt disclosure of information and effective risk communication also contributed to the high degree of trust of the public that contributed to compliance with government policy announcements and social distancing.
Chapter 3

Korea’s Strategic Investments to Build a Resilient Health System
Chapter 3. Korea’s Strategic Investments to Build a Resilient Health System

The measures taken by the Korean government in response to the COVID-19 pandemic are well documented and disseminated, such as flattening the curve at an early stage through large-scale testing, contact tracing, and quarantine, redesignating the service delivery network for treating COVID-19 patients. This section aims to review some key investments the government and stakeholders have made that enabled the country to implement these response measures effectively: organizations, information, and financing.

3.1. Preparedness and response: an organizational network across government

A network of organizations work closely together to realize the infectious disease prevention and control agenda in Korea: from hospitals, and laboratories that provide diagnostic and treatment services among individuals to local and national public health institutions that provide population-level interventions, such as surveillance, epidemiology investigation, and risk communication.

Korea is well known for its resourceful medical service delivery system. According to the Health Insurance Review and Assessment Service (HIRA) and the National Health Insurance Service (HIRA and NHIS 2022), the country had 74,706 medical institutions in 2021, that is, 144.4 medical institutions per 100,000 population. The number of hospital beds in Korea—12.7 per 1,000 population in 2020—was the highest among the countries of the Organization for Economic Co-operation and Development. In 2020, the number of licensed medical workers (including doctors, nurses, pharmacist) was approximately 642,000 (129,000 doctors, 440,000 nurses, 73,000 pharmacists), equal to 12.4 (licensed) per 1,000 population, and the number of active licensed medical workers who were employed by medical institutions was 368,000 (107,000 doctors, 225,000 nurses, 36,000 pharmacists), or 7.1 (licensed and active) medical workers.

A comprehensive public-private laboratory network is distributed throughout the country. The laboratories are an essential part of the infectious disease surveillance system. They provide diagnostic services and support monitoring and inspections. The public laboratories are within the laboratory system of the KDCA (the national reference laboratory) and the 256 public health centers. These public laboratories have operated in Korea since the 1960s and are funded through local and central government budgets. Private laboratories have been established in 298 hospitals and other commercial health care facilities to form a rapid and modern private laboratory network in partnership with the public laboratories.

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3 These include 45 tertiary teaching hospitals, 319 tertiary hospitals, 1,397 hospitals, 1,464 long-term care hospitals, and 33,912 clinics.


The rest of section 3.1. focuses on Korea’s investment in public health organizations, including key players and how they work together.

**Building the institution capacity for the prevention and control of infectious disease**

Stakeholders and the government of Korea have learned from previous outbreaks to optimize governance mechanisms and have undertaken sustained investment in public health capacity. The leading public health institutions were established and strengthened as they confronted various disease outbreaks (Figure 3). In 2004, after the SARS outbreak in 2003, the Korea Centers for Disease Control and Prevention (KCDC) was established. After the MERS outbreak in 2015, the authority of the KCDC was expanded. During the COVID-19 pandemic, KCDC’s authority was again elevated, evolving to become an independent agency with a new name, the Korea Disease Control and Prevention Agency (KCDA), in 2020. The KDCA acts as the control tower for the prevention and control of infectious diseases, in collaboration with local public health agencies, supports a nationwide public-private laboratory network, and carries out surveillance, epidemiological investigation, and diagnostic activities (Wang, Marquez, and Hwang 2023).

![Figure 3. Building Leading Institutions for Infectious Disease Prevention and Control](image)

**Expanding KCDC capacity after MERS (2015–18)**

Following the MERS experience, the KCDC underwent organizational changes and expansions to strengthen its capacity in confronting infectious disease. Between 2015 and 2018, these changes involved the establishment of new bureaus, divisions, and centers to address existing and emerging infectious disease through better risk assessments, more international cooperation, improved management of nosocomial infections, and the early prevention of infectious disease epidemics (table 2). For example, the Emergency Operations Center was
launched on a provisional basis in 2016, and the center was formally instituted in 2019 to collect and analyze information on domestic and international infectious disease outbreaks in real time. This was accomplished through reliance on a control room engaged 24 hours a day, seven days a week in promptly detecting emergency situations and sending out reaction teams for early response (Kwon et al. 2020).

Table 2. Changes at the Korea Centers for Disease Control and Prevention, 2015–19

<table>
<thead>
<tr>
<th>YEAR</th>
<th>ESTABLISHMENT OF NEW BUREAUS, DIVISIONS, AND CENTERS</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>2015</td>
<td>Medical Radiation Division, Tuberculosis Research Division</td>
<td>The role of medical radiation safety management was transferred from the Ministry of Food and Drug Safety (MFDS) to the KCDC in 2013, and the Medical Radiation Task Force was expanded to become a division in 2015. The Tuberculosis Research Division was created as a dedicated unit for epidemiological investigation.</td>
</tr>
<tr>
<td>2016</td>
<td>Emergency Operations Center, Risk-Communication Office, Risk Analysis International Corporation Division, Infectious Disease Diagnosis and Management Division</td>
<td>The Emergency Operations Center and its divisions, including the Risk Analysis International Corporation Division, are responsible for planning and managing infectious disease emergency responses, the operation of emergency situation room and epidemic intelligence service (EIS) officers, the management of emergency response supplies, and the organization of systems for biological terrorism events. The Risk Communication Office, headed by the risk communication officer, is responsible for public relations on infectious and noncommunicable diseases through cooperation with other KCDC units and academic experts. The Infectious Disease Diagnosis and Management Division is responsible for ensuring the credibility of diagnostic testing.</td>
</tr>
<tr>
<td>2017</td>
<td>Bureau of Coordination and Planning, Future Infectious Disease Preparation Division, Medical Infection Control Division, Chronic Disease Prevention Division, Rare Disease Division</td>
<td>The Bureau of Coordination and Planning, including the Future Infectious Disease Preparation Division, is responsible for budget planning, developing plans for managing future diseases, informatization, and the operations of call centers and online information portals. The Medical Infection Control Division is responsible for the prevention and management of nosocomial infection events. The Chronic Disease Prevention Division is responsible for national programs for chronic disease management. The Rare Disease Division is responsible for research and the management of programs for people with rare diseases.</td>
</tr>
</tbody>
</table>

Source: KDCA 2020a.

Establishment of the KDCA, with more authority and autonomy

Emerging from the KCDC, the KDCA is more well equipped to lead the country in infectious disease prevention and control. Instead of receiving allocations from the Ministry of Health and Welfare (MOHW), it participates in the budgeting process independently. The footprint of the KDCA was significantly expanded relative to the KCDC. It encompassed 5 bureaus, 3 directors general, and 31 divisions. It also boosted the number of personnel involved in infectious
Learning from the Republic of Korea: Building Health System Resilience

disease control within the KDCA and other related local organizations as follows (ADB 2021b; Kwon et al. 2020):

+ The number of personnel in the KDCA and affiliated entities rose by 42 percent in 2020, from 907 to 1,476, because of the reform (Jung 2020b).
+ The 17 metropolitan and provincial governments added 140 personnel to populate units specializing in infectious disease policy and coordinate with the regional disease response centers.
+ The number of personnel at the institutes of health and environmental research was raised by 110 to carry out infectious disease testing and research.
+ A total of 816 on-site response personnel were added at the 256 health centers to undertake patient screening and transfers nationwide.
+ The number of epidemic intelligence service (EIS) officers rose from 34 in 2015 to 124 in 2018 and 130 in January 2020, of whom 77 worked at the KDCA and 53 worked with local governments.
+ Within the KDCA, more units focusing on infectious disease control and prevention were instituted (table 3). Notably, the capacity for epidemiological investigation and analysis was strengthened through the new director general for public health emergency preparedness and the Division of Emerging Infectious Diseases. The Division of Infectious Disease Control was created to supervise policies and regulations on infectious diseases and strengthen the management of the key infectious diseases.

Table 3. New Units for Infectious Disease Control and Prevention within the KDCA, 2020

<table>
<thead>
<tr>
<th>ENTITY</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director general for public health emergency preparedness, Division of Emerging Infectious Diseases</td>
<td>Information collection, education on epidemiological investigation, data analysis, enhancing the diagnosis and analysis of emerging pathogens</td>
</tr>
<tr>
<td>Division of Health Care Response Facility Management</td>
<td>Strengthening the health care response system, including inpatient treatment beds</td>
</tr>
<tr>
<td>Division of HIV/AIDS Prevention and Control, Division of Infectious Disease Control</td>
<td>Supervise policies and regulations on infectious diseases. Strengthening the management of key infectious diseases</td>
</tr>
<tr>
<td>National Institute of Infectious Diseases</td>
<td>Strengthening the development and clinical research on virus vaccines</td>
</tr>
</tbody>
</table>

Source: Jung 2020b.

Monitoring the Safety in the Use of Medicines, Vaccines, and other Therapies

Medicines, vaccines, and other therapies are critical countermeasures both during normal times and in a public health crisis.
Although indispensable for improving health outcomes, medicines, vaccines, and their administration and use may produce adverse reactions.

The Korea Institute of Drug Safety and Risk Management (KIDS), established in 2012 per Article 68-3 of the Pharmaceutical Affairs Act, serves as a dedicated agency under the Ministry of Food and Drugs Safety (MFDS) to monitor the safety of drugs postmarketing, which is when they are licensed for general use through prescription or retail purchase.

KIDS coordinates a nationwide network of regional centers (26 are local teaching hospitals, one nationwide center linked with pharmacies across the country, and one center herbal medicines) to monitor, document, and analyze adverse drug reactions—harm that results during medical care directly caused by a drug or a vaccine (e.g., due to adverse drug reactions, allergic reactions, overdose, or products that are defective or deteriorated because of poor manufacturing practices, inadequate storage and distribution processes, inadequate control over the distribution channels including the introduction of counterfeit or falsified products, or medicines that have lost their potency during storage at high temperatures, into the supply chain), and from their use (e.g., medication errors, dose reductions and discontinuations of drug therapy).

The collected data and information represent a critical resource to improve medication safety in Korea. If adverse drug reactions are detected after the approval of new drugs or among older medications, the MFDS takes action on the basis of guidance by KIDS to inform the public, change a drug’s label, or even remove a product from the market. KIDS also contributes internationally by sending regular reports to the Uppsala Monitoring Center that supports the WHO Program for International Drug Monitoring. The work performed by KIDS in the Korean health system is of critical importance as adverse drug reactions can extend hospitalization, lead to physical or mental health damage, and cause death, as well as increase healthcare costs (Wang, Marquez, Figueras, Bieliaieva 2023).

The legal framework for the definition of responsibilities

Following a series of natural and social disasters in Korea in the early 2000s, the government, in 2004, drafted the Framework Act on the Management of Disasters and Safety to shape government efforts in emergency preparedness and whole-of-government coordination. The law was the first to adopt an all-hazard approach to a comprehensive national disaster management system for emergency management in Korea, including infectious diseases. Before the law was drafted, more than 70 disaster-related laws had been enacted under the jurisdiction of 13 agencies, creating large governance and coordination challenges (Bae, Joo, and Won 2016; OECD 2020).

The Framework Act outlines the responsibilities of local and national governments in the disaster management process, from prevention to preparedness, response, and recovery. It provides that each level of government establish a safety management committee for policy planning and implementation and

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6 The shocks were Typhoon Rusa in 2002, the Daegu subway fire in 2003, and the SARS epidemic in 2003.
a disaster and safety countermeasures headquarters to manage operational responses. It also requires local governments to develop safety management plans aligned with the national master plan for safety management published every five years. The law states that emergency responses are primarily the responsibility of local governments, but includes a series of provisions on direct intervention by the national government in case of a large-scale disaster. The law also includes several emergency preparedness measures, such as the creation of alert systems, the gathering and implementation of disaster-related resources, response manuals, emergency drills, and disaster financing and compensation information (OECD 2020).

For outbreaks of infectious disease, the Framework Act is complemented by the Infectious Disease Control and Prevention Act, which was introduced in 2010. This law provides that the MOHW prepare a framework plan for infectious disease control and prevention every five years. It also specifies the responsibilities of local and national governments and health institutions in a national infectious disease surveillance system, vaccination programs, various infection control countermeasures, a policy on stockpiling medical countermeasures, and regulations on financing and compensation.

The national infectious disease risk alert system: triggering countermeasures

The four-level national risk alert system was introduced in Korea in 2004 through the Framework Act. In accordance with the new law, each government agency responsible for a particular type of disaster drafts and supervises the implementation of the relevant standard manual on disaster and risk management. Thus, the MOHW (2019) has prepared a disaster management working-level manual on infectious diseases that outlines the countermeasures to be taken at each level of the national infectious disease risk alert system.

Under the crisis management response system, outbreaks of emerging infectious diseases are managed through a crisis alert system with four levels depending on the scale and rate of transmission. The system provides individual guidance about the actions to be taken by local and central governments (figure 4). The main response principles involve monitoring international situations and outbreak preparedness (at level 1), a strong initial response and enhanced surveillance (at level 2), and the establishment of a pangovernment cooperation system (at levels 3–4), where local and central disaster and safety countermeasures headquarters are convened by local and central governments to coordinate the response to disasters. Annex A shows countermeasures taken by each key player at the level of serious alert, within which the MOHW runs the Central Disaster Management Headquarters, and the KDCA operates the Central Disease Control Headquarters.
### Figure 4. National Infectious Disease Risk Alert Levels, Republic of Korea

<table>
<thead>
<tr>
<th>Stage</th>
<th>Situation</th>
<th>Response system</th>
<th>Local government</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level 1</td>
<td>Outbreak and epidemic of new infectious diseases abroad</td>
<td>KDCA Countermeasures Group</td>
<td>Quarantine Countermeasure Group</td>
</tr>
<tr>
<td>Level 2</td>
<td>Domestic influx of new infectious diseases abroad</td>
<td>KDCA Central Disease Control Headquarters</td>
<td>Quarantine Countermeasure Group</td>
</tr>
<tr>
<td>Level 3</td>
<td>Limited spread of new infectious diseases in Korea</td>
<td>KDCA Central Disease Control Headquarters, MOHW Central Disaster Management Headquarters, MOSPA Pan-governmental Response Center</td>
<td>Quarantine Countermeasure Group</td>
</tr>
<tr>
<td>Level 4</td>
<td>Local community dissemination or nationwide spread of new infectious diseases in Korea</td>
<td>KDCA Central Disease Control Headquarters, MOHW Central Disaster Management Headquarters, MOSPA Pan-governmental Response Center</td>
<td>Quarantine Countermeasure Group</td>
</tr>
</tbody>
</table>

Source: Based on ADB 2021a.

Note: KDCA = Korea Disease Control and Prevention Agency. MOHW = Ministry of Health and Welfare. MOSPA = Ministry of Security and Public Administration.

### Effective public-private partnership during COVID-19 response

The response to COVID-19 in Korea is a public-private partnership. The government has taken the lead on planning and policy development. The private sector has contributed in almost all areas of response, including diagnosis and the treatment of patients, epidemiological investigation of confirmed or suspected cases, social distancing measures, and vaccination (table 4). Examples of the private initiatives are offered by the pharmaceutical companies that have developed and produced diagnostic tests, the physicians and hospitals that have undertaken patient diagnosis and treatment, private laboratories that have implemented rapid-testing and screening strategies, telecommunication companies that have launched risk communication, and credit companies that have supported epidemiological investigations.
Table 4. Public-Private Partnerships: Examples during the COVID-19 Response

<table>
<thead>
<tr>
<th>INTERVENTIONS</th>
<th>EXAMPLES OF PRIVATE SECTOR CONTRIBUTIONS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surveillance</td>
<td>Case reporting by private hospitals and clinics</td>
</tr>
<tr>
<td>Epidemiology investigation, contact tracing</td>
<td>Telecommunication companies providing data to integrated data platform on whereabouts of people (The Global Epidemic Prevention Platform)</td>
</tr>
<tr>
<td></td>
<td>Individual EIS contracted by the KCDC/KDCA for epidemiology investigation</td>
</tr>
<tr>
<td></td>
<td>Private universities and hospitals commissioned by local center of disease</td>
</tr>
<tr>
<td>Testing</td>
<td>Manufacturers involved in testing kit research and development (R&amp;D)</td>
</tr>
<tr>
<td></td>
<td>Private hospitals involved in testing and screening</td>
</tr>
<tr>
<td>Patient management</td>
<td>Majority of patients treated and managed by public hospitals and private hospitals were also involved in treatment</td>
</tr>
<tr>
<td>Preventing nosocomial infections</td>
<td>Telecommunication companies providing data to integrated data platforms on travel history to epidemic zones</td>
</tr>
<tr>
<td>Risk communication</td>
<td>Telecommunications sending SMS on pandemic updates</td>
</tr>
<tr>
<td></td>
<td>Research institutes universities companies involved in development of mobile apps used for risk communication, case reporting, health education</td>
</tr>
<tr>
<td>Health services research and policy analysis</td>
<td>Research institutes and universities involved in policy analysis and research publication</td>
</tr>
</tbody>
</table>

3.2 An effective financing system for infectious disease prevention and control

Complementary sources of financing

The network of organizations contributing to infectious disease prevention and control is supported through multiple financing sources that are complementary to each other: (a) central government budget of the MOHW, the KDCA, and other relevant ministries; (b) local government budgets for local public health organizations; and (c) national health insurance, which reimburses for the services provided by hospitals, clinics, and laboratories (figure 5).

National health insurance: Universal health insurance coverage is a foundational feature of the Korean health financing system. The coverage of national health insurance (NHI) was 97.2 percent in 2018. The other 2.8 percent of the population was covered by the Medical Aid Program. All health providers are mandated to participate in the NHI and are subject to the same benefits package and reimbursement prices set by the NHI Law. The NHI is a single-payer system providing a comprehensive benefits package, including medical, dental, traditional medical care, medicine, and laboratory testing. It is managed by two key agencies, the National Health Insurance Service for the collection of contributions and reimbursement and the HIRA for claim review and quality assessment. The funds for public health services are mainly allocated through the government budget (Kwon et al. 2020).
The central government budget: Central government budget allocations to the MOHW are another main financing mechanism of health expenditure. Annual ministry budgets are determined using a top-down approach (see annex C, table C.1). In this budgeting method, total spending is set first, followed by the expenditure ceiling of each sector and agency for the strategic allocation of fiscal resources, and then fiscal resources are allocated by each government agency to each project below the ceiling (MOSF 2014).

Local government budget: Local government budgets are another source of health expenditure (e.g., for public health centers in each locality), although not much data are available. The budgeting process of local governments is similar to the process of the central government (the top-down approach). The key difference is that, in municipal and provincial budgeting, the Ministry of the Interior and Safety is responsible for formulating the budgeting guidelines, and the municipal and provincial assemblies are responsible for reviewing and voting on the results (MOPAS 1958, 2021).

Complementarity across the three sources: The NHI and local and central government budgets are the main financing sources for infectious diseases prevention and control. As part of a comprehensive benefits package, the diagnosis, treatment, and individual-level prevention of infectious diseases are covered by the NHI, while population-level prevention activities and outbreak response activities, such as surveillance, epidemiology investigation, and quarantines, are covered by the government through its allocations to the ministries and agencies involved.
in these activities. The KCDC, for example, as the leading operational authority, received its budget through the MOHW. With the establishment of the KDCA and its elevated authority, the KDCA followed the budgeting process independently. The budgets for infectious disease control and prevention among local institutions are formulated as part of the relevant local government budgets.

**The Disaster Management Fund**

The current pan government disaster management system was established following major reforms of the Framework Act in 2013–14. The reforms strengthened horizontal coordination in emergency preparedness and response across the government by regrouping the former National Emergency Management Agency, the Korean Coast Guard, and the National Fire Agency under the management of the Central Disaster and Safety Countermeasures Headquarters, which is headed by the prime minister and acts as the central agency in the case of national disasters.

In addition, a central disaster management headquarters can be convened by the relevant government ministry to manage a disaster that is under the purview of the ministry, such as the MOHW in the case of COVID-19. Likewise, local disaster and safety countermeasures offices can be convened by local governments to oversee and coordinate local efforts (MOIS 2021).

During large-scale disasters, coordination among government agencies is facilitated through the Central Safety Management Committee, which is chaired by the prime minister and involves the participation of the Government Office for Policy Coordination and the National Security Council. Dedicated entities for specific types of disaster events also exist within the Ministry of the Interior and Safety to accommodate coordination. For instance, the Infectious Disease

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**BOX 2**

**THE TOBACCO TAX AND INFECTIOUS DISEASE PREVENTION AND CONTROL IN KOREA**

The tobacco tax was introduced in 1989 with the main objective of enhancing public health by curtailing tobacco consumption (Kim and Jung 2020). In 1995, the National Health Promotion Act was passed, and the National Health Promotion Fund was launched in 1997, nourished by a share of the tobacco tax. This is especially relevant in the case of the KDCA given that roughly 13 percent of the National Health Promotion Fund is channeled to the KDCA each year to sustain financing for infectious disease control and prevention (see annex C, table C.2). Through several tax reforms, the tobacco tax has been raised incrementally since its implementation. The most recent reform, in 2015 (Choi and Marquez. 2018), doubled the tobacco tax per pack, significantly increasing the amount of the National Health Promotion Fund derived from the tax. Roughly 70 percent–80 percent of the fund has been consistently financed by the tobacco tax, and the amount of the transfer to the KDCA ranged between US$276 million and US$513 million between 2014 (before MERS) and 2019 (post-MERS).
Chapter 3. Korea’s Strategic Investments to Build a Resilient Health System

Disaster Response Division of the ministry coordinates closely with the MOHW (OECD 2020).

At the local level, 226 municipalities and the 17 first-tier administrative cities and provinces are responsible for emergency preparedness. The passage of the Framework Act on the Management of Disasters and Safety in 2004 increased these responsibilities, especially for the first responders among entities. In accordance with the law, local governments have established disaster management divisions and developed safety management plans in line with national guidelines and manuals. In addition, local governments are required to prepare specific plans on infectious disease prevention and control. Through these steps, the roles and responsibilities of local government are defined within the infectious disease surveillance system and with respect to preventive measures and various countermeasures in case of an outbreak of infectious disease. The central government and local governments implement infectious disease control and prevention policies, together with the network of public health centers and medical institutions across Korea (OECD 2020).

In accordance with the Framework Act on the Management of Disasters and Safety, article 67, all levels of municipal and provincial governments must allocate 1 percent of general tax revenue to the Disaster Management Fund every year. Each municipal and provincial government has the authority to manage the local fund and apply the fund for expenditures during emergency and disaster situations. Before the COVID-19 pandemic, the Disaster Management Fund was mainly allocated to short-term recovery efforts following natural disasters, such as typhoons and landslides.

During the COVID-19 pandemic in Korea, the Disaster Management Fund was used for, but not limited to the procurement of medical supplies for local government personnel and the public, income subsidies, and other necessary special expenditures (see annex C, table C.3). Because COVID-19 is an ongoing event, little is known on the use of the Disaster Management Fund by municipal and provincial governments. However, as COVID-19 spread nationwide, the Framework Act Enforcement decree was amended in April 2020, creating special article 75-2 to allow for and increase the autonomy of municipal and provincial government spending on financial assistance to small business owners and the vulnerable population and to other COVID-19 response efforts. The fund execution rate—the share of expenditures compared with the total accumulated fund—rose significantly after the amendment. One study suggests that the average execution rate of relevant municipal and provincial government spending increased from 3.5 percent before the amendment to 70 percent by the end of 2020 (Lee et al. 2021).

3.3. An integrated information system for data-driven public health actions

In accordance with the Infectious Disease Control and Prevention Act, notifiable infectious diseases must be reported through the national infectious disease surveillance system by public and private health care facilities (Kwon et al. 2020).
Monitoring and control of infectious diseases

An integrated information and communication technology (ICT)–based system for surveillance and other public health actions, which is part of the country’s integrated disaster and safety information system, links human and animal health data systems managed by separate ministries, including the electronic medical records system in health facilities (figure 6). It provides real-time information for cross-agency coordination, risk communication, education campaigns, contact tracing, and the prevention of facility-acquired infections.

Figure 6. The Integrated Information Support System for Infectious Disease Management

The key features of the integrated information system are as follows:

As part of the integrated disaster and safety information system: To manage various types of disasters and for real-time data sharing among relevant agencies, a whole-of-government information system has been created to monitor hazards, detect threats, and define emergency levels, as prescribed in the Framework Act on the Management of Disasters and Safety. The integrated disasters and safety information system is linked to the disaster situation information system and managed by the National Disaster and Safety Control Center of the Ministry of the Interior and Safety. The system gathers information from 15 ministries and...
In Korea, agencies—ranging from the Korea Meteorological Agency (for natural hazards) to the KDCA (for infectious diseases)—have invested in robust monitoring and surveillance networks on the risks that are their focus (OECD 2020).

**Incorporating data across different pandemic response actions:** In 2013, the KDCA developed the informatization plan for the prevention and management of infectious disease, and the integrated information support system for monitoring and control of infectious diseases was developed in 2015. The system integrates information from various public health activities in response to infectious disease outbreaks—including surveillance (diagnosis and reporting of cases), pathogen diagnosis (such as the management of specimens, testing requests, and testing results), epidemiology investigations, vaccinations, patient and contact management, and quarantine management—that are related to the response for nationally notifiable and emerging infectious diseases. It allows users to check the status of infectious disease cases at a glance by linking data with other ministries and agencies through the integrated information support system for infectious disease management (NIA 2020).

**Accessible by stakeholders involved in pandemic response:** Besides the KDCA and health care institutions, information in the system can be accessed by various stakeholders for infectious disease outbreak response at both local and central levels and by ministries and agencies, such as the Ministry of Food and Drug Safety (MFDS), the HIRA, and the Animal and Plant Quarantine Agency (APQA) under the Ministry of Agriculture, the Ministry of Education, and the Ministry of Interior and Safety (see figure 7). In sharing data to advance effective pan government actions, the government takes the legal rights of access to information and patient privacy seriously. For example, in the smart management system used in epidemiology investigations and contact tracing, entities other than the KDCA and health departments participating in the shared data platform, such as telecommunication and credit card companies, have access only to the information they provide, not all relevant information gathered on the platform.

**A data system linking human and animal health:** The one health approach reflects a recognition of the interconnections among people, animals, plants, and the shared environment (WHO 2022a). The Korean government has implemented several information-sharing mechanisms among government agencies to incorporate the one health approach in the management of infectious disease outbreaks of human or animal origin. For example, post-MERS, information began to be actively shared among public health and veterinary agencies through a link established between the KCDC Infectious Disease Integrated Management System and the APQA Korea Animal Health Integrated System (WHOa 2017). APQA conducts active surveillance with provincial governments on a number of zoonotic diseases and other livestock infectious diseases.

In 2018, the MOHW launched the Second Infectious Disease Control and Prevention Framework Plan for 2018–22. The plan strengthened coordinated responses based on one health. Subsequently, in 2019, the KCDC (now KDCA) began developing the one health infectious disease risk information system with the aim of establishing an integrated information system that may be accessed now by relevant government agencies, such as the MFDS, and the Ministry of Agriculture, Food, and Rural Affairs, for real-time information sharing on infectious diseases of human and animal origin.
The one health approach adopted in Korea was strengthened in 2020 through the establishment of the National Wildlife Disease Control Center, an affiliate organization of the Ministry of Environment, to oversee the management of wildlife diseases (MOE 2020). These diseases threaten the survival of the wildlife population and the health of the ecosystem, and some diseases are transmitted to humans and livestock through wildlife, causing social and economic damage. For example, avian influenza, African swine fever, and severe febrile thrombocytopenia may be transmitted to wildlife, humans, and livestock. The National Wildlife Disease Control Center complements the work of the KDCA and the APQA by supporting integrated disease management of the human-animal environment for effective disease control in consideration of interspecies transmission.

**Using nonhealth data:** Taking advantage of the country’s advanced ICT and data platforms, nonhealth data have also been connected within the system for effective COVID-19 response. The SMART quarantine information system is an example. It relies on the information system of telecommunication companies (mobile roaming information), the Ministry of Foreign Affairs (passport information), the Ministry of Justice (immigration information) for timely identification of suspected cases originating overseas and the necessary quarantines that would follow (figure 7). The system performs the following functions:

**Figure 7. The SMART Quarantine System**

Source: NIA 2020.
Chapter 3. Korea’s Strategic Investments to Build a Resilient Health System

+ Checking the information on entrants from countries affected by infectious disease
+ Asking entrants to report any potential infection through text messages
+ Sharing information with medical institutions to monitor potential patients during the incubation period following entry into Korea

Using data system for automated epidemiology investigation

The large-scale spread of infectious disease represents challenges to conventional epidemiology investigations that often rely on individual phone interviews with individuals with confirmed cases and transcripts of handwritten notes. If data from authorities (such as the National Agency of Police) and private companies (for instance, telecommunication and credit companies) are pulled to support the investigation process, the investigation teams need to seek separate permissions from each of the entities holding the information. If the teams are dealing with many cases, this inevitably leads to heavy workloads among epidemiological officers and delays in actions such as the quarantine of close contacts.

Two months into the outbreak, the Ministry of Land, Infrastructure, and Transport and the KCDC launched a computer-aided system, the epidemiological investigation support system, to automate the epidemiology investigation process (Smart City Korea 2020). Transporting data from 28 relevant entities onto the same platform streamlines the administrative process required to fill requests for personal data request. The system makes it possible to check the movement routes of confirmed cases and areas of large-scale outbreak in real time. The time required to identify the movement route of a confirmed case thereby decreased from about 24 hours to less than 10 minutes. With the information on the whereabouts of cases and the time spent in each location associated with confirmed cases, the system may also be used to conduct temporal and spatial analysis to enable the rapid identification of cluster infections and close contacts.

Using data for open and transparent risk communication

A lesson learned during the MERS outbreak in Korea was the importance of clear and open public risk communication to managing an infectious diseases. The revisions made to the legal framework governing public health crisis management also allowed the government to proactively approach management of false information during epidemics. During the MERS outbreak, the government failed to disclose accurate information on testing criteria and the medical institutions hosting infected patients. One successful COVID-19 response strategy taken up by the Korean government was open, transparent, and effective risk communication (ADB 2021b).

7 The Ministry of Science and Technology Information and Communication, KCDC, National Police Agency, Credit Financial Association, telecommunication companies, credit card companies.
Starting on January 30, 2020, 10 days after the first case was reported, the government undertook two-a-day updates on television and social media. The contents of the announcements included regional and national statistics on the number of confirmed cases, deaths, diagnostic tests, and releases from quarantine.

In the event of a confirmed case of COVID-19, information about the individual’s route of movement, transportation used, and places visited two days before disease onset is promptly disclosed on the MOHW website and communication networks and through press releases.

The KDCA call center (1339) is available 24 hours a day and 7 days a week.

Mobile text alerts on new COVID-19 information are sent to everyone on regional networks in real time.

The government takes proactive actions against purveyors of false or misleading information. A total of 197 sources of fake news and misinformation had been blocked by October 2021.

Clear and accurate communication with the public on the status of COVID-19 was largely possible because the number of confirmed patients and deaths was reported daily to the KCDC (KDCA after 2020) by a network of approximately 19,000 medical institutions through the integrated information support system. If a patient is diagnosed with a notifiable infectious disease, a physician can enter the diagnosis result into the electronic medical record system at the facility, and the system automatically generates an infectious disease occurrence report, which can then be sent to the national infectious disease surveillance system of the KDCA (Kwon et al. 2020).

Using data to manage critical supplies

Since March 19, 2020, the National Health Insurance Service has maintained a medical supplies platform to resolve supply-demand imbalances in medical devices and other supplies. The platform service can be used by medical institutions and product manufacturers and sellers, and information can be shared in real time by accessing and entering the type and quantity of medical supplies required or available for supply. Information about personal protective equipment (PPE, including protective clothing), and medical devices (mobile X-ray, X-ray computed tomography, thermometers, ultrasound devices, electronic stethoscopes, manual patient carriers), pharmaceuticals (antiviral, antimalarial), and mobile negative pressure devices is provided.

Using the data system to protect health care workers and prevent nosocomial infections

Learning the lessons of the MERS outbreak, during which almost all confirmed cases arose because of transmissions in health care settings, the KCDC developed the international traveler information system, in cooperation with the HIRA, to protect

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health care workers and prevent nosocomial infections. Built into the drug utilization review system, the traveler information system enables medical institutions to access information on visitor travel history to areas with infectious disease, their visits to other medical institutions in the past 14 days, their quarantine history upon entering the country, and their close contacts with confirmed cases in the past three weeks (Jung 2020a; KCDC 2018; Kim, Eun-young 2020; Kim, Mijung 2020). Such information facilitates safety measures, such as the use of PPE, targeted testing, and facility infection prevention and control.

**Adverse Drug Reactions Reporting System**

To facilitate reporting and management of adverse drug reactions by different sources, KIDS established a computerized system, the Korea Adverse Event Reporting System (KAERS). Anyone who experiences adverse drug reactions can report to KIDS using KAERS.

Its database contains more than 1 million adverse drug reaction reports, from healthcare professionals, consumers, regional pharmacovigilance centers, and pharmaceutical companies, as well as reports based on post-marketing surveillance, observational studies of the safety of drug products, and other drug adverse reaction surveillance programs (Wang, Marquez, Figueras, Bieliaieva 2023).

As adverse drug reactions are an important but preventable patient safety problem, the collected data and information represent a critical resource to improve medication safety in Korea.

**Opening data platforms for research, policy analysis, and risk communication**

The Korean government has established a network of relevant stakeholders to fight COVID-19. While protecting personal information, it shares various medical and epidemiological data with researchers for immediate research and development (R&D) purposes. For example, the KDCA now shares data on confirmed cases with the network for predictive research. By partnering with the largest mobile carrier in Korea, the government also provides researchers with data on the levels of foot traffic and international roaming at no cost to the researchers. Such support is useful for forecasting the macroscopic spread of COVID-19 and evaluating the effectiveness of policy responses.

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*Also see DUR (Drug Utilization Review) (web page), Health Insurance Review and Assessment Service, Wonju, Republic of Korea, [https://www.hira.or.kr/eng/about/05/01/04/index.html](https://www.hira.or.kr/eng/about/05/01/04/index.html).*
Learning from the Republic of Korea: Building Health System Resilience

Chapter 4

Learning from the MERS Experience
4.1. System weaknesses exposed by the MERS response

The MERS outbreak lasted for almost two months between May and July 2015. There were 186 confirmed cases and 38 deaths (20.4 percent). In addition, 16,993 individuals were under mandatory self-isolation (ADB 2021b; MOHW 2016; Oh et al. 2018). MERS mainly spread through hospital infections. Two major waves of MERS occurred in two hospitals, driven by superspreaders (Oh et al. 2018). The economic loss associated with the MERS outbreak in Korea has been estimated at ₩9.3 trillion (US$8.5 billion) (Oh et al. 2018). This roughly corresponds to 0.6 percent of the gross domestic product (GDP) of Korea in 2015.10

A key limitation of the KCDC’s initial epidemiological investigation during MERS was its narrow definition of close contacts, which it attributed to the superspreading event. One patient who had been at the same hospital at the same time as the index case, but was not classified as a close contact, later checked in at Samsung Hospital’s emergency room and ended up infecting 82 other individuals. The outbreak quickly escalated to more confirmed cases at various hospitals. Despite the rising number of confirmed cases, the government initially did not disclose the results of the epidemiological investigation to the public, increasing the public’s fear (ADB 2021b; MOHW 2016).

Analysis following the MERS outbreak revealed that the government response to MERS was inadequate in three respects: the absence of preemptive measures to prepare for the domestic occurrence of MERS, the absence of an early phase response, and the absence of information systems and, indeed, the suppression of information (ADB 2021b). In terms of preemptive measures, although the government was aware of MERS outbreaks in the Middle East, no steps had been taken to address a possible domestic outbreak of MERS, especially nosocomial infections, although the possibility of such an event was discussed (MOHW 2016). For the early phase response, an inadequate quarantine system and deficient early epidemiological investigations have been criticized for an inability to detect a potential patient entering the country and ignoring individuals who were in close contact with a MERS patient by narrowly defining the range of the investigation (see annex A).

In terms of the information system and information disclosure (risk communication), the lack of interagency information sharing through a designated information system and the lack of transparent public communication were notable. In addition, key resources for a MERS response, such as sufficient, designated epidemic intelligence service (EIS) officers, had not been prepared. The lack of capacity in epidemiological investigation was identified as a major weakness of MERS surveillance in Korea. At the time of the MERS outbreak, there were only 34 EIS officers in the KCDC, which was roughly one-seventh of the recommended number. Following the World Health Organization’s recommendation (one EIS officer per 200,000 population), there should have been at least 250 EIS officers in Korea in 2015. Eventually, the government eliminated the shortage by appointing civilian and contract officers during the remainder of the outbreak (ADB 2021b).

4.2. Initiating 48 reforms for better preparedness and response

Following the MERS outbreak, the MOHW conducted a detailed assessment of infectious disease control and prevention capacities in Korea with the aim of responding to the weaknesses and enhancing the capabilities in infectious disease control and prevention across the health care system. As a result, the MOHW announced, in September 2015, a total of 48 measures to reform the national infectious disease control and prevention system in Korea (table 5).

Table 5. Planned Post-MERS Reforms in Infectious Disease Control and Prevention

<table>
<thead>
<tr>
<th>AREAS OF REFORM</th>
<th>TASKS</th>
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</table>
| Initial response to stop an outbreak of infectious disease | + A 24-hour emergency operations center will be established.  
+ In case a suspected case occurs, an immediate response team, led by the Division of Infectious Disease Control of the KCDC (KDCA after 2020), will be formed and dispatched.  
+ The Department of Risk Communication will be established within the KCDC (KDCA after 2020).  
+ The number of epidemiologists will be increased and a two-year epidemiology training program, the Korean equivalent of the EIS programs of the US Centers for Disease Control and Prevention will be introduced.  
+ Strengthened border quarantine measures will be implemented for all travelers returning from countries with a high risk of infection. |
| A specialized diagnosis and treatment system, including quarantine facilities | + Designation of beds and isolation facilities for specialized treatment of infectious disease patients.  
+ Increasing the number of negative pressure isolation rooms in local medical centers and establishing standards on negative pressure isolation rooms for hospitals with 300+ beds.  
+ Designation of temporary isolation facilities across the country.  
+ Increasing the number of laboratories to carry out diagnostic testing for infectious diseases at the Korea National Institute of Health. Designating certain diagnostic methods to private laboratories and regional institutes of health and environmental research. Ensuring prompt use of diagnostic reagents for testing or therapeutic agents that have not been approved by the MFDS, upon the urgent request of the MOHW.  
+ Interagency R&D projects on vaccines and remedies for emerging infectious disease and for diagnostic devices. Creation of a database for clinical and diagnosis data on MERS-CoV for information technology–based analysis and R&D in medical devices and medicines. |
| Prevention of nosocomial infection | + Reform of the current emergency room system to create a process to separate patients with potential infection quickly, add negative pressure isolation rooms, and so on.  
+ Increasing the availability of negative pressure isolation rooms designated for infected patients and the number of general isolation rooms. Change in main caregivers of infected patients from family members to nurses.  
+ A system for nosocomial infection control is strengthened. More hospitals are required to build infection control rooms and raise the number of infection specialists, assessments, and incentives on nosocomial infection infrastructure and management activities, increasing the availability of personal protective equipment (PPE). |
Chapter 4. Learning from the MERS Experience

4.3. Optimizing governance mechanisms for effective pandemic response

Revisions of the legal framework

Korea’s Framework Act on the Management of Disasters and Safety and the Infectious Disease Control and Prevention Act outline institutional responsibilities to deal with public health crises. Following the MERS epidemic in 2015, the
latter law was revised several times to enable more rapid and effective public health response.

**Central government authority and responsibility:** The revised law elevated the authority and autonomy of the KCDC (KDCA after 2020) and provided additional resources to the organization. For example, the KDCA is now able to make decisions on the hiring of personnel, including epidemiologists and EIS officers, who are considered vital to raising capacity in infectious disease surveillance (Kwon et al. 2020). In addition, the widening in the authority of the KCDC (KDCA after 2020) allowed the organization to manage an infectious disease epidemic in all phases, including the designation of areas adjacent to contaminated areas that may be at risk during an infectious disease outbreak and to strengthen quarantining among travelers from these areas (Kwon et al. 2020). The government was also required to support financially the establishment and operation of hospital facilities assigned to manage infectious disease.

**Epidemiology investigation and contact tracing:** Three rounds of revisions of the law between 2015 and 2018 permitted the MOHW to request and collect information on the locations of patients and potential patients. This allowed the MOHW to receive information from the Korean National Police Agency and from telecommunication companies as long as the information collected was destroyed once it was no longer needed for the purpose of controlling and preventing the spread of infection. These revisions of the law enabled extensive contact tracing during the COVID-19 pandemic (Kwon et al. 2020). The revisions also required the government to disclose information about the movements of confirmed patients to ensure the public’s right to information. This allowed the MOHW to override certain privacy law provisions at the onset of a serious infectious disease outbreak. In addition, the revision also required that the minimum number of epidemiological investigators in the KCDC (KDCA after 2020), be more than tripled, from 30 to 100.

**Mandatory isolation:** The revisions of the law included provisions laying out instructions for compensations for individuals and health care providers who were under mandatory isolation. Under the revised law, employers or governments must compensate employees or the self-employed who are in treatment or under a mandatory self-isolation restriction, and the government must compensate hospitals that incur losses because of the treatments they provide to patients with infectious disease or with suspicious symptoms. The law was revised again in March 2020 to include policy measures to address the COVID-19 pandemic. The revision introduced a fine for individuals who are suspected of having become infected, but refuse testing or who do not follow quarantine orders.

**Use of protective gear:** The law required the government to provide masks at an affordable price to vulnerable populations in case of a health emergency and to place a temporary restriction on exports of important medicines and medical supplies to ensure adequate stockpiles and prevent shortages.
Strengthening coordination between local and central governments

Following the MERS outbreak in 2015, coordination between local and central governments was enhanced. The capability and responsibility of local governments in infectious disease control and prevention were significantly expanded. The responsibilities of local governments and central agencies were also clarified to ensure coordinated and complete responses at the various levels of government during an infectious disease epidemic. For instance, only the KCDC had the capability and authority over testing and diagnosis to confirm MERS cases in 2015, but local governments and institutions played important roles during the COVID-19 pandemic in Korea. The KDCA, in collaboration with local governments, is currently responsible for epidemiological investigation during any infectious disease epidemic that might occur. Local governments are now responsible for implementing contact tracing and risk communication; public health education, such as personal hygiene and social distancing; surveillance; coordination in testing at public health centers and other local testing facilities; patient and close contact management; on-site measures, such as disinfection; and the management of self-isolation facilities and isolation among individuals. During a serious outbreak of an infectious disease, the KDCA is now responsible for the distribution of PPE, such as level D protective suits, N95 masks, goggles, and face shields, to public health centers, which then distribute the PPE to private providers. Most local governments now follow instructions issued by the MOHW and the KDCA before implementing emergency measures (ADB 2021b; Kwon et al. 2020).

To deal with an epidemic, relevant local and central government agencies are organized in accordance with the national disaster management system prescribed in the 2004 Framework Act on the Management of Disasters and Safety. The key post-MERS change was the establishment of the Central Disaster and Safety Countermeasures Headquarters (table 6). Led by the prime minister in the case of a disaster requiring a government-wide response, such as COVID-19, the headquarters is responsible for overseeing and coordinating government responses and recovery efforts during large-scale disasters (see annex B). The Central Disaster Management Headquarters was established within the MOHW for disasters involving infectious diseases and health. The Central Disease Control Headquarters was established within the KCDC (KDCA after 2020) as the lead agency during infectious disease epidemics. The local disaster and safety countermeasures offices are assembled by local governments to oversee and coordinate local efforts (MOIS 2021).
Table 6. Revised Response System, by Alert Level, before and after MERS

<table>
<thead>
<tr>
<th>ALERT LEVEL</th>
<th>BEFORE MERS</th>
<th>AFTER MERS</th>
<th>KEY CHANGES</th>
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</thead>
<tbody>
<tr>
<td>Attention:</td>
<td>Situation monitoring; border quarantine measures; KCDC: prevention education and awareness campaign</td>
<td>Situation monitoring; border quarantine measures; KCDC (KDCA after 2020): prevention education and awareness campaign</td>
<td>—</td>
</tr>
<tr>
<td>Caution:</td>
<td>KCDC: Central Disease Control Headquarters</td>
<td>KCDC (KDCA after 2020): Central Disease Control Headquarters; government-wide meeting chaired by the prime minister; MOHW: management headquarters; Ministry of Public Safety and Security: support center</td>
<td>With the KCDC (KDCA after 2020) leading the infectious disease control efforts, a government-wide meeting is organized, and supporting organizations are established within the MOHW and the Ministry of Public Safety and Security</td>
</tr>
<tr>
<td>Alert:</td>
<td>Prime minister or Ministry of Public Safety and Security: Central Disaster and Safety Countermeasures Headquarters; MOHW: Central Accident Response Headquarters</td>
<td>KCDC (KDCA after 2020): Central Disease Control Headquarters; chaired by the prime minister; supported by the Ministry of Public Safety and Security: Central Disaster and Safety Countermeasures Headquarters; MOHW: Central Accident Response Headquarters</td>
<td>The response task force within the KCDC (KDCA after 2020) continues to function as the main authority for infectious disease outbreak events</td>
</tr>
</tbody>
</table>

Source: MOHW 2015.

### Ensuring consistent KDCA leadership across all levels of risk alert

The four-level infectious disease risk alert system has been maintained in Korea since the MERS epidemic in 2015. However, there have been changes in the authorities responsible at each of the four levels. In accordance with the post-MERS infectious disease control system reform, the director of the KCDC (KDCA after 2020) now oversees the response to infectious disease at all levels of the risk alert system. In addition, the prime minister chairs a pan-government meeting (Central Disease Control Headquarters) supported by the minister of health and welfare, and the minister of public safety and security to deliver final decision on the measures adopted by the KCDC (KDCA after 2020) at level 2 and above (ADB 2021b) (see table 6).

### 4.4. Raising resource allocations for infectious disease prevention and control

Table 7 presents the changes in the annual proposed budget for the MOHW in 2014–21. The proposed budget covers the ministry’s general account—the budget
formulated for government agencies through the budgeting process—and the
transfers from the revenue of the national funds that are managed by the MOHW:
the National Pension Fund, the National Health Promotion Fund (nourished by
the tobacco tax), and the Emergency Medical Fund (collected from government
contributions and the penalty surcharge imposed on medical facilities). The total
budget of the MOHW increased from roughly US$43 billion in 2014 (US$840 per
capita) to US$81 billion in 2021 (US$1,577 per capita). Around 80 percent and
20 percent of the MOHW budget are attributed to the welfare and health care
categories, respectively. The budget of the KCDC was included in the MOHW
budget through 2020 before the KDCA became a separate agency, following
the transformation of the KCDC. Between 2014 and 2018, the KCDC budget
represented roughly 1 percent of the overall MOHW budget. However, in the
MOHW health care budget, the share of the KCDC rose substantially, from about
25 percent before the MERS outbreak in 2015 to around 30 percent post-MERS,
between 2016 and 2020, reflecting the rise in government financing for infectious
disease control and prevention.

**Table 7. Annual MOHW Budgets and the Share of the KCDC in MOHW
Budgets, 2014–21 (US$, 1,000s)**

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</thead>
<tbody>
<tr>
<td>Total MOHW</td>
<td>42,635,909</td>
<td>48,611,364</td>
<td>50,766,909</td>
<td>52,420,727</td>
<td>57,414,000</td>
<td>65,922,545</td>
<td>75,024,455</td>
</tr>
<tr>
<td>budget: general</td>
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<tr>
<td>account, plus</td>
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<tr>
<td>funds</td>
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</tr>
<tr>
<td>Welfare budget</td>
<td>34,549,727</td>
<td>39,499,182</td>
<td>41,572,909</td>
<td>43,405,818</td>
<td>47,977,000</td>
<td>55,368,273</td>
<td>63,238,091</td>
</tr>
<tr>
<td>Health budget</td>
<td>8,086,182</td>
<td>9,112,182</td>
<td>9,194,000</td>
<td>9,014,909</td>
<td>9,437,000</td>
<td>9,437,091</td>
<td>11,786,364</td>
</tr>
<tr>
<td>Support for the</td>
<td>6,333,182</td>
<td>7,040,091</td>
<td>7,078,182</td>
<td>6,891,909</td>
<td>7,221,273</td>
<td>8,198,818</td>
<td>9,268,727</td>
</tr>
<tr>
<td>NHIs</td>
<td></td>
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<tr>
<td>Health care</td>
<td>1,753,000</td>
<td>2,072,091</td>
<td>2,115,818</td>
<td>2,123,000</td>
<td>2,215,727</td>
<td>2,355,455</td>
<td>2,517,636</td>
</tr>
<tr>
<td>KCDC budget,</td>
<td>431,182 (24.6)</td>
<td>514,909 (24.8)</td>
<td>629,455 (29.7)</td>
<td>622,182 (29.3)</td>
<td>666,727 (30.1)</td>
<td>706,636 (30.0)</td>
<td>742,818 (29.5)</td>
</tr>
<tr>
<td>% of health care</td>
<td></td>
<td></td>
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</tbody>
</table>

2014–21 data of the Ministry of Health and Welfare and the National Assembly Budget Office.
a. Includes the government subsidy for National Health Insurance. However, insurance contribu-
tion accounts for majority of NHI fund.
b. The budgets of the KCDC are not distinguished within the MOHW budgets and the fund man-
agement plan overviews. The data have therefore been derived through an examination of various
itemized budget information of the MOHW and the KCDC and in budget analyses prepared by the
National Assembly Budget Office. The KDCA replaced the KCDC in 2020. The 2021 KDCA budget
was approximately US$901,545,000 (KDCA 2020b). This corresponds to 32.7 percent of the 2021
MOHW health care budget. From 2022, the KDCA formulates its own budget separately from the
budget of the MOHW.
Table 8 illustrates the changes in the annual proposed budgets for the KCDC, between 2014 and 2020, and for the KDCA in 2021, showing a continued increase. The budgets are composed of a general account and allocations from the Emergency Medical Fund, the National Health Promotion Fund, and, up to 2014, the National Asset Management Fund.

**Table 8. KCDC/KDCA Budgets, 2014–21 (US$, 1,000s)**

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</thead>
<tbody>
<tr>
<td>Total</td>
<td>431,158</td>
<td>514,902</td>
<td>629,441</td>
<td>622,184</td>
<td>666,754</td>
<td>706,627</td>
<td>742,838</td>
<td>900,687</td>
</tr>
</tbody>
</table>


Note: For 2021, the total proposed KDCA budget is shown. Because of the newly established status of the KDCA as an independent agency, the budget items included differ substantially from items in the budget of previous years, making direct comparison inappropriate. Thus, only the total KDCA 2021 proposed budget, the general accounts, and the budgets for the funds are included. US$1.00 = ₩1,000.

The total proposed budget of the KCDC increased from US$431 million in 2014 to US$743 million in 2020 (see table 8). The biggest jump occurred between 2015 (before the MERS outbreak) and 2016 (after the outbreak). This was a surge of 22 percent. The total proposed budget of the KDCA in 2021 was more than US$900 million, which was 21 percent greater than the final budget of the KCDC, in 2020.

Some of the largest budget items included in the general account are expenditures on personnel, infectious disease control, disease control R&D, expanding health care research infrastructure, and the management of infectious disease laboratories (table 9). Over 50 percent of the budget of the National Health Promotion Fund transferred to KDCA is used on immunization management, followed by tuberculosis management, disease management R&D, enhancement of the emerging infectious disease response system, and support for patients with rare diseases (table 10). Around 60 percent of the Emergency Medical Fund is spent on the response system for emerging infectious diseases (table 11).

**Table 9. General Account, KCDC (KDCA after 2020), 2014–20 (US$, 1,000s)**

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</thead>
<tbody>
<tr>
<td>Personnel expenditures (KCDC)</td>
<td>16,053</td>
<td>17,267</td>
<td></td>
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</tr>
<tr>
<td>Personnel expenditures (quarantine stations)</td>
<td>14,722</td>
<td>16,230</td>
<td>36,526</td>
<td>40,708</td>
<td>42,882</td>
<td>45,672</td>
<td>51,166</td>
<td></td>
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<tr>
<td>Basic expenditures (KCDC)</td>
<td>1,418</td>
<td>1,454</td>
<td>1,495</td>
<td>1,874</td>
<td>1,996</td>
<td>2,041</td>
<td>2,051</td>
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### Table 9. (Continued)

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<tbody>
<tr>
<td>Basic expenditures (quarantine stations)</td>
<td>2,345</td>
<td>2,345</td>
<td>2,368</td>
<td>2,417</td>
<td>2,715</td>
<td>2,816</td>
<td>2,702</td>
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<tr>
<td>Information technology system operation expenditures</td>
<td>79</td>
<td>79</td>
<td>415</td>
<td>325</td>
<td>321</td>
<td>421</td>
<td>352</td>
</tr>
<tr>
<td>Support for promoting organ and human tissue donation</td>
<td>4,755</td>
<td>4,371</td>
<td>4,337</td>
<td>6,028</td>
<td>6,269</td>
<td>5,606</td>
<td>5,650</td>
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<tr>
<td>Support for public health services</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>80</td>
<td>75</td>
<td>0</td>
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<tr>
<td>Climate change adaptation and health management</td>
<td>455</td>
<td>455</td>
<td>389</td>
<td>641</td>
<td>887</td>
<td>914</td>
<td>950</td>
</tr>
<tr>
<td>Quarantine management</td>
<td>4,832</td>
<td>4,980</td>
<td>11,206</td>
<td>7,411</td>
<td>7,875</td>
<td>8,500</td>
<td>9,101</td>
</tr>
<tr>
<td>Informatization of KCDC</td>
<td>2,357</td>
<td>5,871</td>
<td>5,855</td>
<td>3,922</td>
<td>3,219</td>
<td>6,278</td>
<td>5,913</td>
</tr>
<tr>
<td>Leprosy management</td>
<td>9,811</td>
<td>9,656</td>
<td>24,679</td>
<td>9,581</td>
<td>10,651</td>
<td>10,275</td>
<td>9,483</td>
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<tr>
<td>Infectious disease standard laboratory management</td>
<td>2,470</td>
<td>2,607</td>
<td>5,283</td>
<td>4,811</td>
<td>16,131</td>
<td>12,149</td>
<td>11,965</td>
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<tr>
<td>Infectious disease management</td>
<td>7,489</td>
<td>8,220</td>
<td>15,572</td>
<td>25,425</td>
<td>24,213</td>
<td>20,965</td>
<td>19,855</td>
</tr>
<tr>
<td>Disease research planning and management</td>
<td>2,240</td>
<td>2,203</td>
<td>1,292</td>
<td>1,163</td>
<td>1,308</td>
<td>1,490</td>
<td>1,853</td>
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<tr>
<td>Building infrastructure to utilize disease research resources</td>
<td>2,215</td>
<td>2,104</td>
<td>2,104</td>
<td>1,894</td>
<td>1,877</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Building infrastructure for disease research</td>
<td>5,427</td>
<td>2,337</td>
<td>2,981</td>
<td>2,759</td>
<td>2,714</td>
<td>2,681</td>
<td>7,122</td>
</tr>
<tr>
<td>Disease management and survey research</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>3,455</td>
<td>8,855</td>
</tr>
<tr>
<td>KCDC revenue substitute expenditure</td>
<td>815</td>
<td>364</td>
<td>345</td>
<td>36</td>
<td>27</td>
<td>27</td>
<td>27</td>
</tr>
<tr>
<td>Disease management research (R&amp;D)</td>
<td>12,875</td>
<td>20,907</td>
<td>11,288</td>
<td>12,423</td>
<td>20,218</td>
<td>29,665</td>
<td>30,419</td>
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<tr>
<td>Building a chronic disease management system and infrastructure</td>
<td>2,823</td>
<td>2,900</td>
<td>3,198</td>
<td>3,971</td>
<td>6,170</td>
<td>5,055</td>
<td>5,270</td>
</tr>
<tr>
<td>Building bioethics infrastructure</td>
<td>239</td>
<td>239</td>
<td>223</td>
<td>221</td>
<td>214</td>
<td>193</td>
<td>187</td>
</tr>
<tr>
<td>Support for diagnosis and research personnel</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>19,810</td>
</tr>
</tbody>
</table>

Table 10. The Budget of the National Health Promotion Fund, 2014–20 (US$, 1,000s)

<table>
<thead>
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</thead>
<tbody>
<tr>
<td>Total</td>
<td>326,454</td>
<td>406,757</td>
<td>495,605</td>
<td>491,022</td>
<td>523,335</td>
<td>544,295</td>
<td>546,131</td>
</tr>
<tr>
<td>Chronic disease prevention and management</td>
<td>13,836</td>
<td>13,872</td>
<td>22,167</td>
<td>20,086</td>
<td>23,297</td>
<td>24,446</td>
<td>30,549</td>
</tr>
<tr>
<td>Tobacco cessation program</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2,727</td>
<td>2,589</td>
<td>2,721</td>
</tr>
<tr>
<td>Health and nutrition assessment</td>
<td>4,025</td>
<td>3,894</td>
<td>3,881</td>
<td>4,824</td>
<td>4,208</td>
<td>4,479</td>
<td>5,167</td>
</tr>
<tr>
<td>Emerging infectious disease response system enhancement</td>
<td>3,148</td>
<td>3,094</td>
<td>50,852</td>
<td>3,717</td>
<td>4,228</td>
<td>26,630</td>
<td>43,750</td>
</tr>
<tr>
<td>Immunization management</td>
<td>165,101</td>
<td>238,459</td>
<td>253,338</td>
<td>285,685</td>
<td>310,971</td>
<td>298,515</td>
<td>307,955</td>
</tr>
<tr>
<td>Enhancement of bioterror response system</td>
<td>5,403</td>
<td>9,221</td>
<td>16,018</td>
<td>14,278</td>
<td>14,173</td>
<td>13,555</td>
<td>14,101</td>
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<tr>
<td>STI and AIDS management</td>
<td>9,097</td>
<td>8,825</td>
<td>8,969</td>
<td>9,878</td>
<td>11,386</td>
<td>12,045</td>
<td>14,343</td>
</tr>
<tr>
<td>Tuberculosis management</td>
<td>33,205</td>
<td>33,566</td>
<td>35,735</td>
<td>37,455</td>
<td>31,224</td>
<td>40,615</td>
<td>46,356</td>
</tr>
<tr>
<td>Disease management research (R&amp;D)</td>
<td>15,218</td>
<td>18,232</td>
<td>28,089</td>
<td>34,675</td>
<td>34,799</td>
<td>38,437</td>
<td>45,494</td>
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<tr>
<td>Operation of the chronic disease surveillance system</td>
<td>10,190</td>
<td>9,680</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Disease management research</td>
<td>18,209</td>
<td>17,898</td>
<td>23,570</td>
<td>25,304</td>
<td>28,832</td>
<td>25,219</td>
<td>17,170</td>
</tr>
<tr>
<td>KCDC (KDCA after 2020) informatization</td>
<td>1,892</td>
<td>1,835</td>
<td>1,902</td>
<td>2,235</td>
<td>2,396</td>
<td>0</td>
<td>0</td>
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<tr>
<td>Building infrastructure for infectious disease diagnosis</td>
<td>3,849</td>
<td>4,111</td>
<td>6,282</td>
<td>6,156</td>
<td>7,177</td>
<td>6,305</td>
<td>6,902</td>
</tr>
<tr>
<td>Support for patients with rare diseases</td>
<td>26,992</td>
<td>27,293</td>
<td>28,746</td>
<td>28,746</td>
<td>29,061</td>
<td>32,245</td>
<td>35,440</td>
</tr>
<tr>
<td>Support for diagnosis and research personnel</td>
<td>16,289</td>
<td>16,778</td>
<td>16,056</td>
<td>17,981</td>
<td>18,855</td>
<td>19,214</td>
<td>0</td>
</tr>
</tbody>
</table>

Note: STI = sexually transmitted infection.
4.5. Building institutional capacity for infectious disease prevention and control

Training health personnel

The 2015 MERS experience highlighted the importance of the proper use of and training in PPE among medical professionals who come into direct contact with patients with infectious diseases. During the MERS outbreak in Korea, medical professionals reported substantial discomfort with PPE and the need for relevant training. Some of the infections among medical professionals were attributed to improper use of PPE during the outbreak. Post-MERS, regular training in the use of PPE has been provided to doctors, nurses, and other medical professionals on the front lines by the MOHW, the KDCA, local governments, and professional medical associations.

Since 2016, the government has also provided training on public health emergencies to senior managers in local governments. In collaboration with the private sector, various other training courses have been organized among hospital staff on managing nosocomial infections and on emerging and reemerging infectious diseases (Kwon et al. 2020).

The government introduced a two-year EIS trainee training system whereby candidate EIS officers received on-the-job training and opportunities to participate in the EIS officer training program of the World Health Organization to improve the capacity of EIS officers and build networks for international cooperation (Jeon 2020). Post-MERS training on how to respond to infectious disease and public health emergencies was also provided to medical professionals and government officials.

Equipping medical facilities

The spread of MERS-CoV in Korea occurred largely through nosocomial infections in a few hospitals and clearly revealed the weaknesses of the hospital system in preventing the on-site spread of infectious diseases. Post-MERS, the MOHW implemented a risk-based capability assessment of hospital systems. It subsequently designated new hospitals as infectious disease hospitals and progressively equipped them with additional negative pressure isolation rooms. The MOHW also took steps in 2017 to establish the Central Infectious Disease Hospital within the National Medical Center to oversee operations at the designated infectious disease hospitals (Jeong 2017; OECD 2020). On February 22, 2020, during the COVID-19 pandemic, the government started

Table 11. The Budget of the Emergency Medical Fund, 2014–20 (US$, 1,000s)

<table>
<thead>
<tr>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>3,203</td>
<td>3,555</td>
<td>4,277</td>
<td>5,552</td>
<td>3,757</td>
<td>4,056</td>
<td>3,976</td>
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<tr>
<td>Support for the emergency medical safety net</td>
<td>1,249</td>
<td>1,345</td>
<td>1,345</td>
<td>1,210</td>
<td>1,032</td>
<td>1,528</td>
<td>1,469</td>
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<tr>
<td>Building a response system for emerging infectious diseases</td>
<td>1,954</td>
<td>2,211</td>
<td>2,933</td>
<td>4,342</td>
<td>2,725</td>
<td>2,528</td>
<td>2,507</td>
</tr>
</tbody>
</table>

designating and operating national safe hospitals (public relief hospitals). A national safe hospital is a facility in which patients with respiratory problems and other patients are separated during the entire treatment process, from visit to discharge (MOHW 2020a, 2020b).

**Ensuring the availability of medical supplies**

To prepare the medical supplies used during an infectious disease outbreak or other public health emergency, the government has implemented a stockpiling policy that follows international standards and is robustly supported by legislation, such as the Infectious Disease Control and Prevention Act and the Pharmaceutical Affairs Act. The stockpiling policy is reviewed and updated every three years. Following the 2009 H1N1 outbreak, a national stockpile plan was drafted, and guidelines for stockpiling were developed. Five national stockpile centers have been established. Antiviral drugs, PPE, and other medical countermeasures for the 11 priority diseases identified by the KCDC (KDCA after 2020) are stored in the national stockpile. Following the MERS outbreak in 2015, the stockpiling policy was improved to adopt a more dynamic approach involving real-time management (OECD 2020).

During COVID-19, the KCDC (KDCA after 2020) was in charge of designing the vaccination program and was assisted by other agencies, such as the Ministry of Trade, Industry, and Energy and the Public Procurement Service, in the process of procurement. Large-scale vaccine deliveries to Korea started in the second quarter of 2021, and by November 2021 more than 80 percent of the population had been vaccinated. The procurement efforts, along with priority setting, the reduction of barriers to vaccination, and the availability of innovative technologies, were the key to raising the vaccination rate quickly and to a high level (Kwon and Oh 2022).

**4.6. The development and timely adoption of innovation and technology**

**Government investment in R&D among private sector manufacturers**

Learning lessons from the MERS outbreak, the Ministry of Science and Information and Communication Technology (Ministry of Science and ICT) has invested nearly US$25 million in the commercial development of infectious disease diagnostic testing technologies since 2017. To lay the foundation for the sustained development of highly capable companies specializing in diagnostic technologies, the ministry formed the Research Council for Infectious Disease and Medical Devices to support R&D in medical devices relevant to infectious disease. The council is responsible for providing technology, equipment, and research networks in response to the demand of companies. Because of the investments, Korean commercial manufacturers are well positioned to develop and manufacture tests quickly.
Fast-track approval by the regulator for innovative medical products

The special MFDS departments are focused on supporting the development of innovative technologies in medical devices and assisting medical device manufacturers in placing new devices on the market. According to MFDS regulatory criteria, a device is innovative if it is based on cutting-edge technologies and provides greater safety and effectiveness relative to medical devices already on the market. Such devices are subject to priority review to accelerate regulatory procedures and make the devices available to health care professionals and patients as quickly as possible. The companies developing such devices may also apply for the support provided through government-funded projects. In early 2020, three of the six companies that had obtained emergency use authorization (EUA) to produce polymerase chain reaction testing kits received R&D investments from the Ministry of Science and ICT (MSIT 2020).

The government also designed an EUA program modeled after the system in the United States (Heo et al. 2020). The EUA program in Korea was established through an amendment of the Medical Device Act in 2016 that allowed the temporary production and use of testing and treatment technologies during a pandemic if no authorized products are available on the domestic market. The EUA process was overseen by the KCDC (KDCA after 2020) and the MFDS (FDA 2021). The EUA program made the development and approval of the first COVID-19 diagnostic reagent possible only three weeks after the genetic sequencing data had been released (MOEF 2020a, 2020b). By utilizing the EUA system, the HIRA reduced the medical treatment registration period from 140 days to 10 days. Thus, Korea was able to conduct massive and extensive testing beginning on February 7, 2020 (Kim, Eun-young 2020).

Agile mechanisms for the amendment of benefit packages

Agile mechanisms have been established to amend the benefits package in response to emerging communicable diseases. For emerging diseases, the NHI Service responds by listing and pricing diagnostic tests and testing methods, following approval by the MFDS, and amendment of the benefit criteria by the HIRA through a shorter review and approval process. The process is expected to be rapid through reliance on EUAs. In COVID-19 early stage, the HIRA shortened the health insurance registration and the review for reimbursement for Covid-19 treatment from 180 days to 10 days (Kim, Eun-young 2020).
Key Takeaways for the Benefit of Other Countries
Chapter 5. Key Takeaways for the Benefit of Other Countries

Health system built on lessons learned: a hallmark of the Korean experience

The government undertook a series of reforms based on the lessons learned from the MERS outbreak and constantly adapted the system to the new situation when the COVID-19 pandemic shock occurred. Indeed, the learning process did not start suddenly after MERS. The government and stakeholders had been optimizing governance mechanisms and improving information systems during the previous two decades as various major outbreaks of emerging infectious disease affected the globe, including SARS in 2003, influenza in 2009, and MERS in 2015.

+ Korea’s experience has shown that a whole-government approach is possible and effective in establishing pandemic preparedness and response, but it is only possible and effective if there is a comprehensive legal framework, capable local public health institutions, effective governance mechanisms, and an integrated information system.

+ The KCDC/KDCA experience is a good example of the importance of building and sustaining robust institutional capacity and capabilities in a country to prepare for, withstand, and respond effectively to public health shocks such as the COVID-19 pandemic.

+ The government investments in the health system to achieve universal health care set the stage for the capacity and resilience that became evident during the COVID-19 pandemic.

+ The division of responsibilities between the government and private sector and between local and central governments is crucial.

Although the Korean experience of COVID-19 has been described as a success story, little attention has been paid to the years of investment and reform in infectious disease control and prevention that made the success possible beginning with the experience gained from the effort to institute universal health coverage.

First, government leadership deserves credit for planning and implementing initiatives early on. Immediately after the MERS outbreak, the KCDC and MOHW announced 48 reforms to improve the infectious disease control and prevention system after a careful reflection on the system. The reforms required a wide-ranging process involving the establishment of an adequate legal framework and supportive information systems. They were associated with clear deadlines, and the responsibility for realizing the changes was assigned to a list of counterpart agencies and departments among which relevant capacities had to be developed. The reform plans were all nearly completed or completed between 2015 and 2020, demonstrating the government’s authority and administrative ability in coordinating across agencies to turn plans on paper into reality.

Second, the institutions and systems involved in infectious disease control and prevention laid the foundations for improvements in the planning of detailed countermeasures and the overall pandemic response. Post-MERS, the government
substantially transformed the management of a potential infectious disease outbreak by fundamentally altering the national infectious disease response system, carefully defining the roles and coordination mechanisms among local and central government agencies in detection, containment, and treatment during an outbreak. As a chief operational authority, the KCDC underwent several organizational changes that involved the creation of new units to carry out pandemic response measures. It was eventually expanded to become the KDCA, a largely autonomous agency that led in many of the initiatives to foster shock preparedness and response. Legislative reforms accompanied the institutional changes to facilitate additional enhancements in governance mechanisms and the capabilities of the new control and prevention structure, which relied on the public and private sectors and local and central governments.

Third, the investment in and development of human and medical resources and innovative technologies was critical in executing the new approaches, policies, and countermeasures involved in the infectious disease and pandemic response. Post-MERS, the size and capability of the workforce engaged in infectious disease control and prevention was increased substantially. A significant number of personnel were added to local and national organizations active in initiatives in quarantine, disease surveillance, epidemiological investigation, laboratory testing, emergency response, treatment, risk communication, and R&D. The training necessary to ensure the quality of the performance of existing and newly added personnel was actively provided by the government. Hospital facilities were equipped with negative pressure isolation rooms to prevent nosocomial infections, and the stockpiling practices for medical supplies were updated to facilitate a more dynamic approach toward the needs of the infectious disease response. The government regularly invested in R&D in innovative technologies in infectious disease control and prevention. The investment in technology and R&D was centered on information systems that allowed real-time information exchanges across the private organizations and government agencies involved in pandemic preparedness and response and on screening and testing technologies, including R&D in laboratory and diagnostic devices developed through public-private partnerships, with the financial support of the government.

The Korean experience also illustrates that building capacity in countries to conduct thorough surveillance of the use of medicines, vaccines and other therapies, is a critical ‘public good’ investment to ensure that drugs are safe and effective and that their health benefits outweigh their known risks.

Fourth, government investments in infectious disease control and prevention need to be persistent and supported by predictable and sustained budgetary allocations. In Korea, government investments in organizations, human and medical resources, information systems and technology, and risk communication have not been based on a one-off reform, but on persistent, linked efforts by local and national organizations following a whole-of-government approach under the leadership of the national government. The investments have been strongly supported by predictable and sustained budget allocations generated through various sources of revenue.
that have been consistent with a predefined budgeting process. The use of specific budgets for infectious disease control and prevention was rapidly and promptly approved, whenever necessary, by amendments to relevant legislation.

Core Capacities of a Resilient Health System

The Korean experience with COVID-19 has demonstrated that five core capacities distinguish a resilient health system equipped to respond effectively during crisis and inter crises periods. These core capacities are public health functions, including monitoring the safety in the use of medicines, service delivery, community engagement and risk communication, supply chain management, and response readiness and emergency operations.

These capacities can be enhanced and mobilized through strategic investment in four interlinked, enabling domains, as follows: governance, coordination, partnership, and policies; service organization and human resources; financing; and innovation and technology. Not only are the four domains linked, that is, investment in one domain has an impact on or is reliant on concurrent investment in another domain, but the investments must also be responsive to the unique economic, political, and sociocultural context in which the health system is situated.

The COVID-19 pandemic has had an unprecedented global social and economic impact. The devastation has been untold, magnifying existing inequalities between and within countries. As discussed in this report, the Korean response to this global crisis offers some valuable lessons that can make it easier to grapple with outbreaks of infectious disease in the future. For this, it is key to understood that Korea’s sustained work in making decisions and taking actions—making investments, capacitating people, and building systems and institutions—have contributed to its success.

Indeed, the main lesson from the Korean experience discussed in this report is that resilient health systems are the result of a dynamic ‘adopt and adapt’ process over time based on learning from experience, accumulated knowledge, and scientific and technological advances.
ANNEX A

Government Responses to MERS

MERS control mechanisms

The Korean government’s responses to MERS followed the countermeasures specified in the Framework Act on the Management of Disasters and Safety. According to the law, the national infectious disease risk alert system is the main mechanism for infectious disease management and response by the government. The system has four levels of crisis alert: level 1 (attention; prevalence of an infectious disease in other countries), level 2 (caution; emergence of nosocomial infectious diseases in the country), level 3 (alert, emergency; community transmission), and level 4 (critical; spread throughout the country) (table A.1).

Table A.1. National Infectious Disease Risk Alert System: Countermeasures, by Level

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>TYPE OF THREAT</th>
<th>NOVEL INFECTIOUS DISEASE EMERGING OVERSEAS</th>
<th>UNKNOWN/ REEMERGING DOMESTIC INFECTIOUS DISEASE</th>
<th>MAJOR ACTIVITIES UNDERTAKEN AS RESPONSE MEASURES</th>
</tr>
</thead>
</table>
| Level 1     | Novel infectious disease emerges overseas, and becomes an epidemic. | Unknown/ reemerging of domestic infectious disease | + Countermeasures teams at KCDC initiate operations to tackle each infectious disease.  
+ Monitoring and surveillance for potential health risk takes place.  
+ Response capacity is prepared.  
+ If needed, measures for on-site measures are implemented, and related infrastructure can be deployed. |
| Level 2     | Novel infectious disease enters ROK. | Limited transmission of the unknown/ reemerging domestic infectious disease | + Central Disease Control Headquarters is formed at KCDC and put into operation.  
+ Cooperation mechanisms for relevant agencies are activated.  
+ Relevant measures are installed and related infrastructures are activated.  
+ Monitoring and surveillance activities are strengthened. |

(Continued)
### Table A.1. (Continued)

<table>
<thead>
<tr>
<th>LEVEL</th>
<th>TYPE OF THREAT</th>
<th>MAJOR ACTIVITIES UNDERTAKEN AS RESPONSE MEASURES</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>NOVEL INFECTIOUS DISEASE EMERGING OVERSEAS</td>
<td></td>
</tr>
</tbody>
</table>
| Level 3 | Limited transmission is detected for the novel infectious disease in ROK. | + Central Disease Control Headquarters of KCDC continues its operation.  
+ Central Disaster Management Headquarters is established at the Ministry of Health and Welfare.  
+ If needed, the Prime Minister holds a pan-governmental meeting.  
+ The Ministry of the Interior and Safety reviews for operation of pan-governmental support headquarters.  
+ Cooperation mechanisms for relevant agencies are strengthened.  
+ Disease prevention and surveillance activities, are enhanced. |
|       | UNKNOWN/ REEMERGING DOMESTIC INFECTIOUS DISEASE |                                              |
| Level 4 | Community transmission of unknown/reemerging domestic infectious disease | + Full-capacity and pan-governmental response is in place.  
+ If needed, Central Disaster and Safety Countermeasure Headquarters begins its operation. |
|        | Nationwide spread of unknown/reemerging domestic infectious disease |                                              |
|        |                                                     |                                              |

Source: ADB 2021a.

Before the outbreak in Korea, alert level 1 was announced in 2014 after cases of MERS were reported in the Middle East. In June 2014, a MERS prevention and control manual was developed and a possible MERS influx event was discussed within the government, but no countermeasures were undertaken (KCDC 2015; MOHW 2018; MOHW and KCDC 2015).

After the first case of MERS was reported in Korea on May 20, 2015, the government raised the alert level to 2. The alert remained at level 2 throughout the MERS epidemic. However, countermeasure activities and the governance structure were set based on level 3 of the response system (ADB 2021b; MOHW 2018). Key countermeasure activities at level 3 in the alert system included establishing a central disaster management headquarters and the organization of an all-government response.

Initially, the Central Disease Control Headquarters was established within the KCDC as the disease management and control center. On May 28, 2015, the government fully reorganized the MERS response by establishing the Central MERS Management Headquarters within the MOHW as the disease management center, while the KCDC retained responsibility for quarantine, epidemiological...
investigation, diagnosis, and testing. At this time, MERS diagnostic teams were established within the KCDC. In addition, strengthened quarantine measures were implemented on individuals entering the country from the Middle East (MOHW 2018).

Beginning on June 9, 2015, a national MERS response was organized. The Prime Minister’s Office convened pan government meetings and reorganized MERS response policies to enhance public-private partnerships in epidemiological investigation, increase the supply of negative pressure isolation rooms, implement the MERS integrated information system, and improve the risk communication strategy (MOHW 2018).

As the outbreak ended, the government announced post-MERS management plans on July 28, 2015, and the Central MERS Management Headquarters within the MOHW was disbanded (MOHW 2018).

Local and central governments and the MOHW

In public health and infectious disease management, the two most important agencies in Korea at the onset of MERS were the MOHW and the KCDC. The MOHW and the central government were responsible for national policy implementation, the management of national hospitals, planning coordination, the provision of technical guidelines, media responses, and the allocation of resources across local entities and provinces (Kwon et al. 2020; MOHW 2018). The KCDC provided technical support and the control and prevention of infectious diseases, including epidemiological investigations of transmission, quarantine measures, laboratory testing, and research activities to support disease control policy formation. The KCDC was overseen by the National Institute of Health and the national quarantine stations and provides financial support for health care entities in establishing the facilities necessary for infectious disease control, such as designated isolation wards (ADB 2021b; Kwon et al. 2020).

The structure of the government organizations that undertook countermeasure activities during the MERS outbreak in Korea is represented in figure A.1. The Central MERS Management Headquarters, established within the MOHW, was the management center for MERS countermeasure activities. The Central MERS Management Headquarters provided oversight of MERS responses, such as the analysis of information for policy development, planning, and prevention measures (quarantine, epidemiological investigation, diagnostic tests, hospital management, monitoring close contact cases, health care resource management), and risk communications (MOHW 2018).
MERS management headquarters units also exist within metropolitan and provincial governments, and local governments played supplementary roles in the response to the MERS outbreak. Thus, local governments were responsible for local epidemiological investigation, the management of close contact cases, patients, and medical resources (Kwon et al. 2020).

Rapid response teams and the private-public response task force were also organized during the MERS outbreak. The rapid response teams consisted of experts in infectious disease who recommended and implemented measures to prevent hospital infections. The private-public response task forces also included experts in infectious disease in relevant academic associations and societies and at the MOHW. The task forces developed guidelines for infectious disease control, diagnosis, and treatment in medical facilities. Once the infection of a patient was confirmed, a rapid response team and a private-public response task force were immediately dispatched to provide on-site directions for countermeasures and administrative assistance (MOHW 2018).
The current national disaster management system in Korea is organized as shown in figure B.1. The Central Disaster and Safety Countermeasure Headquarters is assembled in the event of a large-scale disaster and oversees and coordinates disaster responses and recovery efforts. The Central Disaster Management Headquarters is assembled by the relevant government ministries to manage disasters under their responsibility (such as the MOHW in the case of COVID-19). The local disaster and safety countermeasures offices are assembled by local governments to oversee and coordinate local efforts (MOIS 2021).

Judged by the names of the units, it may appear that there is an overlap in functions. However, the example of the director general for Public Health Emergency Preparedness and the Bureau of Infectious Disease Emergency Preparedness and Response is revealing. Thus, the role of the former is to provide assistance to the commissioner of the KDCA in (a) infectious disease epidemiological investigations and EIS officer management, (b) epidemiological investigations related to education programs, and (c) the collection of information on infectious diseases abroad, and so on. Meanwhile, the role of the latter involves (a) oversight and the management of infectious disease and bioterror emergency situations; (b) infectious disease emergency response and the management, planning, and coordination of negative isolation pressure rooms; and (c) the management of national stockpiling systems, and so on.

Table B.1 shows the countermeasures taken by each key player at the level of serious alert, within which the MOHW runs the Central Disaster Management Headquarters, and the KDCA operates the Central Disease Control Headquarters. Figure B.2 provides an organigram of the KDCA.
Annex B. The Current National Disaster Management System

Figure B.1. Disaster Management System, Korea

Central Safety Management Committee
Chairperson: Prime Minister

Safety Policy Coordination Committee
Chairperson: Minister of the Interior and Safety

Central Emergency Rescue Control Center
(National Fire Agency)
Central Rescue Service
(Korea Coast guard)

City, Province / City, Country, District
Emergency Rescue Center
(National Fire Agency)
Provincial / Regional
Rescue Service (Korea Coast guard)

On-site Rescue Coordination Office
(Head of the relevant rescue control office)

On-site Emergency Medical Center
(Head of Health center)

City/Province Disaster and Safety Countermeasures Office
City/County/District Disaster and Safety Countermeasures Office

Head: Mayor and governors
Head: Head of City/County/District office

Integrated Disaster Site Support Office
Head: Deputy head of City/County/District office

Regional Disaster Management Headquarters
Head: Designated by the Head of the Central Disaster Management Headquarters

Central Disaster and Safety Countermeasures Headquarters

- In case of Large-scale disasters
  Head: Minister of the Interior and Safety
  Vice Head: Vice Minister for Disaster and Safety Management, Ministry of the Interior and Safety
- In case of Disasters requiring a government-wide response
  Head: Prime Minister
  Vice Head: Minister of the Interior and Safety (if necessary)
  Head of responsible disaster management organization

Can serve the role as the Vice Head of the Central Disaster and Safety Countermeasures Headquarters

President

Office of National Security
National Crisis Management Center

Office of the President
Responsible Office of the Senior Secretary

Central Disaster Management Headquarters
Head: Head of responsible disaster management organization

Management Support Group
Head: Designated by the Head of the Central Disaster and Safety Countermeasures Headquarters

Responsible ministries and organizations
Government ministries and responsible organizations
Central disaster Management Support Headquarters (Facilities Management Corporation)

Responsible ministries and organizations
National administrative agencies and responsible organizations

On-site Rescue Coordination Office
(Head of the relevant rescue control office)

On-site Emergency Medical Center
(Head of Health center)

Command and reporting
Cooperation and support

Source: MOIS 2021.
### Table B.1. The Infectious Disease Response System: Countermeasures during a Serious Alert

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>RESPONSIBILITIES</th>
</tr>
</thead>
</table>
| MOHW                                              | + Ongoing operations of the Central Disaster Management Headquarters  
+ Issuing risk alerts and disseminating information on the current situation  
+ Supporting pangovernment responses  
+ Formation and operation of central-local working level councils  
+ Supporting the activities of the Central Disease Control Headquarters, such as quarantine measures  
+ Interdepartmental discussions related to infectious disease disaster responses and recovery measures  
+ Hospitalization and treatment of patients, financial supports for loss of income, psychological support measures  
+ National level risk communication supports                                                                 |
| KDCA                                              | + Ongoing operations of the Central Disease Control Headquarters  
+ Epidemiological investigation and support for working responses, including control and prevention measures  
+ Enhanced monitoring and assessment of risks  
+ Enhanced operation of the 24-hour situation monitoring room  
+ Prevention of the additional influx of infectious disease through strengthened quarantine measures  
+ Recenter regional public hospital functions from outpatient treatment to management of inpatient services and the critically ill  
+ Surveillance of the critically ill  
+ Management of testing facilities  
+ Media and public communication                                                                       |
| Regional disease control and prevention centers (five regions)a | + Ongoing cooperation with municipal and provincial governments  
+ Support for disaster preparedness measures  
+ Support for epidemiological investigation and on-site measures of municipal and provincial governments  
+ COVID-19 testing during quarantine investigations  
+ Management of regional health care resources                                                                 |
| Local governments                                 | + Operation of local disaster and safety countermeasures headquarters  
+ Operation of local quarantine task forces  
+ Operation of local-central working level councils  
+ Operation of patient management teams (severity classification and bed allocation)  
+ Enhancing local patient surveillance systems  
+ Operation of local infectious disease control and prevention infrastructure  
+ Local epidemiological investigation, on-site infectious disease control and prevention measures, patient transport, management of patients and individuals with close contacts, release from isolation  
+ Enhancing cooperation with local institutions  
+ Enhancing communication with local populations  
+ Establishing plans to manage and secure isolation beds and facilities  
+ Reorganize health center tasks to focus on infectious disease control and prevention                                                                 |
### Table B.1. (Continued)

<table>
<thead>
<tr>
<th>ORGANIZATION</th>
<th>RESPONSIBILITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutes of health and environmental research (central and local)</td>
<td>+ COVID-19 laboratory testing at the metropolitan city and provincial levels</td>
</tr>
<tr>
<td>Local centers for infectious disease control and prevention</td>
<td>+ Technical support for metropolitan city and provincial COVID-19 surveillance, epidemiological investigation, and data analysis</td>
</tr>
<tr>
<td>Public and private health care facilities</td>
<td>+ Diagnosis and treatment of COVID-19 patients</td>
</tr>
<tr>
<td></td>
<td>+ Report of COVID-19 cases (incidence, death, discharge)</td>
</tr>
<tr>
<td></td>
<td>+ Cooperation on epidemiological investigation and infectious disease management measures</td>
</tr>
<tr>
<td></td>
<td>+ Operation of COVID-19 screening centers</td>
</tr>
</tbody>
</table>

Source: CDCH and CDMH 2021.

a. The regional centers for disease control and prevention cover the capital region, Chungcheong region (west central), Honam region (southwest), Kyeongbuk region (east), and Kyeongnam region (southeast).
Figure B.2. Organogram of the KDCA, January 2021

Source: ADB 2021b.
ANNEX C
Financing Infectious Disease Control and Prevention

Table C.1. Budgeting Process among Government Bodies, Republic of Korea

<table>
<thead>
<tr>
<th>STEPS</th>
<th>TASK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Budget formation of government administration</td>
<td>Guidelines for the National Fiscal Management Plan, Ministry of Economy and Finance → government agency</td>
</tr>
<tr>
<td></td>
<td>Submission of a medium-term project plan, government agency → Ministry of Economy and Finance</td>
</tr>
<tr>
<td></td>
<td>Guidelines for budgeting and spending ceilings, Ministry of Economy and Finance → government agency</td>
</tr>
<tr>
<td></td>
<td>Submission of budget request, government agency → Ministry of Economy and Finance</td>
</tr>
<tr>
<td></td>
<td>Drafting the budget proposal, Ministry of Economy and Finance</td>
</tr>
<tr>
<td></td>
<td>Submission to the National Assembly</td>
</tr>
<tr>
<td>Deliberations of the National Assembly</td>
<td>Review and vote by the National Assembly</td>
</tr>
</tbody>
</table>


Table C.2. National Health Promotion Fund: Distributions for Infectious Disease Control (US$, 1,000s)

<table>
<thead>
<tr>
<th>YEAR</th>
<th>TOTAL FUND REVENUE</th>
<th>TOBACCO TAX, % OF REVENUE</th>
<th>EXPENDITURE, % TO NATIONAL HEALTH INSURANCE</th>
<th>EXPENDITURE, % TO KDCA</th>
<th>EXPENDITURE, % TO HEALTHY LIFESTYLE PROMOTION</th>
<th>OTHER</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>2,119,493</td>
<td>—</td>
<td>926,486 (43.7%)</td>
<td>276,274 (13.1%)</td>
<td>129,928 (6.1%)</td>
<td>786,805 (37.1%)</td>
</tr>
<tr>
<td>2015a</td>
<td>2,978,321</td>
<td>2,123,543 (71.3%)</td>
<td>1,380,482 (46.4%)</td>
<td>388,992 (13.1%)</td>
<td>263,305 (8.8%)</td>
<td>945,542 (31.7)</td>
</tr>
<tr>
<td>2016</td>
<td>3,421,688</td>
<td>2,645,364 (77.3%)</td>
<td>1,719,463 (50.3%)</td>
<td>469,557 (13.7%)</td>
<td>250,397 (7.3%)</td>
<td>982,271 (28.7%)</td>
</tr>
<tr>
<td>2017</td>
<td>3,394,761</td>
<td>2,788,297 (82.1%)</td>
<td>1,812,343 (53.4%)</td>
<td>466,112 (13.7%)</td>
<td>254,462 (7.5%)</td>
<td>861,826 (25.4%)</td>
</tr>
<tr>
<td>2018</td>
<td>3,692,291</td>
<td>2,759,647 (74.7%)</td>
<td>1,793,771 (48.6%)</td>
<td>493,102 (13.4%)</td>
<td>238,728 (6.5%)</td>
<td>1,166,681 (31.5%)</td>
</tr>
<tr>
<td>2019c</td>
<td>3,846,138</td>
<td>—</td>
<td>1,728,256 (44.9%)</td>
<td>512,781 (13.4%)</td>
<td>307,529 (8.0%)</td>
<td>1,297,552 (33.7%)</td>
</tr>
</tbody>
</table>

Source: MOHW various.
Note: US$1.00 = ₩1,000., a. The tobacco tax was raised from ₩341 to ₩841 per pack., b. Public health expansion, cancer prevention, measures to address low fertility, eldercare, medical insurance, and so on., c. Data of MOHW (2020c).

Korea’s disaster and safety management budget increased by an annual average of 3.6 percent between 2015 and 2020 (table C.3). Investments in areas that affect daily life (for example, to reduce fine dust pollution, workplace accidents, suicide, and so on) and to recover deteriorating social infrastructure (for instance, roads and railways) continued to expand (MOIS 2021).

Table C.3. The Disaster and Safety Management Budget, 2015–20 (₩, trillion)

<table>
<thead>
<tr>
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<tr>
<td></td>
<td>14.7</td>
<td>14.6</td>
<td>14.3</td>
<td>15.2</td>
<td>15.9</td>
<td>17.5</td>
</tr>
</tbody>
</table>
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