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Learning From the Past: Distributed Cognition and Crisis Management Capabilities for Tackling COVID-19

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Abstract

The outbreak of coronavirus disease 2019 (COVID-19) has presented an unprecedented public health crisis across the globe. Governments have developed different approaches to tackle the complex and intractable challenge, showing variations in their effectiveness and results. South Korea has achieved exceptional performance thus far: It has flattened the curve of new infections and brought the outbreak under control without imposing forceful measures such as lockdowns and travel ban. This commentary addresses the South Korean government's response to COVID-19 and highlights distributed cognition and crisis management capabilities as critical factors. The authors discuss how the South Korean government has cultivated distributed cognition and three core capabilities—reflective-improvement, collaborative, and data-analytical capabilities—after its painful experience with 2015 Middle East respiratory syndrome-coronavirus (MERS-CoV). South Korea's adaptive approaches and its learning path examined in this commentary provide practical implications for managing potential additional waves of COVID-19 and a future public health crisis.

Keywords

COVID-19, public health crisis, emergency and crisis management, distributed cognition, state capability

Introduction

The world is suffering miserably from the unprecedented and unforeseen spread of a new coronavirus disease 2019 (COVID-19). Conventional approaches do not seem to work in the face of new challenges with extreme uncertainty and complexity. Many developed countries such as the United States and Japan have not been successful, at least initially, in their efforts to address this "wicked problem" despite solid foundation, infrastructure, formal procedures, and resources for managing disastrous events.

Although the numbers of confirmed and death cases are still adding up around the world as we write this article, some countries are impressing the rest by reversing the curve early on and even declaring zero daily confirmed case of domestic origin. Among them, South Korea has shown notable performances:

> Korea is the only country with a population of over 50 million that has slowed the spread of the virus, and flattened the curve of new infections without shutting down the country nor the city at the epicenter of the outbreak, without imposing an extreme personal travel or movement restriction, and without closing airports or taking other authoritarian actions. (The Ministry of Economy and Finance, 2020, p. 3)

Since the first case was reported on January 20, followed by several spikes of cases in February, the number of daily cases has declined to an average of 9 in the first week of May. The number of active cases surged to 7,362 on March 11 but dropped to 1,264 as of May 10. Considerable worldwide attention has been paid to South Korea's response to COVID-19 and what happened behind the scenes.

In this commentary, drawing on the literature of emergency and crisis management, we examine how South Korea has responded to the COVID-19 outbreak and managed the public health crisis. We highlight the role of "distributed cognition" in South Korea's well-structured but remarkably adaptive crisis management system. Distributed cognition refers to the cognitive properties of a group implemented in the minds of members of the group (Hutchins, 2000; Salomon, 1993). South

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Korea experienced a different coronavirus, Middle East respiratory syndrome-coronavirus (MERS-CoV) in 2015 and its response failure contributed to the development of distributed cognition. Based on the hard lessons and painful memory from the 2015 MERS-CoV, fighting against the infectious disease became the primary rationale widely distributed and shared across the diverse individual actors in the immediate context. Distributed cognition, in turn, triggered a set of structural reforms aimed at enhancing three core capabilities for infectious disease control—reflective-improvement, collaborative, and data-analytical capabilities. We suggest that crisis management capabilities and distributed cognition across diverse actors are fundamental for managing potential additional waves of COVID-19 and a future public health crisis.

Painful Past Experience of a Different Corona Virus, MERS-CoV

In 2015, the outbreak of the MERS-CoV in South Korea resulted in a public health crisis: An official total of 186 cases were confirmed, with 38 deaths and 16,752 suspected cases. After the first case, confirmed on May 11, the number of cases rose sharply over a short time. The number of daily cases peaked on June 17 at 19, followed by the last case on July 4. It was the largest mass outbreak of the disease outside of the Middle East.

Studies of South Korea's MERS-CoV outbreak highlight the initial failure to contain the pathogen. Public health authorities, not recognizing the potential risks, did not take any preventive measures, resulting in a lack of cognition among diverse actors in the health care system and general citizens. The first patient visited three hospitals seeking treatment, infecting 26 people, including health care workers, winning the title of "super spreader." This led to a vicious cycle: Patients transmitted the disease to health care workers, who in turn infected other health care workers and patients (D. H. Kim, 2015). The government did not provide guidelines for isolation or fully conduct an epidemic investigation. Although the infection was mostly nosocomial (intrahospital and hospital-to-hospital transmission), the Korean government refused to disclose information about the hospitals where MERS-CoV patients had been treated.

Comprehensively, the MERS-CoV outbreak revealed structural problems in the Korean infection management system, including the following (D. H. Kim, 2015; K. H. Kim et al., 2017; The Ministry of Health and Welfare [MOHW], 2016):

- Lack of recognition of infectious disease risk
- Failure of preemptive quarantines and isolation
- Limitations in epidemic investigation
- Inadequate health crisis manuals
- Failure to identify an agency to act as the control tower
- Coordination disruptions among central and local governments
- Poor crisis communication by government
- Inadequate hospital infection management and lack of medical supplies/equipment

These reported problems suggest that the Korean government approached the crisis in a convenient way, fitting it into existing institutions and capabilities rather than adapting these capabilities to the actual present challenge. For example, health officials mechanically applied existing testing standards, which later proved wrong, without learning about the new disease. The response failed to exhibit the capacity to recognize public problems, align collective efforts, and adjust to a fluid situation. More importantly, the underlying problem was the lack of "cognition," defined as "the capacity to recognize the degree of emerging risk to which a community is exposed and to act on that information" (Comfort, 2007, p. 187). The impact of the failed government response to MERS-CoV was disastrous. It damaged the Korean economy and led to substantial social ills. Public trust in government plummeted and fear of the unprecedented disease outbreak grew.

The South Korean government turned this challenge into an opportunity to fundamentally reform its crisis management system and build its capabilities for problem-oriented governance (Mayne et al., 2020). In the following section, using Mayne et al.'s (2020) problem-oriented governance framework, we describe how the South Korean government implemented many changes to the design, processes, and practices in disease control response after its experience with MERS-CoV.

After the 2015 MERS-CoV: Developing Capabilities for Infectious Disease Control

Infectious diseases like MERS-CoV and COVID-19 reflect complex, "wicked" problems in contemporary governance. They are unprecedented and lack a set of clear causes and scientific solutions. The recognition of wicked policy problems has called for problem-oriented governance, which refers to "an approach to policy design and implementation that emphasizes the need for organizations to adapt their form and functioning to the nature of the public problems they seek to address" (Mayne et al., 2020, p. 34). Learning and adaptation are at the heart of this approach.

Problem-oriented governance is epitomized in the South Korean government's reform of the public health emergency system. It engaged in reflective practices, revised laws and manuals, redesigned work processes and organizational arrangements, and invested in human resources and health care systems. The learning and adaptation processes allowed public health officials and diverse policy actors to share

understandings of the problem and build core capacities for future infectious disease control, namely, reflective-improvement capability, collaborative capability, and data-analytic capability (Mayne et al., 2020).

Reflective-Improvement Capability

Reflective-improvement capability refers to an "ability to articulate a theory of change around a nominated public problem and its ability to measure performance, learn, and adapt" (Mayne et al., 2020, p. 37). Public health authorities in South Korea conducted a careful evaluation to extract lessons, implementing internal reviews (published in Whitepaper, MOHW, 2016) and participating in the voluntary World Health Organization (WHO) Joint External Evaluation (WHO, 2017). Based on recommendations from these reviews, specific legislation and guidelines have been developed, in hopes of avoiding the mistakes of the past by ensuring the successful implementation of a common operating framework.

First, the Standard Manuals for Crisis Management were revised to address coordination problems found during the MERS-CoV outbreak.[1] The Korean Centers for Disease Control (KCDC) was promoted to a vice-ministerial-level agency and designated as a control tower for infectious disease response. The KCDC amended its organizational structure (e.g., to establish the Emergency Operations Center which works 24/7). The manuals specify the mission, task, and specific procedures and actions to be taken by each central and local government at each stage of emergency progression (Infectious Disease Alert Level 1–4). The manuals have been revised annually (2017–2020) to accommodate feedback from field officials.

Second, the Infectious Disease Control and Prevention Act was revised to provide legal grounds for rigorous contact tracing, quarantine measures, and the public sharing of patient information. To facilitate early detection and isolation, found to be critical during the MERS-CoV crisis, the law mandated that the KCDC and local governments increase recruitment and training in the epidemiological investigation (requiring 30 officers in the central government and two in each municipal/provincial government).

Third, the nosocomial transmission in 2015 highlighted the need for improvements in health care infrastructure and hospital infection management systems. The South Korean government designated national and regional hub hospitals (69 in total) and required medical personnel to research and treat infectious diseases with financial support from governments. The Emergency Medical Service Act was revised to minimize the risk of hospital transmission.

Changes to formal rules and governance arrangements influenced working practices and informal norms. Shared experiences and common training based on comprehensive and granular manuals allowed multiple actors from different organizations to share a "common operating picture" (Comfort, 2007). Clear accountability structures enhanced participants' motivation to continuously learn and adapt. Public health authorities committed to "correcting actions that fail to address the problem and double down on remedies that work" (Mayne et al., 2020, p. 34).

This set of reform initiatives was put to the test in September 2018, when a single case of MERS-CoV was confirmed. Thanks to early detection and control measures, no transmission was found. The reform process was iterative, which Andrews et al. (2017) would call "problem-driven iterative adaptation."

Collaborative Capability

One of the lessons from the 2015 MERS-CoV experience was that no single organization can tackle a public health crisis. Resources, expertise, and skills are dispersed. Coordination and communication between central and local governments and across different sectors are vital to produce concerted efforts. In 2015, there was confusion over each party's responsibilities and the barriers to information sharing among governments. Comprehensive Public-Private Response Task Force for MERS-CoV was created but without empowering private professionals (KCDC, 2019).

Government organizations from different departments and levels of government have built collaborative capability by promoting information sharing, continuously revising the strategies and manuals developed, and aligning their efforts. The governments conducted multiple hands-on drills and held common training every year. For example, the KCDC Emergency Operations Center conducted emergency drills using a scenario of the hypothetical Ebola outbreak that multiple central government departments, local governments, and private sector experts participated in. Similar drills and training were conducted at local governments and private hospitals. Years of the shared experiences reinforced actors' shared goals and motivation and thus enhanced the depth of collaboration.

Empowerment enhanced mutual trust and joint capacity. Health crisis governance arrangements were restructured such that central governments empower local governments. The Standard Manuals for Crisis Management require each local government to form its Local Disaster and Safety Countermeasures Headquarters (LDSCHQ). The Central Disaster and Safety Countermeasures Headquarters (CDSCHQ) should provide supplies, manpower, and other necessary resources to the local counterpart.

In addition, the KCDC sought to build cross-sector relationships to leverage diverse skills and perspectives. It established the Public-Private Alliance on Infectious Disease Testing in 2017 and has strengthened the partnerships since then. The role of public-private partnerships was critical in the response to COVID-19 (described later).

Data-Analytical Capability

The South Korean government strengthened its ability to collect and analyze different types of data to implement the common operating framework and facilitate cross-silo information sharing. For example, health authorities recruited more epidemiological intelligence (EI) officers and enhanced training for them. The revised Infectious Disease Control and Prevention Act allowed EI officers to collect information necessary for epidemiological investigation (e.g., medical records, location information). It should be noted that the need for collecting privacy-sensitive data is carefully assessed within the scope of the act (KCDC, 2020).

Another example is the data-sharing platforms. The KCDC established International Traveler Information System to share patients' travel histories with hospitals when needed (KCDC, 2019). Communication channels between central and local governments were created to facilitate information sharing (e.g., social media and daily meetings in the outbreak of 2018 MERS-CoV).

The KCDC established the Crisis Communication Office and 1339 Hotline Call Center in 2016. Information about a disease outbreak, patients' movement paths, and treatment hospitals were fully disclosed when a MERS-CoV case was confirmed in 2018, which is in contrast to crisis communication in 2015. Information disclosure improved civic awareness and facilitated innovation including the development of mobile apps, technologies, and products that proved fruitful in the outbreak of COVID-19.

Three capabilities for the South Korean government's infectious disease response have been developed, implemented, and reimagined over time. With years of the reform efforts and shared experiences, diverse policy actors developed shared understandings of the problem. Goal-driven learning and adaptation made South Korea prepared for a future infectious disease, which unfortunately happened in 2020.

Response to COVID-19: Distributed Cognition and Four Cs of Crisis Management

South Korea's response to the COVID-19 has been complex and dynamic. Situations have been constantly evolving with some unexpected incidents, that is, several mass-cluster-infections. The whole response process has to cope with disease control with multiple other issues simultaneously. The complex and dynamic situation challenges previous logics and controls of formal response systems. Yet, the South Korean government took adaptive and decisive approaches supported by cognition, coordination, communication, and control—four Cs of emergency and crisis management (Comfort, 2007).[2] It recognized the emerging risk before the crisis occurred, intervened swiftly and effectively, and undertook innovative actions. This was possible due to widely distributed cognition and crisis management capabilities cultivated from years of shared experience, repeated interactions, routinized practices, and continued structural reform.

The process of building capabilities for infectious disease control over the past 5 years instilled a crisis management mindset into the infection management system actors and distributed cognition. Different actors might have different stakes or interests for their involvement in the COVID-19 response. However, the common goal provides the sense-making language for communication across the different stakeholders, which enables coordination among these diverse actors with different capacities and resources. The distributed cognition also supports the government's decisions on the adaptive measures in taking control of evolving situations. The distributed cognition has been supporting interdependent processes among coordination, communication, and control requisite for collective COVID-19 response in South Korea.

In the following sections, we present multiple cases of how the distributed cognition supported the collective operation among coordination, communication, and controls during different phases of disease control (or crisis management) in South Korea.

Before It is a Crisis: Cognition of the Emerging Risk

Multiple cases of unknown pneumonia were reported in December 2019 in China. The KCDC recognized the emerging risk and raised its infectious disease alert level to Level I on January 3. Public health officials monitored the disease and communicated relevant information with professionals and stakeholders who readily understood the risk. Officials also swiftly undertook the diagnostic kit development (January 13). A shared understanding of the potential threat between actors from different organizations activated the initial response to the approaching crisis.

Initial Response: Widespread Testing and Contact Tracing

South Korea raised its alert level to Level II right after the first case was confirmed on January 20. The KCDC began identifying and testing suspected cases to halt the virus' spread. Early detection based on widespread testing and the epidemiological investigation was key to save a golden time (Moon, 2020). At maximum capacity, 20,000 diagnostic tests can be performed at 118 institutions (KCDC, 2020). A very high level of testing capacity was possible due to collaborative efforts between government, private organizations, and professional groups. The KCDC developed the testing kit (real-time reverse transcription polymerase chain reaction [RT-PCR]) by collaborating with professional groups and disclosed its technologies so that private companies produce the kits (January 27). The Ministry of Food and Drug Safety

granted fast-track approval on February 4. Shared motivation and distributed cognition led to the coordination of diverse actors' efforts in one direction.

Adaptive practices and innovation also contributed to massive testing. Public health centers and hospitals established screening clinics to inhibit transmission at health care institutions. This was informed by reflective learning from the 2015 MERS-CoV. Health care professionals and government interacted with each other sharing knowledge and information and adopted drive-through centers and phone booth–style testing facilities. In sum, South Korea has systemized and diversified its operating models to respond more effectively to the increasing demand for diagnostic testing and treatment of infected patients.

Rigorous epidemiological investigations were conducted based on the enhanced capacity of and investment in EI officers. KCDC officers were dispatched to regions with massive outbreaks to jointly conduct contact tracing with local government officers. Governments disclosed investigation results including patients' movement paths. The disclosed information was analyzed and used by private firms and citizens who produced mobile apps and websites (e.g., patients' movement path map). These examples illustrate cognition dispersed across boundaries which led to concerted efforts and innovative results.

Challenges and Adaptation: Sudden Surge of Cases

Early detection along with isolation seemed to have brought the outbreak under control. However, an abrupt surge of new confirmed cases emerged, changing the situation upside down. One patient, who participated in religious worship in a church, infected many other members of the religious group. The number of daily confirmed cases peaked at 909 on February 29 and they were clustered in the city of Daegu and North Gyeongsang province. The surge in the region went beyond the capacity of the region's health care and disease control. The South Korean government raised its infectious disease alert to the highest level on February 23.

Coordination and communication allowed for adaptive and effective response. The CDSCHQ urged concerting all the efforts across different levels of government and diverse social actors to respond to the crisis. Central governments provided supplies and resources and dispatched public health officials and health care workers to the regions with the patient spike. The patient management system was developed to classify the patients according to their severity for more rigorous treatment in emergencies. Hospitals shared sickbeds and facilities. Many doctors and health workers volunteered to work at emergency medical centers to help mitigate the crisis in Daegu and North Gyeongsang.

A number of new measures were developed in a short period, which could have caused confusion. However, distributed cognition and the mindset for crisis management made the focus stay on the problem: tackling COVID-19. Because diverse actors had years of shared experiences and habituated practices and behaviors, coordination and communication operated.

Civic Awareness and Citizen Cooperation Upholding Government Response

Distributed cognition is evident in citizen participation in South Korea's response to COVID-19. Citizens, aware of the disease risk, have practiced social distancing and face coverings recommended by the government. Health care workers volunteered to work at hospitals experiencing the spikes of patients in Daegu and North Gyeongsang. Private firms and ordinary citizens developed websites and mobile apps for sharing disease information.[3] The cognition of risk and the importance of collaboration were shared by citizens as well as governments and policy actors.

Conclusion

This commentary has demonstrated how South Korea became a notable example to emulate for the COVID-19 response worldwide. In particular, we highlighted the distributed cognition and crisis management capabilities that have been cultivated from years of shared experience, repeated interactions, routinized practices, and continued institutional and structural reform. The distributed cognition then supported agile coordination, transparent communication, and adaptive control within and across the governments as well as diverse stakeholders including the ordinary citizens in South Korea so far.

Fortunately, many countries are seeing the flatten curve after many weeks of aggressive isolation or lockdowns. Now countries are preparing for cautious opening ups. Yet, before the actual movement back to normal operations, many countries may want to check whether they have learned enough from the recent harsh experiences with COVID-19 and developed crisis management capabilities to deal with possible second or third waves that may be consequent from the openings. In particular, they may want to start from whether they established a certain level of distributed cognition within and across the governments at all levels and all participants of diverse segments of society.

By presenting and sharing the experience of South Korea's notable COVID-19 responses, we hope to provide some administrative insights and practical implications for other countries to think about, and to be better equipped for similar disastrous situations in the future.

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Notes

1. While South Korea has a relatively long history of building a standardized operating system for emergency/crisis management, politics intervened and impeded its progress. In 2003, then-President Roh expanded the National Security Council (NSC) and created the Crisis Management Center within the presidential office, to function as a control tower to manage crises. The NSC created standard manuals (33 in total) specifying the basic structure of an operating system for emergency/crisis management. Based on these official guidelines, each department and agency developed its practical manuals (276) and action plans (more than 2,400) with more details. This was followed by multiple hands-on nationwide drills and training to enhance the capacity in the field. As a result, Korea successfully controlled the very first coronavirus (severe acute respiratory syndrome [SARS]) crisis in 2003, under the leadership of the prime minister and NSC. However, the next president nullified the emergency/crisis management systems for political reasons. Consequently, Korea came to experience chaotic situations when the second coronavirus (Middle East respiratory syndrome-coronavirus [MERS-CoV]) attacked in 2015. As a long-time political comrade of the former President Roh, the current President Moon reestablished the system by revitalizing and updating the discarded manuals right after he took office in 2017.
2. The interplay among coordination, communication, and control seems a very classic emergency and crisis management response approach in theory. Yet, the literature highlights the difficulty of operation of such a classic approach in emergency and crisis management practice (Comfort, 2007; Yeo & Comfort, 2017). When diverse issues clash, often, rationales and interest of individuals rupture what is rational for the group (Hardin, 1968; Hutchins, 2000). Individual stakeholders become passive and defensive to protect their stakes and positions from emerging tensions across diverse actors (Comfort et al., 2019). To this end, distributed cognition is critical for supporting interdependent processes among coordination, communication, and control requisite for emergency and crisis management.
3. One example is an online map showing movement paths of coronavirus disease 2019 (COVID-19) patients (https://coronamap.site/). Developers made this geographic information using the information provided by the Korean Centers for Disease Control (KCDC).

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