

**PUBLIC DISTRUST OF SCIENCE: SOUTH KOREA AS A CASE STUDY TO PROVIDE
INSIGHT ON THE HANDLING OF COVID-19**

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By

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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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According to the *Lancet's* Global Burden of Disease, the incidence for ischemic stroke has increased 15.8 percent from 2005 to 2015 (Vos et al., 2016). Similarly, the incidence for upper and lower respiratory infections increased 10.3 percent and 6.8 percent respectively over the same time period. Generally, more and more people are being diagnosed and treated for these diseases, whether or not they were predisposed or had preexisting conditions. Additionally, it is expected that the number of vector-borne infectious diseases, such as COVID-19, will continue to exponentially grow with climate change, and as more countries develop, rates of obesity and other risk factors for ischemic stroke will continue to increase (Cassels, 2006; Kenyon & Skuce, 2014). Thus, advances in biotechnology for preventing, diagnosis, and treatment of these diseases is imperative for preserving and advancing the quality of life for many countries.

Ischemic stroke is caused by a blockage in a blood vessel supplying the brain, resulting in cell death due to lack of oxygen (“Stroke Information Page | National Institute of Neurological Disorders and Stroke,” n.d.). The next steps in ischemic stroke therapy and treatment comes with targeting specific biomarkers and signaling processes to prevent further damage after the blockage is removed. For the technical project, Rebecca Della Croce, Annie Ford, and I propose that by detailing astrocyte signaling pathways through a signaling network model, we can inform future stroke treatments through the identification of certain biomarkers and their role within cell-cell communications. We are advised by Professor Richard Price of Biomedical Engineering and graduate students Catherine Gorick and Delaney Fisher. The project focuses primarily on constructing the astrocyte signaling model, as well as validating these finding through cell culture experiments. Loosely coupled, the STS project focuses on extrapolating South Korea’s handling of the SARS and MERS epidemics to identify gaps in the United State’s response to SARS-CoV-2 or COVID-19 and inform handling of future respiratory viruses.

Considering a growing public distrust of science and lack of compliance with public health standards that have been proven to reduce infections such as social distancing and mask wearing, unfortunately the United States will be disrupted by COVID-19 for the foreseeable future (Zimmer, 2020). However, this is not the first respiratory virus that has disrupted a democratic country. South Korea has become a face of multiple respiratory viruses, including Severe Acute Respiratory Syndrome (SARS), Middle East Respiratory Syndrome (MERS), and now COVID-19 (Cho, 2020). Analyzing South Korea's response to these multiple epidemics is important for the United States' handling of the current pandemic and future respiratory viruses that are sure to come. A few analyses have been done, specifically looking how South Korea's preventative measures led to its current successful handling of COVID-19, but extending this analysis to the United States and the growing distrust of science by the American public has not been done yet (Cho, 2020). Actor Network Theory (ANT) will be used to analyze the different public health networks of the US and South Korea because of the negotiation space that exists in this theory (Latour, 1987). ANT will also be used to identify areas of improvement in the American public health infrastructure network.

Together, these projects intend to inform clinicians and governmental agencies to prevent an overwhelming of the US healthcare system while providing insight from the clinical, public health, and policy perspectives on how to better prepare for and treat these increasingly common diseases.

SOUTH KOREA AND PREVIOUS EPIDEMICS

As previously mentioned, South Korea has experience with previous respiratory outbreaks, specifically severe acute respiratory syndrome (SARS) in 2003-2004 and Middle East respiratory syndrome (MERS) in 2015 (Cho, 2020; K.-M. Lee & Jung, 2019). Although South

Korea had zero confirmed cases of SARS, the disease resulted in the formation of the Korea Centers for Disease Control and Prevention (KDCA/ KCDC). In 2015, an outbreak of MERS resulted in 186 confirmed cases and 38 deaths due to travel abroad.

After MERS, the KDCA was restructured so that South Korea would be better prepared for future infectious disease outbreaks brought to the country specifically by travel abroad through the establishment of the Emergency Operations Center (Cho, 2020). The KDCA also increased the number of professional epidemiological investigators to monitor potential viral outbreaks. In addition, the KDCA quickly drafted a MERS infection prevention and control guideline for healthcare facilities, which was approved by the Korean Academic Societies, to aid hospitals on practical aspects of infection control such as isolation of patients and proper wear of personal protective equipment (Oh et al., 2018). These changes proved to be successful when a confirmed MERS case in 2018 was found via rapid detection and led to no further cases.

South Korea's experience with previous epidemics, as well as its reflection on the handling of these crises, encouraged the country to restructure its public health infrastructure to view doctors and hospitals as the first line of defense and brought to light the potential for superspreader patients and events (Oh et al., 2018). South Korea's adaptive style to their public health infrastructure, which will be further discussed later in this analysis, allows the country to have enough precautions in place for early detection and contact tracing of COVID-19, ultimately aiding their control of the virus (Beaubien, 2020; Fox, 2020).

U.S. NATIONAL GOVERNMENT FAILURE

While South Korea's experience with epidemics prepped their response for COVID-19, lack of preparedness and unity contributed to the failed response of the United States. There are multiple factors leading to lack of adherence with well-known preventative measures in the United

States. The four greatest influences on the United States' public COVID-19 response are 1) lack of coordinated national leadership, 2) extreme political partisanship, 3) lack of visibility and leadership from the Centers for Disease Control (CDC), and 4) inefficient and slow testing (Staff, 2020) as outlined in Figure 1 below.

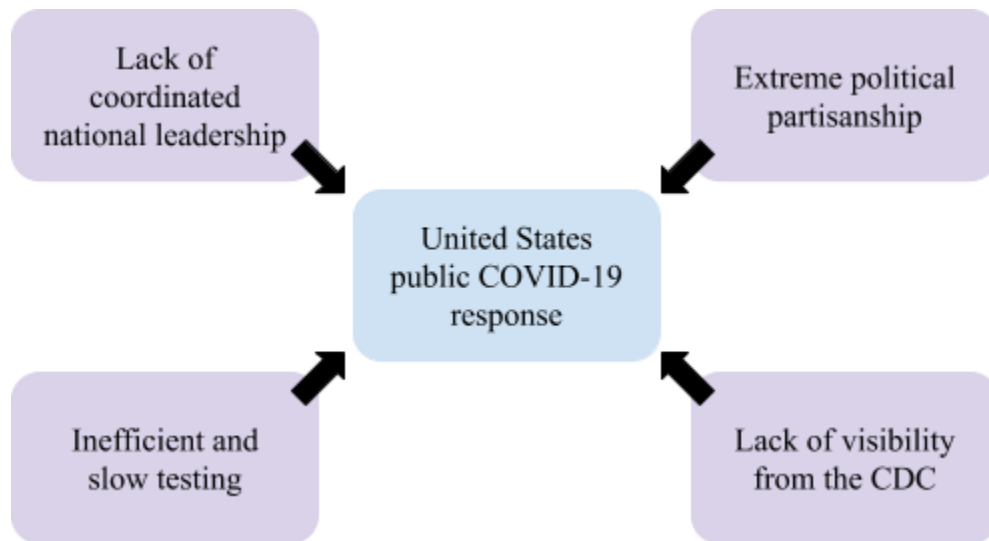


Figure 1: Major influences on United States public COVID-19 response. These influences have led to a dramatic variation in American individual's perceptions, reactions, and actions against COVID-19 (Garman, 2020).

Since before COVID-19 hit the United States in early 2020, the sitting president, Donald Trump, and the national government failed to act and prepare the American public (Lipton et al., 2020). Mr. Trump was told by trade advisor Peter Navarro on January 29th, 2020 about the potential risks of a pandemic, including half a million lives lost and trillions of dollars in economic losses (Lipton et al., 2020). Trump was warned again of the possibility of a pandemic the next day by Health and Human Services (HHS) secretary Alex M. Azar II, yet again did not take any measures to prepare the government or the public (Lipton et al., 2020). Trump also denied being told of the potential risks of a pandemic weeks later. It is well documented that in 2018 Trump's national security advisor John Bolton disbanded the Directorate of Global Health

Security and Biodefense and integrated some of its members into other departments of the National Security Council, but at the time of the COVID pandemic, there was no pandemic response team (Caldera, 2020). It is also important to note that the remaining members of this directorate remained primarily focused on Ebola, the original reason for this team's creation.

After much of the country had shut down and New York City had been hit particularly hard, the national government continued to fail, this time in the form of providing aid both in terms of funds and medical equipment (Lipton et al., 2020). Additionally, Trump did not recommend known preventative measures like social distancing until mid-March when the East Coast had been overcome with the virus. Many within the administration were primarily concerned with economic downturns, but despite these concerns, Republican-controlled Congress failed to pass sufficient economic relief (Lipton et al., 2020; Lopez, 2021).

On top of outward denialism and lack of action, Trump and Vice President Mike Pence suppressed the CDC from holding its own press conferences and releasing precautionary information (Lopez, 2021). This proved to be incredibly dangerous and politicized the CDC which is an apolitical organization.

This lack of coordinated national leadership trickled down to the state and local level as well. Without direction from the President and his administration, governors were left to make their own decisions about what to close and open up, leading to inconsistent efforts across the United States (Lopez, 2021). Without economic support, governors had to choose between public health and the economy, leading many to gamble on partial openings that ultimately led to thousands of lives lost and a struggling economy anyway. The failure of a cohesive, coordinated national response led to a continuous string of case spikes as well as an uncontrollable level of virus within the United States.

GROWING POLITICAL TENSIONS AND AMERICAN EXCEPTIONALISM

This lack of action from the American national government led to state governments to lead their individual COVID-19 responses, but it is not the sole reason for the American public's increasing distrust of science. Western cultures, like the United States, promote the idea of individualism whereas most other cultures promote the idea of interdependence, or a commitment to a collective good (Bavel et al., 2020). Because individualistic cultures value social expression of the self, including hugging, kissing, and direct argumentation, interpersonal transmission of COVID-19 is much more likely in individualistic cultures than interdependent cultures (Bavel et al., 2020). Knowing this, it is important US government leaders align American individual values with those of the collective and promote cooperation within the government to promote cooperation from the public. However, because of the increasing political divisions within the United States, the issues in the individualistic culture are exacerbated.

A study from the Pew Research Center in October 2020 found that the divide in economic attitudes between supporters and non-supporters of the party in power increased in the U.S. during the pandemic compared to other developed economies such as France, the UK, and Japan (Mordecai & Connaughton, 2020). When asked about the unity of the country due to the pandemic, both the supporters and non-supporters of the governing party in the U.S. concluded that the country was not more unified prior to the pandemic, whereas other countries found double digit increases in unity. Additionally, this study also reports that the U.S. was the only country in the study where nonsupporters felt their lives had changed as a result of the pandemic, compared to a non-statistically significant difference in the other countries sampled (Mordecai & Connaughton, 2020). These facts reveal that not only has the political division within the U.S.

influenced the government and public's pandemic response, but they also reveal that the pandemic has deepened political division within the United States, particularly with the economy.

As previously mentioned, these partisan differences are one of the largest factors contributing to the U.S. public's noncompliance with preventative measures. This statement is reinforced by a recent study in *Nature Human Behaviour*, which found that counties that favored Donald Trump over Hillary Clinton in 2016 practiced less physical distancing (Gollwitzer et al., 2020). This study specifically showed for every one percentage point increase in vote share for Donald Trump, counties were 0.11 percentage points less likely to practice physical distancing in terms of reducing visits of non-essential services and businesses. This staggering fact not only provides a statistical analysis of this partisanship's effect on COVID-19 preventative measures, but also highlights the large disconnect surrounding COVID-19 between parties in the U.S.

Tying in American exceptionalism, the idea that the United States is an inherent force of good in the world, many citizens and politicians refuse to follow precedents set by other countries in terms of pandemic response (Haiphong, 2020). This attitude further intensifies the issues of the United States' pandemic response and provides context for the influences on the public in Figure 1 on page 4.

THE ACTORS OF SOUTH KOREA'S PUBLIC HEALTH INFRASTRUCTURE

While American exceptionalism exacerbates political division and the failed pandemic response in the United States, the collective and interdependent mindset of South Korea is reflected in its healthcare system, highlighted in Figure 2. South Korea's healthcare system is divided into three branches: the National Health Insurance Program, Medical Aid Program, and Long-term Care Insurance Program (Song, 2009). The Ministry of Health, Welfare, and Family

Affairs (MIHWAF) is the agency responsible for directing and supervising these programs, as well as supervising health care facilities in their treatments. As of 2009, all people in South Korea are eligible for coverage under the National Health Insurance Program (Song, 2009). In 2006, over 96.3 percent of South Korea’s total population was insured. Although MIHWAF is responsible for supervising this program, the management and enrollment of citizens is delegated to the National Health Insurance Corporation. A third agency is involved in this program, the Health Insurance Review Agency, which is in charge of reviewing medical fees prior to the National Health Insurance Corporation’s reimbursement of the claim (Song, 2009). The Medical

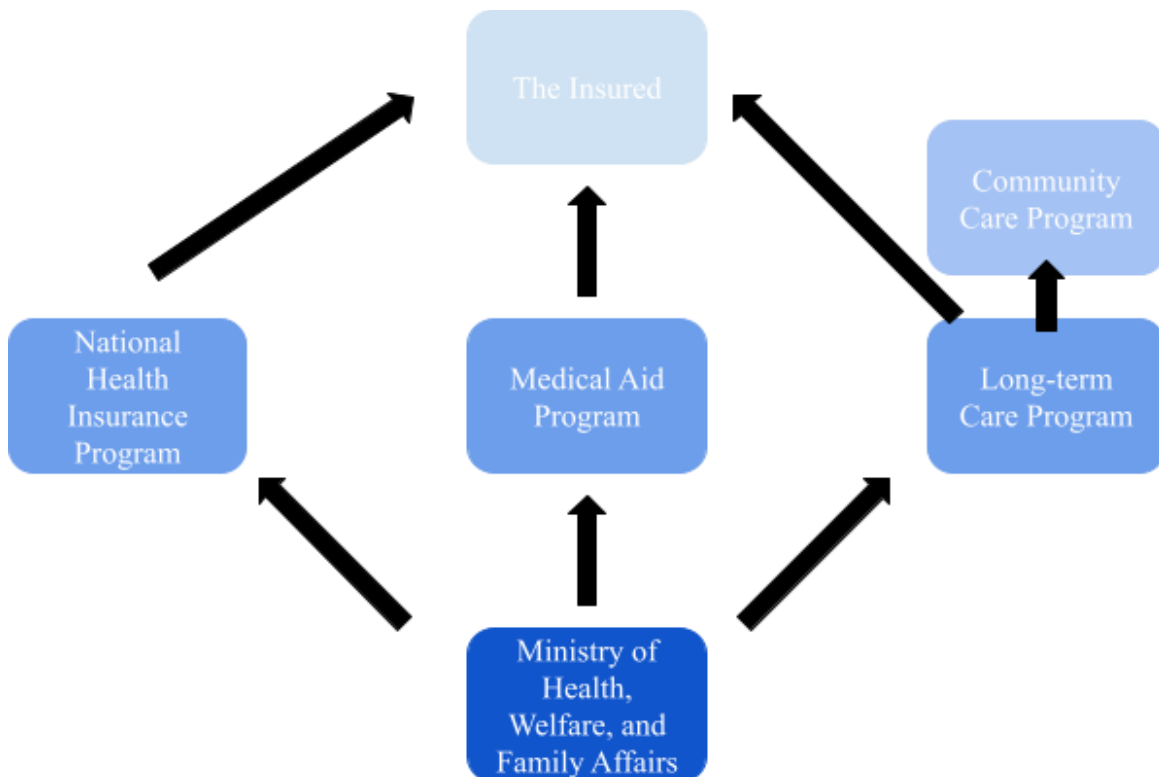


Figure 2: Overview of South Korean healthcare system. Key actors and actants in this network include the Ministry of Health, Welfare, and Family Affairs, the Insured, and the three insurance programs (Garman, 2020).

Aid Program was established in 1979 for low-income households and covers roughly 3.7 percent of the population (Song, 2009). In 2009, the government had difficulties covering these medical services and restructured the National Health Insurance Program to cover some of these

expenses. This program was jointly funded by local and central governments, but after the restructuring is now partially funded by the National Health Insurance Program.

The Long-term Insurance Program was created in 2008 to cover expenses for the elderly who have conditions that impact their daily lives, such as Parkinson's or Alzheimer's (Song, 2009). A distinct facet of this program in South Korea specifically is the designation of certain hospitals for long-term care (Ga, 2020). Despite being created through the Long-term Insurance Program, most of the coverage at these hospitals is the National Health Insurance compared to nursing homes where the primary coverage is long-term care insurance. The long-term insurance program worries the Korean public due to the fact that South Korea is becoming an aging society faster than any other country (Song, 2009). With an increasing elderly population comes with an increase in spending on chronic degenerative diseases that the younger generations will have to pay for unless there is significant comprehensive health care reform. As of September 2020, it was expected that the cumulative reserve fund of long-term care insurance would run out by 2022 (Ga, 2020). The MIHWAF announced a new plan for Community Care Coverage that would be implemented in three stages: trial implementation and design of coverage system (2019-2022), construction of community care provision (by 2025), and widespread implementation of community care services (after 2025). These integrated community services would relieve nursing homes and long-term care hospitals of the burden of an aging population, switching care to more in-home and out-patient services.

Through the outlining the insurance system and a few key agencies involved in the public health structure of South Korea, it is clear that South Korea adapts its infrastructure as quickly as possible to serve its public. Further analysis will be conducted later in the paper, specifically in

comparison to the United States's infrastructure, but it is important to highlight the adaptability of the South Korean system.

THE PUBLIC HEALTH NETWORK OF THE UNITED STATES

The United States Public Health Service is comprised of six central agencies: (1) Centers for Disease Control; (2) the National Institutes of Health; (3) the Food and Drug Administration; (4) the Health Resources and Services Administration; (5) the Alcohol, Drug Abuse, and Mental Health Administration; and (6) the Agency for Toxic Substances and Disease Registry (Health, 1988). However, the main federal agency for public health is the Department of Health and Human Services (HHS) . While the Secretary of HHS is a key actor in the US public health network, the Surgeon General is another important actor who acts as an advisor to the President and the secretary of HHS. Several nonprofits such as the American Heart Association, the American Cancer Society, the Alzheimer's Disease and Related Disorders Association, and the American Diabetes Association serve as actors sponsoring research, developing policy, and exchanging information involved in public health as well (Health, 1988). It is important to note that while the Secretary of HHS is in the Presidential cabinet, heads of the CDC and NIH are not.

However, due to the political tensions and extreme partisanship outlined above, science and public health have become incredibly polarized political issues in the US. Because healthcare has become so polarized, both Democrats and Republicans in Congress are incredibly inefficient at passing healthcare legislation despite campaign promises of lowering prescription drug prices and addressing the opioid crises on both sides of the aisle (Connolly, Nadella, & Grande, 2020). Additionally, the US spends twice as much on healthcare as the average Organization for Economic Co-operation and Development (OECD) country, yet has the lowest

life expectancy out of the OECD countries (Osborn, Squires, Doty, Sarnak, & Schneider, 2016), again highlighting the inefficiencies of the American healthcare system.

One of the greatest differences between the South Korean and American public health infrastructures is the lack of universal healthcare within the United States (Perkins, n.d.). The passage of the Affordable Care Act (ACA) in 2010 was the most significant advancement towards universal healthcare in the US since Medicare and Medicaid over 50 years ago. The ACA provided premium supports for lower income brackets and barred healthcare providers from refusing coverage due to preexisting conditions. The ACA lowered the uninsured rate from 16 percent in 2010 to 9 percent in 2016. However, Trump and his Republican colleagues aimed to repeal the ACA without replacing it. This lack of standardized healthcare plan for all US citizens has contributed to inequalities in treatment in healthcare, which has been especially exposed during the pandemic. Comparing this system to that of South Korea's highlights how democratic countries can still provide socialized medicine to its citizens without degrading the integrity of the democratic government.

SCIENCE IN GOVERNMENT: THE KEY IMPROVEMENT

The largest difference between the public health networks of South Korea and the United States is the incorporation of science at the federal level in the government. Due to the iterative and adaptive nature of South Korea's public health infrastructure, the national government restructured the KDCA again in September 2020 to make the head of the agency a member of the Presidential cabinet to better combat COVID-19 and future outbreaks and plans to restructure the KDCA again after the pandemic ends (S. Lee, n.d.). The flexibility of South Korea's government to assess and restructure its public health agencies has led to the country's success in handling of COVID-19 in addition to the community mentality of the public. Although the

Secretary of Health and Human Services is a member of the Presidential cabinet in the US, heads of national research agencies like the CDC and National Institutes of Health (NIH) are not (“The Cabinet | The White House,” n.d.).

Recently, President Biden appointed geneticist Eric Lander to serve as director of the Office of Science and Technology and scientific advisor, a new addition to the Presidential cabinet (Borenstein, 2021). Lander is the founding director of the Broad Institute of MIT and Harvard and is the lead author of the first paper detailing the human genome. While this new addition is promising, more needs to be done to incorporate existing agencies like the CDC and NIH into policy making. However, the preservation of these scientific agencies as apolitical is crucial to preserving their legitimacy. Science is increasingly being weaponized and polarized in American politics to undermine an argument rather than incorporating it into policy, which increases the American public’s distrust of science in general (Sciences et al., 2015). Establishing that trust of science from an early and deep level through education and increased access to science across the country would not only allow an improved public perception of science, but would also allow politicians to work with scientists to make more informed decisions.

It is impossible to analyze these networks without discussing technological citizenship and literacy. When technology involves public spaces, technological citizenship and literacy are civic duties (Andrews, 2006). In this analysis, it is clear that this is fundamentally understood and recognized in South Korea’s network. While the population may be on differing levels of understanding, the collective understanding of this duty has led to South Korea’s success in

handling COVID-19. Conversely, this collective lack of understanding in the US at both the public and federal level has culminated in the US's failure in handling COVID-19.

The key recommendation in addressing the United States's COVID-19 failure is greater accessibility to science. Learning more about mRNA and how infection or vaccines work would allow the American public to be informed in their decision making and more likely to listen to necessary public health measures. However, this also needs to be addressed at the level of the federal government through the incorporation of science in policy making, potentially through incorporating the heads of the CDC and NIH into the presidential cabinet, while maintaining the necessary apolitical nature of the science. While South Korea is a great case study to improve the healthcare network of the United States, comparison to other democratic countries might highlight gaps within both of these networks as well. Additionally, as highlighted in the analysis, there are still some challenges within the South Korean public health network. Overall, there is much to be learned from the COVID-19 pandemic in the US, and comparing the US's network to other countries like South Korea highlights the gap in our policy, decision-making, and institutions.

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