

Federal Agencies and Governmental Partnerships in Public Health Emergency Management:

Implications for Continued COVID-19
Preparedness and Response



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Abstract

The novel coronavirus disease (COVID-19) has tested the global governmental and public agency response to pandemic emergencies with regard to a number of areas. This essay focuses on major agency involvement in the United States as well as relevant historical comparisons to highlight important aspects of our current challenges in mitigating the COVID-19 pandemic. Analysis of previous pandemics including both domestic and international response inform our suggested best practices for public agency involvement in ongoing pandemic operations in the United States and abroad.

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Introduction

Since being first recognized in December 2019 and declared a global pandemic on March 11, 2020, by the World Health Organization (WHO), the 2019 novel coronavirus disease (COVID-19) outbreak has caused severe damage in terms of human life, healthcare systems, and the economy both in the United States (U.S.) and around the world. In the United States alone, the death toll has surpassed 500,000 as states forge ahead with reopening to continue the economic recovery process and ease social unrest. COVID-19 represents the latest of several disease outbreaks that have afflicted society in the 21st century, including SARS-CoV in 2003, H1N1 Influenza in 2009, and MERS-CoV in 2012. While COVID-19 is structurally related to other coronaviruses causing severe acute respiratory syndrome (SARS) in SARS-CoV and MERS-CoV, there is substantial evidence of significant differences from these previous outbreaks, including a further delayed onset of symptoms, which has led to increased transmission.¹ Undoubtedly, COVID-19 continues to be one of the most formidable public health challenges in recent history.

An abundance of literature has been written about the importance and impact of monitoring, travel restrictions, social distancing, and other mitigation strategies to reduce community transmission of COVID-19.² Generally, pandemic preparedness in the U.S. has centered on the four pillars of surveillance, vaccine delivery, communication and coordination, and emergency response.³ A study analyzing how our pandemic preparedness has evolved since the 1918 Flu Pandemic points to far advanced capabilities in each of those four pillars in the U.S. through the Centers for Disease Control and Prevention (CDC).⁴ However, these capabilities have been tested severely in the U.S., given critical supply shortages of personal protective equipment (PPE) and ventilators, sub-optimal testing rates, and knowledge gaps in the critical care setting to treat the disease.⁵ While there is uncertainty and unpredictability regarding the presence and severity

of a second wave, there is a consensus that the U.S. must be better prepared for future events, including continued surveillance, risk mitigation, vaccine development, serologic testing, and general healthcare preparedness.⁶

A key identified emergency management area and effective pandemic response is the interplay between federal, state, and local governments, along with their respective supporting agencies. This collaborative dynamic is an inherent concept within the discipline of public health. A fundamental difficulty governments and public health agencies face when dealing with infectious disease outbreaks is the need to adjust human behavior, such as through effective communication and public health messaging.⁷ Over the past few decades in the U.S., the federal government has recognized that successful pandemic response relies on well-prepared state and local governments, providing an impetus for increased federal funding to state governments for state-specific pandemic planning.⁸ Through this model, it is believed that state and local governments might be better able to influence the necessary behavior change.

Coordinated federal and state planning has yielded many effective programs in the U.S. In the 2009 H1N1 response, the CDC administered funds to all 50 state health departments and additional localities in the form of the Public Health Emergency Response (PHER) grant, which was reported to have increased partnership strength and response efficacy.⁹ The CDC quickly mobilized resources through its International Reagent Resource to public health laboratories across the U.S. for virus surveillance.¹⁰ Additionally, coordinated case reporting between state health departments and the CDC improved H1N1 national surveillance.¹¹ It has been noted in the 2009 H1N1 response that federal officials relied on state and local health officials to encourage people to get vaccinated, given their credibility within their locales.¹² Another potential mechanism that may contribute to better outcomes in such collaboration and partnerships is the informal networks accompanying interagency coordination that promotes effective public health preparedness.¹³ Of course, sharing institutional knowledge as it pertains to coordinated public health emergency response is helpful as well.

This essay seeks to explore key federal agency actions and government partnerships and lessons learned from both past pandemic responses in the United States and the initial response to COVID-19 worldwide. Our objective is to further the literature that asserts federal, state, and local government and agency partnerships strengthen the pandemic response. In doing so, we hope to provide insight into avenues for improved preparedness for potential events in the coming months and years, such as mitigation of COVID-19 recurrences and future pandemics.

Preparing for the “Next” Wave

Previous pandemics are consistently characterized by a pattern of successive waves of disease, each with a varying impact.¹⁴ An examination of the A/H1N1 pandemic from 1918 to 1919 reveals that an initial low mortality wave in the summer of 1918 preceded the catastrophic wave of the fall of 1918.¹⁵ The initial wave of the A/H2N2 influenza pandemic occurred in the fall of 1957 and was followed by a second wave in the winter of 1959 as well as a third wave in the winter of 1962.¹⁶ Further, the three waves showed almost equivalent mortality.¹⁷ This pattern is documented again during the 1968 A/H3N2 pandemic, which had a mild herald wave during the

winter of 1968 that was followed by a severe second wave in the winter of 1969.¹⁸ Lastly, during the first year of the 2009 H1N1 pandemic, the USA experienced two waves of influenza - one in the spring and one in the fall.¹⁹ We have already experienced multiple waves and recurrences of the COVID-19 pandemic, with public health officials worldwide being wary of future outbreaks.

Based on our review of previous pandemics, it is likely that actions taken during the initial COVID-19 crisis by public health agencies, along with federal and state governments, dictate the severity of subsequent waves. The occurrence of multiple waves throughout previous pandemics underscores the need for action on a global scale in the form of case monitoring. International cooperation and partnership are vital for exchanging medical information that could lead to better treatment methods and help to identify the best population-based strategies to mitigate the severity of future waves of a pandemic. Further, international collaboration continues to facilitate vaccine development, perhaps the most powerful tool to prevent mortality from additional pandemic waves. For example, most of the deaths in Europe and Asia would have been prevented during the A/H3N2 pandemic had an effective vaccine been available one year after the initial wave.²⁰

While the exact cause of different pandemic waves requires further investigation, we speculate that one source could be the disease's public perception. Often after the initial wave of a pandemic, the perceived threat of disease diminishes substantially. For example, acceptance of the H1N1 vaccination lacked in the fall of 2009 among certain healthcare providers and personnel. Later in December of 2009, during the second wave of H1N1, much of the U.S. population remained unvaccinated despite an ample supply.²¹ Healthcare professionals, public health agencies, and the government must decide if it is worthwhile to press the issue of pandemic preparedness. Subpar vaccination rates, declines in disease-mitigating behaviors such as social distancing, and new disease strains are worrisome for COVID-19 recurrence.

CDC EOC and Identification of Infectious Disease Outbreaks

The United States Center for Disease Control and Prevention (CDC) is one of the Department of Health and Human Services' major operating components. During a public health emergency, the CDC works directly with both state and local health officials. Not only does the CDC provide guidance on how to proceed in the given situation, but they also send people to help with field activities. When the situation calls for an agency-wide response with centralized management, the CDC manages its response from a central location known as the CDC Emergency Operations Center (EOC).²² To date, the EOC has responded to over 60 public health threats.²³ To coordinate responses to various public health emergencies, the CDC EOC utilizes the National Incident Management System (IMS). An IMS is an internationally recognized model that can be used to respond to emergencies.²⁴

The EOC is the central point of contact for reporting public health threats and supports the Secretary's Operations Center (SOC) of the U.S. Department of Health and Human Services (HHS).²⁵ The SOC's overarching goal is to protect the health, safety, and security of the country.

They accomplish this by serving as the main center for the collection of both public health and medical information. The SOC then analyzes and shares this information with the public.²⁶

The CDC played a major role in response to the 2009 H1N1 pandemic. This pandemic originated in the United States before spreading to other countries. The CDC approximated that from April 12, 2009, to April 10, 2010, there were 60.8 million H1N1 cases, 274,304 hospitalizations, and 12,469 deaths in the U.S.²⁷ The first two patients infected in the U.S. were living in California and were identified through laboratory testing at the CDC on April 15th and 18th of 2009. The CDC worked rapidly with various health officials to trace both patients' contacts to determine where each patient contracted their infection. Just a few days later, the CDC activated its EOC to initiate a robust response to this clear threat. Following this, the U.S. Government declared a nationwide public health emergency. In response, the CDC started to release supplies from the Strategic National Stockpile (SNS) that would be helpful in the fight against influenza.²⁸

A similar timeline of events occurred with COVID-19. On January 19, 2020, a man arrived at an urgent care clinic in Washington state. His presenting complaint was a history of cough and fever for around four days. Additionally, he reported that he recently traveled to China. Given the presenting situation, the urgent care clinician and Washington Department of Health immediately notified the CDC Emergency Operations Center, and specimens from the patient were collected and sent to the CDC. The very next day, the CDC reported back that the patient's swabs tested positive for 2019-nCoV.²⁹ In response to this, the CDC activated its EOC.³⁰

Despite the CDC's initial robust actions in identifying the novel coronavirus disease, top health officials around the country agree that the CDC's response throughout the rest of the pandemic could have been better. In an interview with the *New York Times*, Dr. Ashish Jha, the director of the Harvard Global Health Institute, stated that the CDC is "no longer the reliable go-to place."³¹ This is likely because the CDC was using outdated technology in conjunction with a subpar public health reporting system. The CDC's current and former employees also claim that the Division of Viral Diseases, the group within the CDC responsible for the first phases of the response, was understaffed and not as experienced in communicable pulmonary infections.³² However, it is essential to remember that the CDC is just one of many players handling the global emergency. Therefore, not all blame for the pandemic's ongoing nature in the U.S. can be placed on them. The strained relationship between the U.S. federal government and the CDC undoubtedly made it more difficult for the country to contain the pandemic effectively.

FEMA's Response to COVID-19

The Federal Emergency Management Agency (FEMA) of the United States Department of Homeland Security is in charge of preparing the nation before disasters occur, managing resources during disasters and coordinating recovery in their wake. A pandemic presents a unique challenge for FEMA, as it usually faces disasters that are less expansive in scope and scale, such as hurricanes, wildfires, and earthquakes.³³ These are usually limited to specific regions of the nation, whereas the COVID-19 pandemic has left no part of the country unscathed.³⁴ When President Trump invoked the Stafford Disaster Relief and Emergency Assistance Act on March 13, 2020, in response to the COVID-19 pandemic, FEMA was brought

to the center of the federal pandemic response.³⁵ The Stafford Act was previously invoked by President Obama in response to the H1N1 outbreak of 2009, but as it turned out, much less was required of FEMA at that time than has been required in response to COVID-19 due to the relative severity of each pandemic, respectively.³⁶

The COVID-19 pandemic has created critical shortages of medical supplies, such as personal protective equipment and ventilators.³⁷ One source of emergency medical supplies is the Strategic National Stockpile (SNS), which HHS manages. In response to the COVID-19 pandemic, the SNS has delivered over 12,000 tons of cargo to states in need.³⁸ However, the SNS has not met the demand for supplies sufficiently, as it was not originally conceived to meet a threat of this scale.³⁹ Expanding the SNS to respond to a nationwide shortage of medical supplies effectively may be necessary to prepare for future pandemics adequately.

In responding to the COVID-19 pandemic, FEMA's primary role has been to alleviate supply shortages. The Supply Chain Stabilization Task Force was created to do so. The task force's proposed activities were based on a four-pronged approach: 1) preservation of current medical supplies, 2) acceleration of manufacturing, 3) expansion of the medical supplies industry, and 4) data-driven allocation of resources to the areas that need them most.⁴⁰ This task force has yielded some genuine successes, such as Project Airbridge, which organized over 200 flights containing PPE shipments between March 29 and June 18, 2020. At that point, the project was phased out due to the apparent stabilization of the supply chain.⁴¹

Another aspect of FEMA's role during emergencies is coordinating between government entities,⁴² but coordination between states and the federal government has proved to be a challenge for FEMA during COVID-19. Given the greater scale of the COVID-19 pandemic than the usual disasters that FEMA is tasked with, FEMA's ability to coordinate effectively with states may have been strained. While FEMA has striven for a whole-of-America response,⁴³ it has at times fallen short of that goal. In a time of shortage, the federal government's role should be to coordinate offers to suppliers to avoid bidding wars and price gouging. This is consistent with FEMA's mission to coordinate the national response to crises.⁴⁴ However, FEMA's failure to cooperate with states has resulted in states bidding against each other, and occasionally against FEMA itself, for critical supplies, according to state and local officials.⁴⁵ FEMA has been inconsistent in this response, sometimes commandeering deals that have been made independently by states. Governors in Connecticut, Michigan, Maryland, and New York have all called for FEMA to better coordinate supplies based on need and end competition between states and the federal government to secure critical resources.⁴⁶ In California, FEMA reportedly seized a shipment of supplies while it was going through customs, according to San Francisco Mayor London Breed.⁴⁷ These practices have led some states, like Colorado, to make their private deals for fear that FEMA will swoop in and undercut their offer.⁴⁸ For its part, FEMA has denied any seizure of supplies from states.⁴⁹ However, FEMA acknowledges that it has used its power of priority in making deals with suppliers, granted by the Defense Production Act (DPA).⁵⁰ This authority is consistent with FEMA's mission to coordinate the federal response. Unfortunately, the federal government's mixed messaging has impeded our ability to reach the goal of a whole-of-America response. When questioned in March about his hesitation to use the full extent of the DPA at that time, President Trump laid the responsibility to secure resources on states themselves, suggesting that the federal government's role should be as limited as

possible.⁵¹ This message, taken with FEMA's actions only weeks later using the DPA's authority to step in ahead of states to secure private contracts, has caused confusion and distrust. One of the critical lessons learned from the COVID-19 pandemic is that cooperation, coordination, and communication between all government levels are necessary for an effective response.

Vaccine Production and Distribution

Medical countermeasures are crucial to the governmental and public health response to manage pandemics, and vaccines are the most effective medical countermeasure to combat the spread and health impact of an infectious disease pandemic.⁵² Given the successful development and production of multiple COVID-19 vaccines, rapid and widespread vaccine distribution is now a primary challenge in COVID-19 response.

Historically, prophylaxis with vaccines and other antiviral medications was wildly unsuccessful during the 2009 influenza pandemic.⁵³ Despite the HHS's \$1 billion allocations of funds in May 2009, the availability of H1N1 vaccines was too delayed to limit the virus's spread effectively.⁵⁴ In the 2009 pandemic, the U.S. government distributed antiviral medications and vaccines through the Strategic National Stockpile (SNS).⁵⁵ A tactical optimization model for distributing the stockpile during a pandemic was proposed based on the antiviral medications but can be applied to any pandemic policy model.⁵⁶ The simple SNS distribution plans, such as releasing a fixed quantity each month from the stockpile to states proportional to each states' population size, were optimal for mitigating the virus's spread and effects.⁵⁷ However, this is most likely attributed to influenza's mild contagious effect, whereas more contagious strains, such as COVID-19, will require additional courses from the Federal SNS and more optimal policies to include greater-quantity early releases.⁵⁸

An effective production and distribution plan will be crucial in combating re-emergence of COVID-19. Rapid, efficient, and equitable vaccine distribution will be critical in reducing morbidity and mortality and ameliorating the harmful effects on social functioning and essential services.⁵⁹ In 2009, H1N1 vaccines were shipped directly to vaccination provider sites (public and private) from the central distributor.⁶⁰ States then deployed various distribution plans via a combination of state and local public health authorities, private healthcare providers, and pharmacies.⁶¹ While some states relied on local health departments for distribution, others received all of their vaccine supply and coordinated the physical distribution to vaccine provider sites without partnerships with various agencies.⁶² The heterogeneity in distribution plans was reported to have caused communication challenges, especially in the states where each local health department deployed a unique distribution plan.⁶³ Given limited quantities of the COVID-19 vaccine, priority groups and allocation plans to state distribution centers need to drive efficient distribution.⁶⁴

The current CDC Pandemic Vaccine Program, which is scalable to distribute nearly 900 million doses, consists of CDC distribution from vaccine manufacturers to public and private healthcare providers, who can then transport vaccines to clinical sites for immediate use.⁶⁵ This program uses national, regional, state, and local vaccination covering monitoring to tailor communications among states and distribution patterns to meet specific needs.⁶⁶

In past pandemic management efforts, many state-level immunization programs collaborated with state emergency preparedness programs while using incident command structures (ICS) and emergency operation centers (EOC).⁶⁷ The federal government encourages states' use of ICS and EOC operations. Both have been proven to help the organization of personnel and resources, particularly in the 2009 H1N1 vaccination campaign.⁶⁸ According to a survey conducted by Chamberlain et al., more than three-quarters of immunization program managers, used an ICS, and about half utilized an EOC to manage vaccine distribution.⁶⁹ The majority of participants agreed that the use of ICS helped them work effectively with their emergency preparedness collaborators.⁷⁰ Immunization managers stated that the use of previous pandemic influenza plans provided a crucial framework for carrying out the immunization campaign operations and providing the campaign with previously established affiliations with hospitals and federally qualified health centers, both of which are central to the campaign objectives.⁷¹ Prior collaboration among state-level immunization programs and emergency preparedness programs was also regarded as beneficial in the mass vaccination campaign, indicating that inter-program exercises of responding to real-life events may contribute to future successful collaborations.⁷²

Perhaps the most valuable organizational tactic used in the H1N1 pandemic was immunization information systems (IIS) or vaccine registries. The use of IIS assisted in tracking vaccine coverage rates, the registration of non-traditional vaccine providers, sending communications out to providers, and tracking recalled influenza vaccines.⁷³ Fifty-seven percent of immunization program managers who utilized IIS and had the capability of registering non-traditional vaccine providers rated this function as beneficial to the campaign.⁷⁴ Fifty-nine percent of immunization program managers who utilized IIS and had the capability of pushing communications out to providers rated this function as beneficial to the campaign.⁷⁵ While both functionalities are crucial in distributing a mass quantity of vaccine in an urgent situation, 40% of IIS reported that they were unable to facilitate either action.⁷⁶ Enabling more IIS with these capabilities would significantly improve the vaccine distribution efforts soon. Vaccine data gathered by IIS is also integral to the management of vaccines. A CDC survey analyzing the H1N1 pandemic determined that a large number of vaccines were never administered to patients (20% of distributed doses to NYC providers were returned).⁷⁷ Vaccine data can help the U.S. Department of Health adjust the vaccination distribution plan in certain areas to ensure the demand is met across a diverse population.⁷⁸

Lastly, the 2009 CDC H1N1 Vaccine Pharmacy Initiative proved to play an important role in the vaccination efforts. In conjunction with the Association of State and Territorial Health Officials (ASTHO), the CDC distributed vaccines directly to pharmacies to assist in the state vaccination campaigns.⁷⁹ Approximately 10% of adults who received a vaccine during the 2009 pandemic reported getting vaccinated at a pharmacy.⁸⁰ As part of the response to COVID-19, the HHS has partnered with national pharmacy and grocery retail chains including CVS, Rite-AID, Walgreens, and Walmart as a part of the Community-Based Testing Program to provide convenient COVID-19 testing available to Americans.⁸¹ This partnership has created more than 600 COVID-19 testing sites across the country, including 48 states and the District of Columbia.⁸² The accessibility of community pharmacies makes them a popular location for COVID-19 testing and is often the first encounter with a healthcare professional for many Americans seeking care. This public-private relationship is a method to leverage the private sector's power to

continue to provide convenient access to testing, which can help slow the spread of COVID-19 in communities across the country.⁸³ Utilizing pharmacies increased the accessibility of vaccines at a community level. Their contribution to national, regional, and local storage and distribution can be used with large-scale administration of vaccines, which will most likely be required to combat COVID-19.

Governmental Responses to COVID-19 Worldwide: South Korea Case Study

As COVID-19 spread worldwide, South Korea had one of the highest initial case-loads, yet relatively quickly reduced its incidence and mortality rates to impressive numbers during a time where these numbers trended on an upward trajectory globally.⁸⁴ Being both geographically close to the accepted source of the virus and having a high population density, South Korea and its success in COVID-19 provides a valuable case study of government responses to pandemics that work and *why* they work.

South Korea's response to COVID-19 is primarily due to successful and preventative efforts not to repeat the past. In 2015, the MERS outbreak in South Korea highlighted the inadequacy of governmental and public health pandemic policies and preparation with subsequent consequences; 186 confirmed cases, 38 deaths, nearly 17,000 people quarantined to control transmission, and an economic impact valued at 8.7 billion U.S. dollars.⁸⁵ Following recovery, the Korean CDC (KCDC) and other government agencies faced fierce public outcry at their actions or lack thereof to identify the apparent cracks in the country's response and propose ways to rehabilitate them.⁸⁶ Modifications made focused on improving healthcare and government infrastructure to better handle pandemics in the future. Broadly, these changes included mitigating super-spreader events more effectively, particularly in the hospital setting which was primarily responsible for the spread of MERS, providing adequate supplies and facilities for hospitals to manage the infectious disease and appropriate isolation precautions, increasing the capacity to test individuals and subsequently isolate persons with positive test results, increasing public and private sector collaboration avenues to maximize a coordinated response, and maintaining thorough contact tracing of positive patients and families.⁸⁷ Also, particular emphasis on aggressive quarantine strategies was recommended, especially in healthcare settings.⁸⁸ These efforts to improve pandemic response were ultimately tested in early 2020 with the advent of COVID-19.

South Korea's government launched an organized, coordinated response to COVID-19 centered on a foundation of high-volume testing and detailed contact tracing for containment. This was bolstered by aforementioned efforts to make hospitals better equipped to handle infectious disease after the 2015 MERS outbreak. The United States' response was also centered on testing and contact tracing to mitigate COVID-19. However, the U.S. was slower in development and implementation, greatly handicapping its ability to address the continual threat of the pandemic.⁸⁹

In South Korea, public and private partnerships were deployed early on to develop large quantities of testing kits and ensure their subsequent expedited approval for federal agencies' use.⁹⁰ This proved beneficial, as South Korea outpaced many countries in testing early on, testing over 300,000 individuals in just over two months from their first confirmed case.⁹¹ To accomplish this, South Korea pioneered the use of remote testing locations, including drive-through and walk-through testing sites, to ensure ease of test access for the masses while also minimizing overflow in hospitals and emergency departments.⁹² Initially in the U.S., the general population required specific need or suspicion to get tested for COVID-19 given limited supply of testing kits and a lag in governmental approval time for various tests.⁹³ This limitation of supply was not unique to the United States but was detrimental to early response efforts.

Contact tracing was another integral element to the South Korean governmental response to COVID-19. Contact tracing applications allowed for detailed real-time information for health officials and citizens. In contrast to the MERS 2015 pandemic, where health information was primarily kept private in South Korea, more detailed accounts of known and unknown cases, including gender, age, and location, were disseminated to public health agencies and citizens daily.⁹⁴ For public health agencies, this provided a means through which evidence-based, epidemiological analysis could be done to determine the efficacy of efforts and tailor the policy approach based on findings. For citizens, this helped ensure they were well-informed and equipped to make the changes necessary at home to minimize spread via physical distance maintenance or other routes. Citizens could opt to allow the government to track their movement via GPS and credit card records to provide accurate tracing as well, and many did.⁹⁵ Perhaps more South Koreans were willing to do this given their recent experiences with MERS in 2015.⁹⁶

South Korea provides a prime example of government response modification, government response success, and the importance of citizen involvement and commitment to realizing governmental responses. It also opens the door to further discussion on public-private sector collaboration, the use of technology in engaging and employing citizens as critical players in national and international efforts, and other elements such as patient privacy during a pandemic.⁹⁷ While some parts of South Korea's response are more accessible in implementation or incorporation there as opposed to in the United States due to political climate, citizen sentiment, and some health system differences, significant lessons can be learned, and policies took and catered to the United States political climate to be effective here as well.

Lessons Learned and Implications for Future COVID-19 Response

The novel coronavirus disease (COVID-19) outbreak has resulted in millions of fatalities, upended the global economy, and tested worldwide governmental policies, plans, and procedures for pandemic preparedness and response. In this essay, we have sought to emphasize the significant agencies in the U.S. government's response to pandemics, highlight important aspects of our current challenges in mitigating the COVID-19 pandemic, and propose how state and federal government collaboration might best solve these challenges. By analyzing the U.S. response to previous pandemics and a case-study comparison between the

United States and South Korean governmental responses to COVID-19, we hope to provide a foundation on which governmental agencies can best act, collaborate, and cater their response for maximum efficacy during such unprecedented times.

COVID-19 has highlighted key departments and institutions within the United States government that play vital roles in a coordinated state and federal response to a pandemic. The CDC has been crucial in the U.S. response to COVID-19 and previous pandemics. Their role in identifying disease outbreaks and activating the EOC is vital in slowing disease spread at the onset of an outbreak. In the future, improvements in their technology and increases in staffing and resources will improve the CDC's ability to respond effectively to emergent situations such as COVID-19. While normally responding to national disasters of a different nature, FEMA continues to play a key role in mitigating pandemics by coordinating federal and state government responses and allocating supplies appropriately. COVID-19 has highlighted shortcomings in FEMA's response. This essay makes recommendations to address these shortcomings, including the expansion of the Strategic National Stockpile (SNS), locating and acting on supply source delays proactively and aggressively, and addressing issues in cooperation, coordination, and communication that have been insufficient in the United States' handling of the coronavirus pandemic.

Two key barriers to resolving the coronavirus include the development and distribution of an effective vaccine and the looming potential for continued virus resurgence. Through extensive analysis of past large-scale vaccination efforts in the U.S., we have developed several key aspects to keep in mind during production and dissemination efforts of an effective SARS-CoV-2 vaccine. These include continued partnerships to foster financial support between the public health sector and biotechnology industries, effective planning for vaccine distribution, prioritization of at-risk population groups, and a plan for adequate record-keeping and reporting of vaccine data to state and federal health departments to ensure vaccination plans are modified to evolve with the populations' changing needs. As the federal and state governments prepare for the subsequent waves of COVID-19, we propose initiatives that will best help mitigate its severity, including global-scale case monitoring, international cooperation and partnership in all aspects of the pandemic response, attention to the role of citizens in pandemic preparedness with particular emphasis on non-medical interventions like social distancing, and continued support of vaccination initiatives in production and distribution.

The COVID-19 pandemic has called upon governments worldwide to be proactive, adaptive, and assertive in an unprecedented manner. How individual governments have chosen to do this has varied significantly and this provides the opportunity for the United States to compare observations and strategies as it continues to mitigate COVID-19 and bolster pandemic preparedness moving forward. As a democratic country deemed successful in its COVID-19 mitigation efforts, South Korea serves as an important case study for the U.S. A key takeaway is the importance of harnessing citizen sentiment and involvement and the science of human behavior in planning pandemic response policies. This comparison with South Korea also raises questions regarding the federal government's ability to fast-track processes through public-private partnerships, our nation's HIPAA privacy laws during times of crisis, and the unique challenges and implications posed by economic and political systems.

The United States' governmental response to pandemics at both the state and national level is vast and intricately complex. We hope to continue the conversation on this response model's essential aspects as we move forward in our mitigation efforts for the COVID-19 pandemic and future pandemic preparedness.

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