

VIEWPOINT

COVID-19: BEYOND TOMORROW

From Mitigation to Containment of the COVID-19 Pandemic
Putting the SARS-CoV-2 Genie Back in the Bottle

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Editorial

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As part of pandemic preparedness, epidemiologists promote “containment strategies” designed to prevent community transmission. For coronavirus disease 2019 (COVID-19), countries like South Korea—an example of successful containment—had a coordinated governmental response, testing on a massive scale, and prompt contact tracing and quarantine.¹ The first cases of South Korea’s COVID-19 outbreak were in mid-January; by late February, South Korea was testing more than 10 000 people daily and, as a result, cases peaked on February 28. Since April 5, 2020, no more than 53 new cases daily have occurred nationwide.¹

When disease outpaces containment, countries rely on “mitigation strategies.” Countries like China, Italy, Spain, and the US moved from containment to mitigation, albeit at differing paces. Mitigation relies on nonpharmaceutical interventions such as hand hygiene, travel restrictions, school closures, and social distancing. While a blunt and inconvenient tool, social distancing has proven in pandemic influenza (in both 1918 and 2009) to reduce and delay peak attack rates and mortality.^{2,3}

When Does Normalcy Return?

Important in answering the “when” of returning to normalcy is to acknowledge that the US has not had a uniform COVID-19 experience or response. As of April 13, the US epidemic has disproportionately affected New York City, accounting for nearly 40% of cases with more than 1100 infections per 100 000 population to date; a “return to normal” there will necessarily be different than in more diffusely populated areas, such as Texas where the rate of infection is 45 per 100 000.⁴ Indeed, COVID-19 has surged over the country from the “outside in,” and each state has differentially implemented “shelter in place.” As such, projected peaks in reported cases in New York, Maryland, and California are expected to occur from April 8 through 15, whereas peaks in Missouri, Nebraska, and Kentucky are anticipated from April 26 through May 1.⁵

Because sufficient hospital capacity is essential and critical care needs and mortality lag 2 to 3 weeks behind peak cases, early signs of normalization may begin at the coasts followed weeks later in the country’s interior. As the US moves toward mid- to late May, there will be a staccato progression toward the restoration of a more normal life. The expected waves of recurrent disease will require management with intermittent short-term or “rolling” reclosures—triggered by sudden increases in hospital census data—all in an attempt to avoid another major surge of COVID-19 cases. Despite how challenging it is to answer the “when” question, addressing the “how” is no less daunting.

How Does the US Resume Normal Activities?

Diffusing Density

In the absence of a breakthrough treatment or vaccine, the US must navigate from mitigation back to containment, using the brute-force strategies effectively mobilized by South Korea. First, density must be limited; US areas most affected by the disease share the common feature of either having dense urban living conditions or temporarily dense population influxes (eg, Mardi Gras in New Orleans). Until and unless there is widespread protective immunity, the risk of large gatherings, festivals, conferences, and sporting events must be considered by decision-makers when they determine how to proceed. On a smaller scale, businesses should consider work schedules that limit office crowding (eg, limited in-person activity), and health care settings should reduce schedules, space out waiting rooms, and create weekend and evening timetables to accommodate backlog and care for the highest-risk patients. Commercial businesses could limit the number of individuals in the store; the immediate future of restaurant dining is unclear.

Testing Is Critical

The cornerstone of the next phase will require massive testing, in 2 forms. First, serologic testing that detects immunoglobulins (IgM and IgG) specific for SARS-CoV-2 will provide estimates of population exposure. Because a significant number of individuals with COVID-19 are asymptomatic or mildly symptomatic, the population fraction that has been infected remains unknown. It must be presumed (and hoped) that prior exposure provides some protection, at least long enough to bridge to a vaccine. With an estimated reproduction number (R_0) of 2 to 3, the benefits of herd immunity will occur when 50% to 66% of the population has already been infected, whether or not symptomatic. These population estimates could help guide the necessary level of vigilance and intervention.

Second, virologic polymerase chain reaction testing that detects active disease is important to effectively stop transmission. These tests must be easy to perform, quick to result, readily and equitably available outside of the health care setting, and inexpensive. Testing must be immediately accessible to anyone with any symptom suggestive of COVID-19, such as headache, fever, runny nose, cough, shortness of breath, diarrhea, malaise, or anosmia. Furthermore, because asymptomatic and presymptomatic transmission is important, additional wide-scale intermittent testing (eg, weekly) of asymptomatic persons also may be required, particularly for individuals with significant exposure to others, such as athletes, teachers, service industry employees (eg, in retail and maintenance), and health care workers.

Strategies such as home testing should be aggressively pursued to allow people to self-test whenever necessary.

Whereas expansive testing is critical, testing alone is insufficient. Vital to any screening program is the action taken when a test result is positive. People identified with COVID-19 must be immediately informed, educated, isolated, and then their contacts efficiently identified, all in a manner sensitive to individual needs. Modeling studies suggest that to achieve effective control, contacts must be quarantined within 24 hours; SARS-CoV-2 transmission is simply too fast and manual contact-tracing too slow to curb epidemic spread.⁶ Rapid and effective tracing of contacts of infected individuals mandates creative app-based methods for immediate contact notification and quarantine.

Attending to Vulnerable Populations

At least some of the global spread of COVID-19 involved people with financial resources, such as cruise-goers and international flyers, but like many other epidemics, COVID-19 has quickly turned into a disease of the socially vulnerable.⁷ With expanded testing, isolation, and contact-tracing, special care to implement these interventions in a manner that maximizes the benefits in underresourced communities is critical, without increasing stigma and marginalization. For example, how will patients be isolated who live in crowded quarters or who have no home at all? Low-income employees who rely on work to feed their families and maintain stable housing may avoid testing if a positive result means forced restrictions that threaten their livelihood. COVID-19 has highlighted the consequences of glaring social disparities; as such, an effective response must address both social justice and the development of a comprehensive public health plan to avert such personal and societal crises in the future.

A Necessary Investment in Public Health

Estimates suggest that the growth rate of the US gross domestic product (GDP) will decline 5% for each month of partial economic shutdown; with only 2 months of shutdown, the pandemic is estimated to cost the US more than \$2 trillion.⁸ Facing an extraordinary opportunity cost of remaining closed, the US must finance the critical investment in public health required to safeguard well-being and avert the personal and financial tolls of future pandemics.

Urgent interventions include establishing the public health infrastructure, pandemic coordination plans, and synchronized strategies for stockpiling supplies to achieve a more effective response

should COVID-19 reemerge or if another pandemic should develop. Serologic testing (\$10/test) for half of the adult US population could cost an estimated \$2.5 billion; frequent viral testing for those with symptoms (excluding asymptomatic screening) is likely to cost upward of \$1 billion; and web-based contact tracing might cost as much as \$1 billion to \$2 billion. These estimates suggest that more than \$5 billion in public health investment will be required, calculations that exclude the costs of protecting the most vulnerable communities or the investment in research and development required to deliver life-saving diagnostics, therapeutics, and vaccines. Nevertheless, this investment pales in comparison to the exponentially more profound losses from economic shutdowns.

Opportunities for a Better Normal?

As the US contemplates all that is needed to return to normal, a commitment to a "better normal" is necessary. The COVID-19 pandemic has resulted in unprecedented creativity, imagination, resourcefulness, and compassion. The US has expeditiously integrated telehealth into patient management and has fostered more fluid and convenient communication. New strategies have been deployed to identify population clusters, including internet-connected thermometers and app-based symptom and social-distance trackers, which could become a new standard for disease surveillance.

Perhaps more important are the multitude of ways social distancing has ironically fostered connections. The multidisciplinary teams required to respond to this outbreak have created new networks across communities, hospitals, systems, and states. Expanded resources dedicated to well-being and mental health have been developed. Because of factors such as boredom, loneliness, and stress, many in the US have capitalized on social media to reconnect with former roommates, coworkers, and extended family. Many have reached out, protected, and strived to secure the safety of the fragile elderly population.

The COVID-19 pandemic will one day be in the rearview mirror. US history will inevitably recount an early phase of the crisis plagued with denial, flawed testing, a patchwork response, and inadequate supplies that resulted in thousands of excess infections and deaths. Therefore, before the US "reopens," the country must ensure that this chapter will end with a course-corrected public health strategy that promises widespread testing, resources for those affected, and a profound appreciation for an impressive, inspired, and tireless health care workforce that helped the US deal with this pandemic.

ARTICLE INFORMATION

Conflict of Interest Disclosures: Dr del Rio reported grants from NIH/NIAD. No other disclosures were reported.

Published Online: April 17, 2020.
doi:10.1001/jama.2020.6572

Additional Contributions: We thank Loren D. Walensky, MD, PhD for his critical review and editing of the manuscript and Nicole McCann for her technical assistance.

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