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Follow South Korea's Lead

The COVID-19 pandemic has placed much of the world in a bind: without an effective vaccine or therapeutic, countries can only control the outbreak using non-pharmaceutical interventions. These NPIs, which include face masks, social distancing, limiting of mass gatherings, and closing schools and businesses, have greatly constrained the spread of the virus, but come at an enormous economic cost. In weighing these costs, as well as the inherent threat of the pathogen, countries have deployed NPIs to varying degrees and achieved different levels of control. Sweden has rolled out a limited response and instead chosen to let the virus spread. At present they have experienced 10 times as many COVID-19 deaths as neighboring Norway, which has responded with more aggressive control efforts.

To date, the US response has been fragmented, late and inadequately informed by evidence. As a result, we have more cases and deaths from COVID-19 than any other country in the world. Further, the NPI measures we have imposed have been highly disruptive and come with a large economic, psychological and emotional cost. Consequently, we are bearing the burdens of both the disease and economic disruption. As a society, we need to find a path that re-opens the economy so people can earn and spend money, but at the same time, we also need better control of the virus.

Facing these dual issues, many states have or are already re-opening portions of their economies. However, these loosening restrictions are likely premature. It is vital that a re-opening of the economy occur from a position of strength: continued reductions of new COVID-19 cases for multiple weeks and a quashing of the reproduction number, R_t , which measures the current transmissibility of the virus in a particular community, to well below 1.

The reductions of cases are needed to alleviate the burden on healthcare systems. This clears out hospital and ICU beds and restores the normal standard of care for both COVID-19 patients and those needing routine services, such as dialysis, chemotherapy, emergency care for accidents. An R_t of 1 is the important dividing line between increasing numbers of infections ($R_t > 1$) and decreasing numbers ($R_t < 1$). When a community drives R_t well below 1—through social distancing, shuttering of businesses, wearing of face masks, restricting mass gatherings—there then exists wiggle room to begin carefully opening economy. With R_t well below 1, re-opening measures can increase R_t some without as much risk that it rises above the critical $R_t = 1$ line.

So what should the form of a re-opened economy look like? I believe we need to learn from the successes and failures of control efforts made by other countries. To my mind, no country has been more successful in controlling COVID-19 than South Korea. A densely populated nation of nearly 52 million, South Korea experienced its first confirmed case of COVID-19 on the same day as the US (January 20, 2020), but since that date, the US and SK have followed dissimilar paths: as of May 22, 2020 the US has 1.6 million confirmed cases; South Korea has 11 thousand.

When COVID appeared in South Korea, the government pursued a series of policies intended to tackle the crisis pro-actively and aggressively, including tasking laboratories and pharmaceutical companies with the rapid development of diagnostic tests. These test kits went through an urgent-use approval process and were quickly made abundantly available. South Korea had an advantage—they had recently experienced an epidemic scare from another coronavirus—Middle Eastern Respiratory Syndrome or MERS—5 years earlier. MERS may have caught South Korea by surprise at the time, but unlike COVID-19, MERS could be contained without much disruption to society. Experience with MERS, primed South Korean society and informed their approach for responding to future novel disease outbreaks, and other earlier infectious disease outbreaks elsewhere in the world, such as Ebola, had provided the political impetus for South Korea to pass legislation that gives public health officials the authority to isolate infected individuals and quarantine their contacts.

Contact tracing and quarantine has allowed South Korea to bring their outbreak under control, and here's the reason why. COVID-19 has an average 3-5 day latent period, the length of time from acquisition of the virus to the onset of shedding. During this time period an individual is infected but not contagious, and the virus is not detectable by standard diagnostic testing. Following this latent period, infected individuals become contagious *before* becoming symptomatic—if they become symptomatic at all. This period of pre-symptomatic contagiousness, as well as contagiousness among people with mild or no symptoms who may be out and about in the community, supports silent transmission of the virus broadly and makes it very difficult to control. This is a key feature of SARS-CoV-2, the virus responsible for COVID-19, that allows it to spread efficiently. Many people only experience mild symptoms—and they do what you and I do when we experience a slight runny nose, mild sore throat, or weak body aches—we go about our normal routine—we go to work, go shopping, see movies, use public transportation and even go on business trips or vacations. We might take some medicine, but we still are active. And in doing so, we unwittingly provide the virus opportunities for spread—on buses, in offices and schools, on airplanes. We introduce the virus into new settings and communities and even bring it to the new localities to which we travel. All this supports the silent or stealth transmission of the virus.

To combat this silent threat South Korea made testing and contact tracing central to its control response. By identifying the contacts of people who are infectious, authorities can sequester these potentially infected individuals **BEFORE** they become contagious before they act as silent spreaders. The government provided individuals resources for managing quarantine, including food, water, information, a thermometer and sanitizing products. They called quarantined individuals daily, tracked their location via their cell phone, and had the authority to arrest individuals violating quarantine. They used this approach to crush a large outbreak that emerged in Daegu, the fourth largest city in South Korea, and have since throttled the disease, keeping new cases to very low levels using social distancing, face masks, continued testing and contact tracing, and quarantine of international travels.

While combatting COVID-19, South Korea has kept businesses open; however, the process has not been without economic cost and disruption. Restaurants, bars, and businesses have struggled with social distancing requirements, and patronage has been far below normal. But in the last month, as new cases have fallen to single digits, consumer confidence has increased. The government has re-opened churches, baseball season has begun, albeit without fans in attendance, and a general election with record voter turnout has been held.

At this point, the US is in catch up mode, trying to control an outbreak that has grown much further out of control than South Korea experienced. Testing and contact tracing have not been

sufficient. As of May 22, 2020, South Korea had performed 814,420 tests and identified 11,165 infections, a 73-to-1 ratio. In contrast, the US has performed 13,909,905 tests to identify 1,645,094 infections, an 8-to-1 ratio. By performing so many more tests per identified infection, South Korea has more aggressively searched its population for the silent transmission that allows the virus to spread unknowingly. South Korea has been able to more comprehensively find infections, quarantine suspected infections and throttle COVID-19.

The US would be well advised to follow this strategy: aggressive testing—an order of magnitude more than we've conducted to date—with rapid turnaround; abundant contact tracing, for which we need an army of trained individuals with the authority to quarantine individuals and to provide those individuals the resources and information needed to get through a 14-day quarantine; use of masks, so that transmission from people with few or no symptoms is limited; and altered business practices that limit person-to-person contact. The US needs to deploy the resources to implement these control measures and get the upper hand on COVID-19. For places with low activity, such as Montana and Wyoming, more abundant testing, contact tracing and quarantine will preclude the growth an outbreak. In places with high or increasing incidence, such as Chicago and Texas, these measures can accelerate control of disease and guide more informed back-to-work policies. Our aim should be to control the virus in order to safely return people to work. Without effective, informed control policy, we risk doing neither.