

The following are recommendations from the WUSM Student COVID-19 Recovery Think Tank. They are based on data reviewed up to **April 26, 2020** and thus subject to change. These recommendations do not necessarily reflect the intuitional policies or opinions of Washington University School of Medicine.

Background:

The outbreak of COVID-19 starting in Wuhan, China, has now spread to over 200 countries and represents one of the most devastating global pandemics in history (1). Although affected countries are still grappling with strategies to contain the spread of the disease and mitigate the associated economic downturn, many of these regions are now entering a post-acute COVID-19 phase where preparation for the longer-term consequences of this pandemic must be considered. Chief among those concerns is the highly probable occurrence of a “second-wave” phenomenon, in which the relaxation of public health restrictions allows for a resurgence of CoVID-19 transmission and an increase in the number of new cases. Furthermore, leaders at the CDC and WHO warn that a second wave of COVID-19 could be even more difficult to control than first should it overlap with peak winter influenza months (2, 3). Indeed, countries such as Hong Kong, Taiwan, and Singapore, have had great initial success with controlling first peaks of COVID-19, but are now experiencing disease resurgence after relaxing quarantine measures (4). While the uptick of new cases in these previously well controlled regions likely represents incomplete control of primary COVID-19 waves, their experiences provide insight into what the U.S. may expect in the months to come.

Past and present examples of second wave phenomena during viral pandemics

Nonpharmaceutical interventions (NPIs), implemented to safely reduce community disease transmission, make up an essential component of public health strategies to combat viral pandemics. However, the inevitable and necessary relaxation of NPI practices requires that communities re-open to the public without the promise of complete disease eradication. The 1918 influenza outbreak, one of the deadliest pandemics in world history, was comprised of three distinct waves starting in March 1918 and subsiding in the summer of 1919, with peak deaths occurring during the second wave in the fall of 1918 (5). Analyses of 17 large U.S. cities affected during the 1918 flu show that each city suffered from subsequent disease resurgence after recovering from initial periods of peak deaths (6). Unsurprisingly, second waves of influenza only occurred after relaxation of NPI measures. Furthermore, there existed an inverse correlation between the peaks of the first and second waves, suggesting that higher initial disease peaks resulted in greater levels of herd immunity and thus blunted the impact of secondary disease resurgence. Significantly, cities who implemented stronger and earlier NPI interventions during the first wave were not protected from subsequent waves of influenza (6).

Similarly, despite having been lauded for early and effective NPI measures – including extensive testing and digital contact tracing, to control COVID-19 outbreaks, Asian countries including Hong Kong, Taiwan, and Singapore, are currently facing the challenge of controlling secondary disease resurgences (4). In January 2020, Singapore adopted a swift and strict response to its COVID-19 outbreak, which at the time was the highest reported outside of China (1). By early March, after implementing mass testing, rapid hospitalization of infected individuals, meticulous contact tracing, and quarantining of high risk individuals, Singapore had effectively reduced the disease burden while also avoiding a complete lockdown. However, as of early April Singapore was forced to reinstitute new “circuit breaker” lockdown measures in order to combat a

resurgence of over 8,000 new COVID-19 cases that began mid-March (7). Hong Kong and Taiwan have experienced similar, albeit milder, resurgences, forcing these regions to implement new school and restaurant closures as well as additional restrictions on travel and immigration including mandatory testing of incoming travelers (4). While many of these instances of COVID-19 resurgence have been attributed to imported cases of COVID-19 after initial lockdown interventions had been relaxed, disease transmission among migrant workers living in crowded conditions has also contributed to challenges in disease control.

What could a second COVID-19 wave look like in the U.S.?

As many U.S. cities are now contemplating the move to re-open their economies, the timing and design of re-opening must be carefully considered given the mounting evidence of a probable second wave. The severity of a second wave will be a function of the extent of COVID-19 immunity among the community. Estimates of disease contagiousness, represented by R_0 , can be used to predict the extent of immunization required to achieve herd immunity in which the disease is unable to travel through the population. Recent estimates calculate the COVID-19 R_0 anywhere from 2.2 to 5.7, with the lower estimate requiring that 55% of the population would have to be immune in order to stop the spread of disease (8). The higher estimate would necessitate that 80% of the general population have immunity. Without an effective vaccine, immunity is only achieved through primary disease exposure. Thus, cities looking to relax NPI measures and re-open their economies in the coming summer months will have to do so knowing that a significant portion of their population will be at risk.

Plans for how and when to re-open the economy will need to balance protecting public safety and the consequences of delaying an economic restart. In response to a resurgence of new COVID-19 cases, Singapore and Hong Kong are advocating a “suppress and lift” strategy whereby quarantine restrictions are applied and then relaxed iteratively in order to keep the pandemic under control at an acceptable social and economic cost (9). While more time is needed to determine the success of this approach, Hong Kong believes it has already started to see a reversal in its increasing cases. Singapore and Hong Kong both have densely populated metropolitan areas with populations of 5.5 and 7.5 million, respectively, such that their “suppress and lift” policies may serve as a model for large U.S. cities emerging from first waves of COVID-19. However, such measures would require collective planning, social patience, and acceptance of setbacks that will be inevitable with large scale public planning. In response to many states’ quarantine orders, some U.S. citizens have organized protests to voice frustrations with stay-at-home orders in an attempt to force a reopening of the economy (10). These activities reflect the polarizing opinions in the U.S. regarding personal liberties and the collective good during crises, and highlight fundamental challenges in implementing a universal U.S. public health response. How best to implement a such a strategy would vary greatly by state and city. During “lift” periods, authorities would have to determine which businesses are priorities for opening and make challenging decisions regarding how schools, churches, and small businesses, should be operated in a COVID-19 era. Moreover, as many questions still surround the novel coronavirus, such as possible transmission from asymptomatic carriers and the strength and duration of seroconverted individuals' immunity, re-opening decisions must be informed in real-time as we continue to study and learn more about the virus.

References:

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