

Lockdown to contain COVID-19 is a window of opportunity to prevent the second wave

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We know what can happen when COVID-19 catches a city off guard. Wuhan, central China, the unsuspecting ground zero of the COVID-19 outbreak, saw a tsunami of tens of thousands of COVID-19 cases quickly overwhelm their health care system within a matter of weeks. After some initial delays - now typical for many other countries - China reacted swiftly and relentlessly. China escalated a response unlike any the world has seen before and which many have still not fully appreciated. Extraordinary public health measures, pulling from the full armamentarium of non-pharmaceutical interventions<sup>1</sup>, were implemented. These included early identification of cases by prompt laboratory testing, hospital or facility-based isolation of all cases<sup>2</sup>, rigorous contact tracing and meticulous follow-up of quarantined contacts, enhanced by artificial intelligence.<sup>3</sup> In the community, mobility was restricted and social contact minimised.

A lockdown of the entire city was instituted to protect the rest of the country and the rest of the world. The lockdown started on 23 January, 2020, at a time of 495 laboratory confirmed cases. New cases continued to increase exponentially before peaking on 12 February 2020, with 15,152 new cases on that day. Thereafter cases declined almost daily. By 18 March 2020, no new cases were occurring. By that date Wuhan had recorded 50,005 cases, or just over 60% of the total 81,092 cases reported in China. With 'only' 81,092 cases in a population of more than 1,4 billion people in China, there would be basically no population-level herd immunity, even if we assume an additional 50% asymptomatic rate. China showed that containment of COVID-19 is possible. Only when the outbreak was contained with cases down to zero for more than 4 weeks (corresponding to twice the duration of the maximum incubation time), China incrementally eased the restrictions. At the same time, China put preparedness plans into action including upscaling of testing capabilities and building of new capacities, to detect and quickly contain the next wave due to increasing importations from the new epicentres that are springing up elsewhere in the world.

Despite early warnings in January 2020, the international community was slow to respond in building testing capabilities, contact tracing and isolation and quarantine measures.<sup>4</sup> While

Asian countries, traumatized and experienced by the relative recent Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS) outbreaks, swiftly put action plans in place to identify importations and new clusters—essentially without lockdowns—the rest of the world saw a series of Tsunami-like waves of outbreaks with rapidly moving epicentres: first Northern Italy, then Spain, New York, United Kingdom, and then by May, Brazil and Russia became the new epicentres. By 28 May 2020, the tragic toll of COVID-19 entailed more than 5.5 million infections and more than 350,000 deaths globally. The exponential rise in cases and deaths forced much of Europe and then many other countries around the world including the United States to implement lockdowns, either at national or sub-national level. Natural herd immunity would be expected to require at least 60% of the population to have been infected.<sup>5</sup> Clearly, with COVID-19 achieving “natural herd immunity” as the end game would be associated with an enormous death toll and a prolonged and crushing pressure on health care systems, and collateral damage on all other sectors.<sup>5</sup>

Policy-makers are debating two strategies to reduce deaths and the demand on health care utilization<sup>6</sup>, in addition to considering major collateral damage to economic, society, mental health and other outcomes: (a) containment or suppression of COVID-19, which aims to reverse the rate of epidemic growth, thereby reducing new case numbers to low levels, and (b) mitigation, which focuses on slowing but not necessarily stopping epidemic spread – to reduce peak healthcare demand while protecting those most at risk of severe disease from infection. Containment requires all out action to reduce the reproductive number,  $R$ , to below 1, thus causing case numbers to decline. Mitigation aims to merely slow spread by reducing  $R$ , but not to below 1, and new cases continue to rise.

There are three reasons why containment is the much-preferred option. First, the rapid reduction in the number of cases that can be achieved is almost the mirror of the rapid increase, occurring over a very short period of time—potentially as short as a few weeks. Second, the period of large-scale impacts including suffering, death and economic impacts is limited to these weeks. Third, an all-out short-term approach to containment will most likely have a lower socio-economic impact than longer-term mitigation efforts.

A wide range of specific control measures are considered in policy discussions. But the prescription for 'all-out containment' should essentially include three key aspects that together achieve what any one cannot by itself:

First, movement restrictions: It is well understood that by themselves movement and travel restrictions do nothing but delay an outbreak.<sup>7</sup> However, combined with reductions in the local transmission rate, such restrictions can be a critical component of a complete strategy. International travel restrictions and national or sub-national movement restrictions, restrict the outbreak to more limited areas reducing the human and economic costs, and allowing available resources to be focused on priority regions. For example, China sent 42,000 health workers from other parts of China to Hubei province to help in the response effort, allowing areas that were less affected to have more lenient restrictions. Even now, when Europe and the US are implementing almost complete lockdowns, later, during the recovery phase when restrictions are being relaxed, areas that are less impacted will recover first with earlier lifting of lockdown measures.

Second, active case finding and reporting: The benefit of rapid laboratory testing of even mildly symptomatic cases with prompt isolation, and contact tracing with enforced quarantine of contacts should be clear.<sup>8</sup> The delay between symptom onset and isolation has the largest role in determining whether an outbreak would be controllable, therefore prompt isolation of all cases should be the primary goal.<sup>9</sup> Cases that are not isolated result in a high secondary attack rate. Institution-based isolation, even of mild cases, was modelled to reduce the outbreak size by more than 50%.<sup>10</sup> 14 temporary facilities were built in China for different levels of severity including sports arenas that had makeshift hospitals to look after the mild cases. In Wuhan such accommodation amounted to 50,000 beds. Likewise, in Korea 4,000 beds were created over 20 dormitories. The determination to isolate positive cases was maintained even when huge transmission was underway, thus reducing the subsequent transmission. In contrast, most of Europe and the United States continue to rely on people's compliance on self-isolation at home.

Third, lockdown: The anchor for the containment effort is the lockdown of active outbreak areas, which ensures transmission is dramatically curtailed to manageable numbers, thus

enabling the re-establishment of contact tracing to be effective. It also ensures that no further importations occur via incoming travelers. An effective lockdown requires government to engage directly in supporting economic activity, including the provision of necessities by safe measures. Economic support for placing much of the economy on 'pause' must be implemented. Given a limited period of weeks for such a pause -if done correctly<sup>11</sup>- the disruption need not be the devastation that would occur for longer periods. This is another reason that all-out efforts are essential. Without all-out lockdowns, testing, and travel restrictions, the duration of effective interventions dramatically increases.

The combination of three interventions in an all-out assault on COVID-19 can not only contain the outbreak but do so within 5-7 weeks almost independently of the level the outbreak has reached; a logarithmic correction in time is almost unnoticeable given the exponential decline in number of cases. Travel restrictions limit the area of outbreak and provide a means of progressively relaxing local control efforts geographically; testing and contact tracing reduce  $R_0$  locally and limit the number of isolations that are required; and the lockdown acts to limit transmission to cohabitants, dramatically reducing  $R_0$ , and limiting the number of individuals that need to be traced. Finally, effective contact tracing for a disease that is dominated by close contacts can control new outbreaks. Overall the current outbreak can be resolved within 1-3 months as suggested by modelling<sup>9</sup> and the China experience. The recovery process can be shortened as well by government policies that protect individuals and corporations through the pause in most economic activity. The fear of an extended recurring outbreak scenario should not impede actions that are effective and will reduce both the human and economic costs.

But, the argument goes, a new outbreak may occur afterwards when lock-down measures relax resulting in the re-emergence of indigeneous chains of transmission or new importations. However, the success in China and South Korea to date, and Hong Kong and Taiwan's containment achievements, suggests that new importations need not lead to new outbreaks. Modelling has shown that not all contacts need to be identified to ensure a suppression of the epidemic curve. Across different initial numbers of cases, the majority of scenarios with an  $R_0$  of 1.5 were controllable with less than 50% of contacts successfully

traced, and to control the majority of outbreaks, for  $R_0$  of 2.5 more than 70% of contacts have to be traced.<sup>9</sup>

The lockdown is a window of opportunity to bolster basic public health systems. If basic public health systems had been in place earlier on, lockdowns would not have been necessary. Lockdowns provide some additional time to build up basic public health interventions needed to suppress new outbreaks without having to necessarily reinstate the economically damaging lockdown measures. The lockdown period should be used to prepare and implement best practices for the next wave. This includes upscaling testing capabilities and increasing the capacity and work force for contact tracing. To this end, we commend the United Kingdom's efforts to build up a work force of more than 17,000 contact tracing staff. While traditional shoe-leather contact tracing should remain a core function in the "test, trace, treat" strategy, in our highly mobile populations, digital technologies can enhance contact tracing and retain privacy. In Taiwan and South Korea, the legal basis and data governance structure for responsible accessing and managing personal information during a health crisis was prepared after the 2003 SARS and 2015 MERS outbreaks. Mobile phone use for epidemiological purposes is not new.<sup>12</sup> The U.S. Health Insurance Portability and Accountability Act (HIPAA) Privacy Rule may serve as a foundation for COVID-19 contact tracing.<sup>3</sup> Europe's new privacy law, the General Data Protection Regulation (EU) 2016/679 (GDPR), which ensures data protection and social media privacy for all individual citizens of the European Economic Area (EEA) and the European Union (EU) might be further expanded to address the need of digital disease surveillance during COVID-19.<sup>3</sup> Researchers, IT programmers, Google and Apple have developed ways to enable contact-tracing without mass surveillance to achieve the benefits of location-tracking while protecting individual privacy.

The World Health Organization set out 6 criteria countries need to meet before lifting lockdown restrictions (<https://www.businessinsider.com/when-can-countries-lift-stay-at-home-restrictions-according-who-2020-4?r=US&IR=T>). These criteria include that health system capacities are in place to test, isolate, and treat every case and trace every contact; minimize risks in special settings like health facilities and nursing homes; social distancing principles at workplaces, schools and other essential places; minimizing

importation of new cases from countries or areas that have not yet contained the outbreak; community willingness to continue social distancing wherever possible and community engagement in all measures.

Lockdowns are being eased incrementally in many locations. Unfortunately, many countries are relaxing restrictions without having achieved zero community transmission, without which a resurgence is likely both increasing incidence of disease and prolonging the time until full reopening is possible. All countries are naturally keen to restart their economies but priorities also factor in social and cultural activities of importance. Arrangements for air travel between specific countries are underway and risks are high unless both countries are near or at zero transmission.

While testing and contact tracing capacity have been ramped up, these are only effective when the number of cases is small enough. While some individuals, communities and countries are continuing to take social distancing seriously, the enthusiasm about returning to normalcy has the potential to undermine the lessons learnt. It seems many have forgotten how aggressive this virus is in death, in severity of disease, and in crippling a health system, overwhelming it and allowing amplification of fatalities. More cases and more clusters will appear and different countries will manage these differently. Indeed, it is likely that as countries come out of lockdown most will need to revisit lockdowns in some form or another as community transmission grows. How this is managed will be a major test of leadership and community engagement in every country. The opportunity remains to use widespread testing to selectively identify regions of a country and reopen economic activity and travel as those regions become transmission free, accelerating the process of economic recovery.

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