When Can We Move Forward From COVID-19? When Four Capabilities Are In Action.

As shelter-in-place orders are extended, authorities and residents are asking, "When will it be safe to resume normal activities?" In response, many are looking to ongoing updates of epidemiology models that estimate when regional COVID-19 outbreaks will peak and subside. These estimates can help public officials anticipate the potential numbers of seriously ill COVID-19 patients and expand the capability and resources needed to care for the ill without hospitals becoming overwhelmed. However, the emphasis on 'getting past the peak' gives a false impression that managing the pandemic is like weathering a storm that will pass over and then depart. Because COVID-19 infections come as a series of rolling outbreaks that emerge in different regions at different times, authorities need to be concerned that epidemic "storms" will recur if we are careless in how we move forward.

The current health crisis is not at all like hurricanes or other storms we have experienced in the past. The virus resides in human beings, is carried by human beings, and transmitted between human beings. In other words, *human activity is the storm*. This means that the way we think about and manage this type of disaster needs to be different.

Despite the complexity of the situation, authorities must decide when and how to relax restrictions to reduce the economic, public health, and social sacrifices currently being made, but without losing control of pandemic and creating additional health risks. Decades of research on human response to a wide variety of crises indicates that the key to managing competing priorities in a volatile, complex environment is *resilience* -- i.e., the capacity to monitor conditions, anticipate possible futures, take adaptive actions, and learn in real time.

Resilience depends on building and sustaining the capabilities to *act*. Resilience is not about how many ventilators or backup generators you have, because none of those are useful if you can't deploy them when they're needed. Thus, resilience is really about *what you can do*.

This article identifies four *action capabilities* that are necessary to guard against the threat to human life posed by COVID-19 and other emergent infectious diseases. Significantly, the four actions require building the regional and national *systems* that can rollout and carry on the actions at a large scale of operation.

1. Can we test/track/isolate new cases that emerge and could become new hotspots?

Best practices for managing disease outbreaks are based on the premise of *testing* suspected people for infection, *tracking* their recent contacts, and *isolating* anyone potentially exposed. This practice is known to be the most effective in terms of public health outcomes as well as most economically efficient. In the current pandemic, our inability to build the system to carryout test/track/isolate in the U.S. has left authorities with little other than a blunt instrument: restrict all activity and shelter-in-place. Lifting these restrictions only makes sense when we have the capability to test/track/isolate so we can block potential hotspots from re-emerging. To make this happen, we need to develop new testing infrastructure coupled with a *surveillance and rapid action system* that ensures we can implement the best epidemic control tactics thoroughly (as has been accomplished in South Korea, Germany, Iceland). In effect, when the current waves of seriously ill COVID-19 patients begin to subside, the U.S. gets a "do over" – the chance to carry out the most effective actions to stop outbreaks with the least economic impact.

2. Can we meet all non-COVID-19 patient health needs while sustaining the ability to ramp up care capacity to provide treatments for all those seriously ill from new COVID-19 infections?

Hospital systems have reconfigured rapidly to try to avoid overload from a surge of seriously ill COVID-19 patients. This emergency reconfiguration has produced widespread changes and new forms of coordination and cooperation across many organizations. The priority has been to stand up the capability to accommodate the disease progression and risks from COVID-19 infections. As a result, hospitals have ramped down and shifted normal care and access for non-COVID-19 patients (e.g., creating tele-health consults, deferring other procedures), and health systems more broadly have imposed sweeping prohibitions on elective procedures that including medical imaging and biopsies. As a result, healthcare for other potentially life-threatening conditions has been deferred, and many health providers have had to lay off non-COVID related staff. Thus, in its current configuration COVID-19 preparation and response is not just a matter of health versus economy, but one type of health treatment versus others.

There will be a need for another reconfiguration post-outbreak. This re- reconfiguration will have to be able to:

- provide access for non-COVID-19 patients to address the backlog of care needs that have built up,
- remain ready to treat new inflows of COVID-19 positive patients,
- sustain the special operational constraints imposed by COVID-19 patients (e.g., separate inflow and treatment streams), and
- take advantage of the innovations developed to cope with the outbreak (e.g., the ability to ramp up care sufficient to handle any new influx; tele-health mechanisms).

Meeting these constraints will also require flexibility in a system that was already under stress before the crisis.

There are three prerequisites for the *re*-reconfiguration of health delivery to provide care for all. One is re-establishing standards for protecting health care workers. This means establishing a supply chain that produces a higher flow of protective gear to meet the higher burn rate of the post-COVID-19 world. Second, the sustainable reconfiguration of health care delivery needs to decrease barriers to medical care for potential COVID-19 patients (e.g., access, cost); otherwise, people who do not receive care can be sources of transmission that increase the risk of re-emergence. Third, *re*-reconfiguration of care requires new forms of coordination across hospitals, health care specialties, and governmental jurisdictions at a national scale.

3. Can we provide safe and effective treatments to promote recovery and reduce risks for patients seriously ill from COVID-19?

Widespread efforts are ongoing to develop treatments for seriously ill COVID-19 patients. This is a major area of focus, and we are all hopeful that these efforts will succeed quickly. Effective and safe therapeutic interventions will reduce future fatalities and thus can speed decisions to relax activity restrictions.

However, there are tradeoffs between (i) the speed at which the health care system can respond to outbreaks by identifying promising treatments and (ii) the thoroughness with which these treatments can be assessed to identify contraindications, side effects, what subgroups benefit and which might be at risk. Managing this tradeoff requires relaxing some constraints to be both responsive to and avoid missing harmful side effects. For example, all treatments have a 'therapeutic range,' that is a range of patients, co-morbidities, dosages that help the patient, on balance. Giving treatments outside that

range harms patients or imposes disproportionate risks. Initial rollouts need to be carried out flexibly with the ability to change course as evidence builds about how the treatments will work in practice and where it adds risks. Because that takes time before guidelines that cover a broad range of possibilities, new treatments raise the question of equitable access and proprietary knowledge. In a crisis such as COVID-19, protection of private intellectual property rights may be a small sacrifice to make in the interest of accelerating the learning process.

As potential treatments are trialed in multiple places under different constraints, we will need new systems to support gathering, validating, sharing new information. Feedback from trials will indicate some treatments should be pursued further and the scale of use expanded. Information clearinghouses need to be developed to collate, curate, check the emerging but uncertain and partial results. Rolling out promising directions can require standing up new mechanisms to generate access to critical resources. A current example is the class of potential treatments exploring convalescent plasma. Building state, regional or national registry of potential donors from those who have recovered can speed the availability of this treatment as clinicians learn how and who it helps.

4. Have we created the ability to assess immunity and build immunity in the population through antibody testing and vaccines?

Infectious diseases come under control by taking steps to build immunity and reduce disease severity in the population. We need the ability to assess immunity through antibody testing at scale that allows for monitoring population risks (and the means to track virus changes over time). The scale of the pandemic has overwhelmed the ability to stand up the necessary assessment capability in some areas. The degree of coordination required to develop and deploy the means to assess immunity in a timely manner across the world is a challenge that goes beyond the current system's reach. Again, we face the need to stand up a system, as we build our base of knowledge for this infectious disease, that can extend our reach to encompass the global reach of the virus.

Conclusion

As outbreaks subside, when can jurisdictions move forward restarting normal life activities while still preventing the recurrence of new hotspots or second waves? The four capabilities outlined briefly here will allow activities to return to normal faster, even in the immediate aftermath of the current outbreaks.

These capabilities do not yet exist at the scale needed to help us navigate the current uncertainty of our situation, but developing them will allow us to re-adjust our course as we learn. We need to be able to implement the best epidemic control tactics, reconfigure health delivery to treat all patient needs, and use the experience gained with telemedicine to hasten innovation and reduce costs throughout the healthcare system. Implementing these changes will require us to work across many collaborating roles, organizations and jurisdictions in unprecedented ways.

The next step is to delineate how progress on these four action capabilities provide specific criteria that can be used by policy makers and authorities to decide on when and how to relax social, economic, and healthcare-related activity restrictions.

As we move toward a post-pandemic world, there is the opportunity to find a new balance across multiple competing societal goals, including considerations of equity, access, and payment in healthcare. How the post-pandemic world adapts depends on institutions and governments being

open to learning about what works and what does not work well in managing high risk, high uncertainty events from the experiences of this particular challenge. Disaster resilience tells us a great deal about how learning in complex systems either leads to constructive systemic change or breaks down into debates on who erred.

In the lead-up to this outbreak, a variety of capabilities for resilient performance had been degraded. The slow pace of monitoring delayed recognition of the disease. Denial and politics frustrated anticipation of the extent of the crisis. Response readiness was hampered by a lack of coordination over levels of society, a fragmented healthcare system, and failure to apply what had been learned from controlling previous infectious disease outbreaks.

What remains critical is learning the right lessons from the COVID-19 experience, such that we can improve resilience and responsiveness to further waves of COVID-19 patients, or the emergence of a new crisis.

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Based on our work in Disaster Resilience, Sustainability and Resilience Engineering. For background:

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