Planning for the Next Pandemic: A Global, Interoperable System of Contact Tracing

The Harvard community has made this article openly available. Please share how this access benefits you. Your story matters

<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Published Version</td>
<td><a href="https://muse.jhu.edu/article/789557">https://muse.jhu.edu/article/789557</a></td>
</tr>
<tr>
<td>Citable link</td>
<td><a href="https://nrs.harvard.edu/URN-3:HUL.INSTREPOS:37367586">https://nrs.harvard.edu/URN-3:HUL.INSTREPOS:37367586</a></td>
</tr>
<tr>
<td>Terms of Use</td>
<td>This article was downloaded from Harvard University’s DASH repository, and is made available under the terms and conditions applicable to Open Access Policy Articles, as set forth at <a href="http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#OAP">http://nrs.harvard.edu/urn-3:HUL.InstRepos:dash.current.terms-of-use#OAP</a></td>
</tr>
</tbody>
</table>
The list of ways in which human beings have done poorly in responding to the COVID-19 pandemic is long and growing.\(^1\) Of the many shortcomings in our global response to the COVID-19 pandemic, our failure to coordinate efforts across geographic areas, within and between countries, ranks near the top of the list.

Much of the blame can be placed at the feet of national governments. The federal government of the United States, for instance, refused to take full responsibility for the health and well-being of a nation’s people, deferring major decisions to the states in some cases and obscuring the truth in others. Some United States governors and mayors have stepped up in their respective jurisdictions, but they lacked the mechanisms by which to coordinate what states, cities, towns, and regions are doing to stop the spread of disease. Around the world, few true global leaders emerged to address the crisis; the international institutions established to handle this type of work, including the World Health Organization, faced funding cuts when states should have been tripping over one another to fund and support them properly.\(^2\)

We have learned, yet again, that there is no way forward during a pandemic such as the COVID-19 crisis of 2020 without a massive, well-coordinated testing regime plus a system of contact tracing, absent a widely distributed vaccine and prior to herd immunity. To keep people safe while getting everyone back to work and the economy running again, the testing and tracing systems need to work within and across geographic and political boundaries.\(^3\)

Widespread testing is an absolutely necessary starting point.\(^4\) During the COVID-19 pandemic, there were too few reliable tests, they were poorly distributed, and cost and availability problems meant that there were terrible inequities in terms of who could take advantage of the benefits of testing in the United States and around the world. The Centers for Disease Control in the United States, among many others, called for greater accessibility and more affordable access to testing.\(^5\) While a sound national strategy would be helpful, ramped up testing can presumably be managed locally and regionally.\(^6\)

Unlike testing, contact tracing, by its nature, needs to be coordinated across geographic and political boundaries. Some number of people will travel outside their hometown, state, or country either as the pandemic is breaking or later in its spread. It is not enough to be able to track and trace a person within a
limited jurisdiction. It became clear very quickly that there was no coordination of contact tracing systems during the COVID-19 pandemic of 2020. This absence of coordination was one of the most glaring failures in a year characterized by many glaring failures in the public health system. What’s worse: despite the experiences of this year, we are in no way prepared to carry out an effective system of contact tracing in our deeply interconnected world.

We learned during the COVID-19 pandemic that we are a long way from having systems that can work together to protect the public health while protecting individual privacy across the board. Even Pope Francis commented in an encyclical on our failure to coordinate in the interest of public health: “Aside from the different ways that various countries responded to the crisis, their inability to work together became quite evident. For all our hyper-connectivity, we witnessed a fragmentation that made it more difficult to resolve problems that affect us all.”

While the system of contact tracing does not need to be the same in every area--and probably should not be the same everywhere, even within a region such as the European Union--the approaches we adopt need to be interoperable. That is to say, we will need a mechanism for the data to be shared from place to place and for the essential knowledge to flow from jurisdiction to jurisdiction in a timely fashion. The policies that we put in place need to work together if the next global pandemic is to be contained better than this one was. For it to work, people need to trust this interoperable system and to know that their privacy will be protected as the data are shared and that contact tracing will be carried out in an equitable manner. Put another way, a key aspect of this system is to establish trust at the individual level and between and among institutions.

Approaches to Contact Tracing

Effective contact tracing during a pandemic can be highly nuanced. The idea behind it, however, is age-old and simple. When someone tests positive for COVID-19, somebody or some system needs to record information about that person and those with whom that person has been in contact. Word needs to get to those they have been in contact with so those people, in turn, may get tested and self-quarantine. Contact tracing is most effective as a containment strategy—when relatively few people have been affected—rather than as a mitigation strategy when millions of people are affected.

Contact tracing can be carried out in a number of ways. Consider, for instance, a low-tech approach and a high-tech approach. The old-fashioned, low-tech way involves a community health worker who knocks on someone’s door, clipboard in hand. Networked smartphones might work nearly as well as a way to record the initial data, though not without additional complications. This community health worker can help the afflicted individual get access to helpful services, provide a reliable source of information, and perhaps offer much-needed safe human contact.

Just as the idea behind contact tracing is not at its core all that complicated, it has been done well in the past. Contact tracing has been carried out at medium scale for a number of decades, especially early in pandemics. Partners in Health, a Massachusetts-based NGO, has honed the low-tech system over decades of public health work, fighting Ebola across West African countries and cholera in Haiti. In April 2020, the leadership of Partners in Health teamed up with state officials to drive the Commonwealth of
Massachusetts’ contact tracing system. In some ways the astonishing fact about this partnership is this: at the time of its launch, the Massachusetts Community Tracing Collaborative was the first-ever statewide contact tracing program in the country. This partnership model holds great promise, though challenging issues remain.

Also in spring of 2020, technology companies offered an alternate approach as COVID-19 broke: let ubiquitous mobile phones do the work for us. Google and Apple developed a platform – at its core, an application programming interface, or API – to allow mobile applications to manage contact tracing, along with built-in protections for data privacy. If someone tests positive for the virus, that person’s mobile phone can communicate with a database that then informs people with whom they have been in contact, via a mobile app, that they need to get tested and perhaps self-quarantine. As of September 1, 2020, Google and Apple declared that their future smartphones would be equipped with what they called a “privacy-protective” contact tracing feature. This high-tech approach, too, faces important challenges and limitations and has been slow to be adopted.

There are myriad variations on these low-tech and high-tech themes. Many cities, including Chicago, aim to use a combination of low-tech and high-tech approaches. The Chicago approach is community-based, starting with contact tracers hired principally from the communities most affected by the pandemic. These newly-hired and trained staff persons carry out a shoe-leather approach similar to the Partners in Health model to learn about who has been in contact with those infected with the virus. From there, the ongoing contact is managed through a series of technological means, including text and email. The plan calls for a “web/mobile platform” to be used to manage the data and interactions between the contact tracers and individuals potentially affected by the virus.

Several approaches at the state level have achieved a measure of success in contact tracing. Two of many possibilities stand out: the Swiss and the South Korean approaches. In Switzerland, authorities enjoy a much higher level of trust among citizens than in many other jurisdictions. Building upon this measure of trust, the Swiss system has offered an example of contact tracing that others might emulate. Similarly, the South Korean contact tracing effort has helped keep the level of COVID-19 spread much lower than many other countries despite the early arrival (January 20, 2020, the same day as the first recorded case in the United States) and the density of the 50 million-plus people on the southern part of the Korean peninsula.

Communities on a scale smaller than a city or a state, such as university campuses, also rolled out their own approaches to digital contact tracing. Consider the University of Illinois, which developed a smartphone application for its students to manage contact tracing. This high-tech approach built upon publicly accessible technology and an application that administrators had already rolled out to students for other purposes. Watchdog groups, such as the Surveillance Technology Oversight Project (STOP), quickly posted concerns about the level of privacy protection and inequities built into the application offered to students. As on many campuses with strong computer science programs, faculty members at the University of Illinois have also developed a novel “secure, digital contact tracing option.”

No matter what approach we use for contact tracing, thorny issues remain. One important trust barrier that limits the efficacy of both traditional and digital contact tracing has to do with the concerns about the
use of data related to individuals, data which are at once essential and extremely sensitive. Without a consistent framework and legal safeguards, it will be hard to share data across systems in a way that will protect the public health and ensure privacy. These concerns are amplified in digital contact tracing, which in our view needs to be an instrument in the future’s pandemic response toolkit, despite the shortcomings and limitations that have become apparent over the past few months.\textsuperscript{22}

\textbf{A Global Viewpoint, Global Interoperability, but Not a Single Global System}

The best approach would be to see a pandemic for what it is: a global phenomenon. By developing a global approach to contact tracing that makes the best use of digital technology, the spread of the next new virus—or even the next variants of the COVID-19 virus itself—across the planet might be slowed dramatically as compared to the spread of COVID-19. The approach would not yield a single, global system but rather should take the form of local systems that can interoperate sufficiently to keep people, and the personally identifiable data about them, safe according to a baseline set of shared norms.

To establish a truly global system of this sort is much easier called for than done. A fully integrated and seemingly interoperable contact tracing system would require that widely different healthcare systems work in concert, that fragmented technological systems are able to interoperate, and that workflows and training of organizations and people involved in the mission are standardized. When it comes to trust and data, however, one of the biggest interoperability barriers is the patchwork of relevant policies and legal requirements across regions, countries, and in places such as the United States, even across states.

The process of seeking interoperability across nearly 200 legal systems around the world such that data could flow freely would require a major lift and a great deal of compromise. The system that allows for telephony to work (phone calls to interconnect across national boundaries) and the domain name system that allows for bits to flow across the Internet prove global networking is possible when the will exists. A system for health data would be vastly more complicated than these general purpose systems; however, the promise of slowing the next global pandemic—and the number of lives at stake—might be enough to get parties to cooperate more extensively than in the past.

The European Union is ahead of the game in terms of planning for an interoperable approach to contact tracing. While initiatives in the US have provided only high-level guidance or predominantly focus on the hardware and data layers of interoperability,\textsuperscript{23} the EU has taken a more holistic and principled approach, both leveraging its harmonized data protection laws as well as building upon previous investments like the eHealth initiative.\textsuperscript{24} Several EU member states began testing a shared gateway for applications developed and managed at the national level in the Czech Republic, Denmark, Germany, Ireland, Italy and Latvia. This EU initiative does not mandate the applications all operate the same way but rather connects the applications at the back end, making use of a decentralized architecture and the legal framework for data privacy that extends across Europe. If successful, this principle-based and multi-layered approach to contact tracing interoperability could be the basis for a larger, global project.\textsuperscript{25}

To be clear, a system that can work together across borders does not mean developing a single, global system for health-related data. It would be neither practical nor desirable to set up a system that would enable, say, a Chinese person’s data to be held in the same system as someone from Canada and someone
from Chad. However, should a Canadian person travel to Chad and test positive for a new virus, it would be helpful to have a series of systems that could interact with one another to manage the contact tracing related to that Canadian. The spread of the disease might be contained, or at least limited, much earlier than in the case of COVID-19, which plainly spread unchecked for months across national borders.

This distinction highlights the difference between a single, standardized system and a series of systems that are interoperable. A global series of contact tracing systems might simply be connected at the data, legal, and policy layers. In other words, the states involved might agree to the types and format of the data that describe the person with the infection and agree to a protocol for sharing information in a way that is consonant with local and international law. That protocol could be combined by local practices that are informed both by principles of equity and data privacy, developed and enforced close to the individuals involved.

The challenge of creating an interoperable system at a global level for contact tracing is not a tiny one; it may in fact prove too great of a challenge to get it done before the next pandemic. But it should not be impossible, especially if the European Union is able to pull off its own internal interoperability framework in a way that is consonant with its extensive privacy regulations, such as the General Data Protection Regulation (GDPR). There are nascent efforts, such as BlueTrace and OpenTrace, proposed by the Singapore government, on which efforts might also be built, while important questions concerning robust legal safeguards need more work. It is an effort worth attempting. And even if it is only partly successful, the project may well lead to learnings about how international governance in a hyper-connected, technologically driven world could work.

**Equity as a Starting Design Principle, not an Afterthought**

Past approaches to technological systems design have underplayed or ignored issues of equity. The COVID-19 crisis has laid bare inequities across our society that have been here all along, inequities that fall along the lines of race, ethnicity, income, wealth, status, and power. Early outbreaks in U.S. cities like Detroit, Chicago, and New York have all exposed, once again, fault lines based on race. Native American communities across North America have felt the economic pressure disproportionately as well as suffered higher rates of infection than white communities in many cases. Similar disparities based on race and ethnicity are likely to play out with respect to who is inoculated with the most effective vaccines most quickly.

Contact tracing must be carried out in an equitable manner in order to work. Yet we have a track record of terrible health inequity in the United States and around the world. Poor areas often have much less effective, less well-funded hospitals than wealthier areas. One might reasonably worry that people in communities with high numbers of undocumented residents may be less comfortable putting an app on their phone to share data or to answer the door when a contact tracer comes by to help. In addition to these trust barriers, significant participation gaps – for instance limited tech skills among elderly populations or lack of access to mobile phones that support schemes like Google and Apple’s exposure notification framework – can interfere with the promise of technologically-supported contact tracing. Designing next-generation interoperable digital pandemic response tools will require deep analysis of these and related equity issues in the light of new evidence from research as well as on-the-ground
experiences—both troubling and encouraging—from across the country that emerge from the current crisis.30

A Participatory Design Process: Your Government Needs YOU!

Technological system designs have too often ignored the people who use the systems on a daily basis and the communities that are principally affected by its usage. Technologists, lawyers, public health leaders, and systems designers may be well-intentioned in their work and yet ignore obvious issues that a human-centered design process might pick up and help address early in the process. That is particularly true when a pandemic hits certain communities—here in the United States, poorer communities and communities of color in particular—more than others. If those affected in larger numbers are not well-represented among those designing the systems, inequities are more likely to persist.

It may be a bridge too far to attempt a broad-based design process at a global scale,31 but it is worth considering given what we have learned about who is affected in a pandemic such as COVID-19. User input from a diverse array of citizens, from around the world, could greatly improve the design process for a large-scale, interoperable system of contract tracing and infection control. A truly participatory and inclusive process of helping to design and shape a system that would support all people’s health could help to ensure that the next pandemic does not lead to the same exacerbation of inequities that COVID-19 has.32 That would require leaders to be open to input from all people and communities; it would also require the time of ordinary people and communities to focus on a complex public health problem that they probably do not think much about on a typical day. If both sides step up to create and participate in a truly collaborative design process, the outcome could be remarkable both for what it allows and for the promise of participatory design efforts in public policy in future.

--

Too often, we pay lip service to the idea that we can learn a lot from our failures. This time around, we need to be sure to learn from what we have done wrong at a systems and policy level in preparing for and responding to the COVID-19 pandemic. At the national level, we need a policy regime that ensures the data can be securely shared from place to place, system to system. That’s hard to manage with a federal government that has failed to play a reliable role. Absent meaningful global or federal leadership, either states or the private sector will have to step up to establish and maintain a sound system. Philanthropic organizations are helping fund approaches to contact tracing, but without government involvement, any system is likely to be insufficiently coordinated. Ideally, this coordination would allow not just for internal coordination within states but international coordination across the globe.

We failed to develop a system of contact tracing during the early days of the COVID-19 pandemic. Unfortunately, it is almost certain that we will have a chance at a do-over. We should learn from this failure to prevent illness and loss of life the next time a pandemic hits—or perhaps even to prevent the spread of dangerous COVID-19 variants, given that many experts believe this pandemic may be with us for a while. The process of developing a contact tracing system should have a series of key design principles: equity, privacy protection, user-level feedback from a diverse set of stakeholders, and interoperability should be among them. This system should be developed in such a way that allows for
cities, counties, states, and nations to work. A process that includes diverse voices from a range of stakeholder perspectives and geographic backgrounds can help to make the system work in a sustainable way. This problem—and opportunity—points to a broader global governance issue: we need a new generation of technologists, public health experts, international affairs officers, and political scientists who can design and implement this type of complex, global solution for the future.

John Palfrey is president of the John D. and Catherine T. MacArthur Foundation. Urs Gasser is Professor of Practice at Harvard Law School and Executive Director of the Berkman Klein Center for Internet & Society at Harvard University.

10 Dr. Anthony Fauci, Remarks shared with the Board, Staff, and Guests of the Carnegie Endowment for Peace, October 27, 2020.


