A National Plan to Enable Comprehensive COVID-19 Case Finding and Contact Tracing in the US

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Executive Summary

In order to save lives, reduce COVID-19's burden on our healthcare system, ease strict social distancing measures, and confidently make progress toward returning to work and school, the United States must implement a robust and comprehensive system to identify all COVID-19 cases and trace all close contacts of each identified case. It is estimated that each infected person can, on average, infect 2 to 3 others. This means that if 1 person spreads the virus to 3 others, that first positive case can turn into more than 59,000 cases in 10 rounds of infections.

COVID-19 is already spreading through communities across the United States. Therefore, a case-based intervention approach (employed routinely for diseases like TB, measles, sexually transmitted infections, and Ebola) will be impossible to achieve for COVID-19 without a new national initiative that combines a massive expansion of rapid diagnostic tests in every community with an unprecedented growth in a public health workforce and adoption of new technologies dedicated to case identification and contact tracing in each state.

To manage COVID-19 epidemics going forward, communities in the United States need: (1) ready access to rapid diagnostic tests for all symptomatic cases or those with a reasonable suspicion of COVID-19 exposure; (2) widespread serological testing to understand underlying rates of infection and identify those who have developed immunity and could potentially return to work or school without fear of becoming infected; and (3) the ability to trace all contacts of reported cases. In order to trace all contacts, safely isolate the sick, and quarantine those exposed, we estimate that our public health workforce needs to add approximately 100,000 (paid or volunteer) contact tracers to assist with this large-scale effort. This workforce could be strategically deployed to areas of greatest need and managed through state and local public health agencies that are on the front lines of COVID-19 response. To do this, we also estimate that Congress will need to appropriate approximately $3.6 billion in emergency funding to state and territorial health departments.

This plan outlines a vision for how to accomplish this goal, including ways that case identification and contact tracing capabilities can be greatly expanded; actions that the federal, state, and local governments and other organizations must take to stand up these capabilities as quickly as possible; and resources that will be needed to accomplish comprehensive case finding and contact tracing.

Introduction

Until a COVID-19 vaccine or a prophylactic treatment is available and we have serological tests to help determine if a person has developed immunity to the virus, management of the COVID-19 pandemic will rely heavily on traditional public health methods for case identification and contact tracing, similar to those methods used for tuberculosis, sexually transmitted infections, and vaccine-preventable disease control across the country every day. This kind of case identification and contact tracing will be critical in the effort to ease social distancing around the country. Controlling COVID-19 in states and localities across the country will require that public health authorities identify nearly all cases of COVID-19; isolate infected individuals at home or, as necessary, isolate them on a voluntary basis in healthcare facilities or dedicated isolation facilities; alert and trace the contacts of each case; and quarantine exposed contacts in their homes (or other dedicated facilities, if home is not an option) for 14 days after their last exposure to the case.

Augmented by the President's Coronavirus Guidelines for America, issued on March 16, 2020, the US population is currently under significant social distancing restrictions, including stay-at-home orders or other similar measures in at least 45 states.[1,2] These measures are absolutely necessary now to reduce community transmission, avoid overwhelming our hospitals, and ultimately save lives. While social distancing measures are working toward these ends, they cannot be sustained indefinitely at this scale. As COVID-19 incidence in states begins to decline, a new phase of pandemic management will be required to avoid resurgence of the virus while also allowing individuals to return to work. Civic and community engagement will also be needed at appropriately timed stages throughout mid- and late 2020.

A national effort to scale up and expand local, state, and territorial case investigation and management is necessary before US communities can begin to return to "normal." If we can find nearly every case, and trace the contacts of each case, it will be possible, in time, to relax the bluntest approaches: the extreme social distancing measures, such as stay at home orders, and realize the commensurate social and economic benefits.

This document sets forth a call to action that specifies what is needed to enable the United States to massively scale up its ability to identify COVID-19 cases in every community and trace contacts of every case in support of national recovery from COVID-19. In this document, we aim to aid public health officials and decision-makers at all levels of government—local, state, territorial, tribal, and federal—in expanding the capabilities and capacities necessary to undertake the case-based interventions that will greatly reduce transmission of COVID-19 and enable the country to gradually lift social distancing measures and movement restrictions, even before a vaccine is widely available.

Lessons from Around the World to Inform State, Territorial, and Community Response

Several countries have demonstrated that an approach of aggressive case-finding and contact tracing can be an effective measure in helping to control the spread of COVID-19. These countries have dedicated substantial resources to establishing both the staff capacity and technological capabilities to support these efforts. The experience of other countries provides an example that states, regions, and the federal government can emulate to help reduce the transmission of COVID-19 and support case investigation and containment efforts. Due to the vast range of state size and geography as well as state-specific population characteristics, state and territorial response efforts will vary greatly in the United States. As we develop national efforts to support case finding and contact tracing, each state and territory will implement efforts specific to the unique characteristics of their populations and existing public health infrastructure.

One example of extensive contact tracing comes from South Korea (population 51.47 million), a country that was able to develop contact tracing plans in response to the spread of a different coronavirus, Middle East respiratory syndrome (MERS) in 2015. This experience also prompted the revision of several laws to help improve outbreak response. Contact tracing in South Korea incorporates patient interviews as well as the use of medical records, cell phone GPS records, credit card transaction records, and closed-circuit television.[3]

Based on their experience from the 2003 SARS outbreak, Taiwan (population 24 million) and Singapore (population 5.6 million) have used technological approaches to augment traditional approaches to contact tracing. Taiwan linked medical records, health insurance records, and travel history to contact tracing efforts and provided a toll-free hotline for reporting of potential cases.[4,5] Singapore introduced the use of TraceTogether, a mobile app that uses Bluetooth signals to determine when users are near each other.[6] Records from TraceTogether are stored for 21 days and can be used by the health ministry to identify close contacts of confirmed cases. Singapore has freely released this technology to developers.[7-9] A similar system is now being launched in Britain.

In the Report of the WHO-China Joint Mission on Coronavirus Disease 2019, it is noted that Wuhan, China, employed 9,000 contact tracers (1,800 teams of 5 people) to undertake “meticulous case and contact identification.” These teams reportedly traced tens of thousands of contacts per day and followed up often with both cases and contacts.[10,11]

New Zealand (population 4.8 million) and Iceland (population 364,000) have also found success through the use of aggressive traditional contact tracing measures supplemented with complementary technology. As of April 7, Iceland claims that approximately 50% of newly diagnosed cases found in the country had already been

quarantined and linked to other confirmed cases, as a result of contact tracing efforts. Iceland's Department of Civil Protection and Emergency Management is running a special contact team, including dozens of police detectives. In addition to the human workforce, Iceland also recently rolled out a mobile contact tracing app, C-19, which can track GPS and other user location information. Through a voluntary user agreement for data collection and sharing, the contact tracing app uses the information and promptly deletes it when it is no longer needed.[12,13]

As of April 6, New Zealand claims that 81% of total cases are linked to overseas travel (43%) or are close contacts of other cases (38%), with only 2% of cases occurring as a result of unidentified community transmission. The country is operating with a close contact tracing center with 190 Ministry of Health staff. The country also has moved from manual contact tracing to a national electronic platform that syncs contact tracing with other healthcare databases, including the National Health Index, which includes monthly updated contact information.[14] Despite their small populations, both New Zealand and Iceland provide examples of useful ideas that could be considered as US states and territories implement case identification and contact tracing strategies to rapidly decrease COVID-19 transmission.

While technology-heavy methods used by Taiwan, Singapore, and South Korea may be difficult to replicate in the US context because of privacy protections, New Zealand and Iceland's approach could be achievable with a large enough contact tracing workforce. The United States could possibly roll out a mobile contact tracing application that could capture contacts and record their self-reported symptoms. Following the Iceland and Singapore models, with user permission, an app could also record and store user location for contact tracing and tracking purposes. In addition, a national electronic platform for contact tracing could be developed and potentially synced with existing electronic health records.

State, Territorial, and Community Capacity to Massively Scale Up Contact Tracing: Identifying Gaps and Needed Resources

State, territorial, and local public health agencies in the United States have existing capacity to conduct contact tracing for infectious diseases as a core public health function, but this capacity is sufficient only to respond to isolated outbreaks or individual cases of infectious diseases. Tuberculosis and syphilis are examples of diseases for which case identification and contact tracing are used in the United States to reduce infectious disease spread. In these systems, once a case is confirmed, public health staff identify each of the case's contacts and then alert them to their exposure. In both examples, infected individuals receive treatment, and contacts are offered behavior change messages, screening, and treatment, if required. Typically, the timelines for identifying contacts to prevent onward spread is on the order of weeks. The same is true for cases of sexually transmitted infections (STIs), foodborne outbreaks, and the recent outbreaks of measles in US cities and states.

COVID-19 has a number of characteristics that make it more difficult than other diseases to trace and that require even more rapid case and contact identification and tracking. First, because COVID can be transmitted before people have symptoms, in order to prevent onward transmission from exposed contacts, these contacts must be identified and quarantined immediately after the case with whom they have had contact is identified. Second, there are no proven effective treatments for COVID-19, which makes cooperation between public health officials and cases and contacts all the more important. Third, COVID-19 can cause large outbreaks quickly, so even 1 missed case can significantly undermine control efforts. A contact tracing effort of this unprecedented scale and of this critical and historical importance to the functioning and reopening of society has never before been envisioned or required. And our current core public health capacity is woefully insufficient to undertake such a mammoth task.

In 2014, the US Centers for Disease Control and Prevention (CDC) called on state and local public health agencies to undertake active monitoring of returning travelers from West Africa in an attempt to detect cases of Ebola coming out of the region. In response, each US state implemented some form of monitoring and movement restriction policies, although the exact policies differed from state to state. In total, from late 2014 to late 2015, nearly 30,000 people were monitored nationwide, including active monitoring (daily reporting) and direct active monitoring (daily reporting with direct observation by a public health official).[15] Although no cases of Ebola were identified through these efforts, understanding the operational lessons from this effort may be instructive for COVID-19. There were many associated challenges reported by jurisdictions, including the large amount of time and resources required to call or visit monitored individuals, security concerns around enforcing orders, cross-jurisdictional coordination, and difficulties finding temporary housing for those without a local residence.[16] Questions also arose about the level of authority required to enforce compliance for those under movement restrictions, such as quarantine.

While not an exact comparison to the efforts needed now for COVID-19, this monitoring of thousands of individuals across the United States stretched many local and state health departments to the maximum of their capacity. Notably, Ebola is not a respiratory disease and was much less infectious than COVID-19; it did not result in widespread community transmission in the United States. The Ebola effort focused on identifying travelers, who identified themselves at international airports, and instructing them to quarantine and monitor their symptoms. By contrast, efforts for COVID-19 must identify cases, then identify community contacts, and ask them to quarantine, which is a far larger effort. Current and traditional approaches to identifying cases and contacts (contact tracing) have already been overwhelmed in jurisdictions with even moderate community spread. Therefore, far more resources will be required for COVID-19 than were required for Ebola or any other outbreak in the past.

While the experience and lessons learned from US domestic response to the 2014-15 West Africa Ebola outbreak better positioned us for the COVID-19 response, nevertheless, public health agencies are now being asked to do something that has never

been done before at the scale required in the United States: find every COVID-19 case in the midst of a national epidemic with widespread community transmission already occurring and then work quickly to contain spread through intensive case and contact tracing interventions.

Workforce Gap

The US public health workforce has been sharply reduced by funding cuts over the past 15 years. Federal funding for public health preparedness has been reduced by 28% over that time. In addition, public health job losses in the 2008 recession amounted to a reduction of 50,000 positions across public health organizations nationally.[17]

For COVID-19, we need an unprecedented and rapid scale-up of the public health workforce dedicated to case identification and contact tracing. Estimates vary as to how many workers are needed, depending on the size of the state and the true size of its outbreak (confirmed by diagnostic testing). Contact tracing is particularly resource intensive, and, as cases rise, more individuals will be needed to ensure comprehensive contact tracing of all confirmed cases can be done. For example, Massachusetts (population 7 million) has recently announced plans to hire an additional 1,000 individuals solely to conduct contact tracing activities, with the aid of Partners in Health.[18,19] Looking at the examples above from other countries, numbers of individuals employed for contact tracing have ranged from 190 for all of New Zealand to 9,000 just for the city of Wuhan, China, which has a population of about 11 million.

Learning from what has worked elsewhere, when normalized by population, there would be 15 contact tracers per 100,000 population in Massachusetts, 4 in New Zealand, 81 in Wuhan, and about 7 for Iceland. When applied to the US population, a New Zealand-like approach would mean a total of 13,000, and a Wuhan-like approach would mean more than 265,000 contact tracers in the United States. These are useful examples. But when considering the workforce needs for a successful US contact tracing effort, it is essential to take into consideration that the United States leads the world in numbers of cases, the virus was able to spread unabated for several weeks, ubiquitous testing is still not available, and international travelers are not the main drivers of the US outbreak. Therefore, the United States will require a much larger workforce than a country like New Zealand, which has their outbreak under better control, has reported significant compliance with physical distancing and stay-at-home measures, and can efficiently identify visitors and travelers to the country who may be COVID-19 positive.

If we take the Massachusetts approach and apply it across the country, that will mean about 50,000 additional contact investigators are needed in the United States. However, it is likely that many more will be necessary, considering the large number of cases already in the United States, that COVID-19 has been circulating widely for many weeks, and that we still do not have sufficient levels of testing. Therefore, it would make sense to at least start by adding an extra 100,000 contact tracers across the United States. While this figure may be stunning, it is still the equivalent of less than half the number employed in Wuhan City.

Scaling up a contact tracing workforce of this size should be managed by state and territorial public health departments who already do this work and have a keen understanding of state and local capacities and capabilities needed to reach scale quickly for COVID-19 response. Local and tribal health departments, as well as other state assets and organizations, should also be involved to coordinate contact tracing activities in their jurisdictions across the state. The contract tracing initiative announced by Massachusetts involves not only the state department of health, but also the Commonwealth Health Insurance Connector Authority and private and nonprofit companies.[18,19] This multi-agency and multisectoral coordinated approach can serve as an example to other states.

Required Skills and Training

The aim of contact tracing is to contact every person diagnosed with COVID-19, gather their contacts, and proceed to then get in touch with every contact discovered. The World Health Organization recommended (in the context of Ebola) that contact tracers have the necessary skills to assess relevant symptoms; investigate and follow up with contacts; and have basic analytical skills.[20] Most workers will be able to work remotely and conduct contact tracing via phone or using other technologies, but some may need to go to people's homes to follow up on contacts and conduct interviews. Those individuals should be provided with training and personal protective equipment to mitigate risk of infection. Contact tracers should also be aware of local cultural sensitivities and be able to help contacts navigate the public health and healthcare systems in the jurisdictions in which they are working. While contact tracing is desperately needed, the good news is that the skills required can easily be taught, advanced degrees are not required (a high school–level education suffices), and no previous public health education is necessary—other than the just-in-time training and management that can be provided.

To be effective, case investigators and contact tracers must receive training on the basics of disease transmission, the principles behind case isolation and quarantine of contacts as a public health measure, the ethics around public health data collection and use, risk communication, cultural sensitivity, and the specifics of local processes and data collection for the effort. Basic training modules on the principles and basics of COVID-19 are now being created for widespread use by national organizations such as the Association of State and Territorial Health Officials (ASTHO); however, specific training modules for local processes and data collection will have to be developed locally. Online training modalities will be required to begin to build the workforce while social distancing measures remain in place.

Hiring Authority and Funding

Local and state health departments should be able to hire quickly under emergency declarations, which have already been made in every US state and territory. If not, state action will be needed to remove barriers to workforce development and to rapidly expand the recruitment of needed contact investigators.

Based on the average pay for a community health worker of $17 an hour, the potential overall need for funding for a cadre of 100,000 contact investigators, absent a huge number of unpaid volunteers, would amount to approximately $3.6 billion. This is assuming that all 100,000 workers work full time for 1 year. The chance to both contribute to containment of the virus and to replace some amount of income lost during this outbreak may present a welcome opportunity for many workers. As part of this contact tracing workforce, states could include resource coordinators who could help with connecting quarantined individuals with necessary services, such as food banks, mental health services, visiting nurses, and other needed programs.

States should be able to employ different types of models, and funding should be able to be used flexibly in accomplishing the quick scale up of a contact tracing workforce. Flexibility for different types of funding and hiring models is needed so that funds can be most efficiently put to use. For instance, some models (as in Massachusetts) could involve experienced nongovernmental organizations (NGOs) working with state and local health departments to perform these functions and ensure rapid launch of the programs. Options for direct funding of partners to the public sector could expedite work in many states.

Workforce Management

A robust management infrastructure at the state and local level will be needed to strategically deploy, guide, and supervise workers; to ensure the fidelity of the work; and to properly manage the data coming out of this effort. Effective management of contact tracing teams by expert public health practitioners is essential to ensure the work is completed correctly and that contacts are appropriately reached and monitored. Existing disease investigation specialists (DISs) and epidemiology specialists in states can serve as supervisors and mentors to the new lay contact investigator workforce. A management structure could be set up whereby existing public health staff act as top-level managers, and beneath them, there is another level of management of contact tracers.

Technologies and Applications

Technologies are also needed to aid this process. They can act as a force multiplier so that 1 worker can connect with many more people in the community.[21] They can also enable contact tracing without exposing workers to infection.

Force-multiplying technologies to enable an army of contact tracers to be more efficient are clearly needed. Contact tracing requires:

- Identifying an individual who has been clinically confirmed as having COVID-19;
- Identifying and listing epidemiologically meaningful contacts of that individual;
- Communicating with that list of contacts to warn them of potential exposure, and linking them to public health officials, diagnostic services, or self-isolation information and services;

- Monitoring symptoms of people on the contact list until diagnostic results show that a person is not infected or are beyond a reasonable time frame, such as the incubation period of the virus; and
- Visualization and analytics to optimize, monitor, and determine efficacy of contact tracers.

Technological solutions will be helpful across many of these use cases.[21]

First, a strong connection with diagnostic capabilities will be needed to determine who has been infected, and handing off information from diagnostic labs or public health agencies will need to be worked out.

Second, there are a handful of means of identifying and listing epidemiologically meaningful contacts. A range of apps are in development to allow individuals to easily enter their health status and contacts or to automatically identify people with whom they have been in contact, based on location data or Bluetooth broadcasting, and to connect with a public health worker who can follow up.

Third, several symptom trackers have been developed for a range of uses. Symptom trackers can be helpful for monitoring persons under investigation while waiting for testing and results. These technologies would be useful for population-level monitoring as well. For example, smart thermometers around the country have been used to monitor users for fevers, and the resulting data are being considered as potential surveillance input.[22]

Privacy and responsible data management must be considered when thinking about contact tracing technologies for several reasons. First, without the ability to reassure concerned citizens and privacy activist groups that sensitive information will be respected and safeguarded, there may be significant opposition to a systematic contact tracing program being initiated, and individuals may be unwilling to participate. Second, mishandling of sensitive information may cause public blow-back after such a program is in place, sabotaging its effectiveness. Third, official contact may be mistaken for spam or scams by cases or contacts, and strategies are needed to ensure the public can tell the difference. To increase the chances that these efforts will be effective, trusted, and legal, use of technology in the contact tracing space should be conceived of and planned with extensive safeguards to protect private information from the beginning

A National Plan

To build a national capacity for long-term management of COVID-19 in the United States, there are multiple levels of action and commitment needed with states and territories directly the overall response in their jurisdictions support by federal assets and resources and in partnership with local health agencies and health system partners.

National Level

Congress should work quickly to provide emergency funding to state and territorial health departments. They should also pass legislation giving public health agencies the legal authority to flexibly expand their workforce and ensure sufficient liability protections for agencies and workers for the duration of the public health action. As Congress considers a fourth stimulus package, we urge them to include $3.6 billion to support contact investigation training and workforce support in the states and territories.

State, Territorial, Tribal, and Local Levels

Much of the work required to implement this national action plan falls to local, state, territorial, and tribal public health departments. Contact tracing approaches will need to be adapted to jurisdictions based on existing public health infrastructure, and coordination will be needed between state and local jurisdictions in order to allocate financial and personnel resources to the locations of greatest need and to maximize interjurisdictional coordination. In addition, considerations should be given to vulnerable communities and to the territories and freely associated states in the Atlantic and Pacific regions. Incorporation of mayors, community leaders, and faith leaders into planning and discussions will maximize the ability of jurisdictions to successfully support contact tracing at the community level.

Once plans are in place, health departments should begin recruitment efforts. All plausible pipelines should be explored. Potential workforce recruits may include individuals recently separated from government employment because of the economic downturn, retired public health and public safety workers, and medical personnel; medical and public health students as part of a national service program for public health;[23] Medical Reserve Corps or Peace Corps members;[24] community health workers; and individuals seeking employment—especially those who have lost their jobs due to COVID-19. Consideration should be given to identifying particular skill sets, such as effective interviewing, communications, and interpersonal management skills. If possible, workers should be hired from the communities where they will work. Situational awareness of local characteristics will make individuals better able to communicate and gain people's trust in the health department.

Workforce protection and safety are critical, and measures should be taken to ensure that any individuals going out into the community have appropriate protective measures to maintain their health and safety during the response. If shortages in personal protective equipment persist, then phone- and internet-based contact tracing will be even more necessary to ensure the safety of the contact tracers.

Management of data collected during contact tracing and surveillance will need to be organized and communicated effectively both to state and national health authorities. Prior to workforce training of new public health staff, systems should be established for collection and storage of data and for maintaining these systems. Provisions should

be made to employ staff to link data systems, analyze data, and provide real-time visualization of the data for decision making. If a common platform were used to collect, store, and summarize data, adjacent state and local jurisdictions could share data and/or visualizations so that they could more easily communicate and coordinate efforts.

Conclusions

In order to relax community mitigation efforts and other measures to reduce COVID-19 transmission, it is essential to rapidly test all symptomatic cases of COVID-19, identify and isolate all positive cases, and conduct contact tracing for all close contacts of each and every case. This level of case-based intervention will help enable a lessening of social distancing measures, but it can be accomplished only by massively scaling up the local and state public health workforce—on the order of 100,000 newly engaged workers—to assist with the enormous and unprecedented task of contact investigation and containment on this scale.

In parallel with helping the United States to shift from population-level interventions to more precise case-based interventions, this initiative could provide an income to many who have lost their earnings as a result of the pandemic. Strategic management, training, and support for this workforce will be necessary, and technology must be explored as a force multiplier. Federal, state, territorial, tribal, and local governments each have a role to play to successfully advance this ambitious expansion of existing local, state, and territorial public health capabilities.

Now is the time for Congress, the administration, and the country to come together to adequately fund and implement contact tracing at this required scale. The goal of adding at least 100,000 new contact tracers in the United States and managing their work, while challenging, is achievable with appropriate financial support and a collective commitment.

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