

Medical News & Perspectives

Building an “Army of Disease Detectives” to Trace COVID-19 Contacts

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As state and local governments deliberate how and when to get back to business, much discussion has centered around contact tracing to rein in coronavirus disease 2019 (COVID-19).

Health departments have used contact tracing—the practice of identifying and monitoring people who’ve had close contact with infected individuals—to control communicable diseases such as [tuberculosis](#), [syphilis](#), and [HIV infection](#). But, in terms of the sheer number of cases and the ease with which it spreads, COVID-19 presents special challenges.

“The scale of this infectious disease outbreak is far beyond anything we’ve seen since HIV,” said Marcus Plescia, MD, MPH, chief medical officer for the Association of State and Territorial Health Officials (ASTHO). “It takes a much bigger workforce to be able to manage that than what we’ve had in place.” In addition, he said, “the public workforce has eroded over the last 2 decades,” although even at full strength, it still wouldn’t have been big enough.

Plus, while people with [latent](#), or asymptomatic, tuberculosis infection can’t spread that disease, those infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) appear to be infectious for several days before the onset of COVID-19 symptoms, making contact tracing “very complicated,” said Barun Mathema, PhD, MPH, an infectious disease epidemiologist with a focus on tuberculosis at Columbia University’s Mailman School of Public Health.

Estimates of the number of people needed to conduct COVID-19 contact tracing in the US range from [100 000](#) to more than 300 000. The higher estimate [comes from](#) ASTHO, which assumes that 1 contact tracer will be needed for every 1000 in the population. California Governor Gavin Newsom [announced](#) May 4 a goal of training 20 000 contact tracers in his state over the following 2 months, while New York Governor Andrew Cuomo [announced](#) April 30 that his state expects to enlist 6400 to 17 000 contact tracers, depending on the projected number of



cases. To help meet the unprecedented demand, the Johns Hopkins Bloomberg School of Public Health is offering a free online how-to [course](#) on COVID-19 contact tracing. As of May 17, 141 298 people had enrolled.

“This is really an army of disease detectives across the United States that will be built,” said Judy Monroe, MD, president and CEO of the CDC Foundation, an independent nonprofit created by Congress to marshal philanthropic and private-sector support for the US Centers for Disease Control and Prevention (CDC). Through a cooperative agreement with the CDC, the CDC Foundation [is hiring](#) contact tracers, among other public health workers, for the COVID-19 Corps.

Building an army of disease detectives won’t come cheap, but it would be money well spent, said Andy Slavitt, former acting head of the Centers for Medicare & Medicaid Services.

Slavitt was part of a bipartisan group of 16 public health experts who recently [wrote](#) congressional leaders, urging them to commit \$46.5 billion as part of the next stimulus legislation to scale up contact tracing and self-isolation capacity. Of that amount, \$12 billion would go toward expanding the contact tracing workforce by 180 000 people.

“We don’t get our economy back unless we’re willing to make this investment,” Slavitt said in an interview.

Boxing It In

A national contact tracing [plan](#) released April 10 by the Johns Hopkins Center for Health Security and ASTHO estimated that each person infected with SARS-CoV-2 can, on average, infect 2 or 3 others.

That might not sound like many, but, if left unchecked, that first positive case could lead to more than 59 000 cases in 10 rounds of infections, the authors noted.

But contact tracing can “box it in,” according to a recent [report](#) about containing COVID-19 from the Resolve to Save Lives initiative, part of Vital Strategies, a global health organization helping to develop New York’s contact tracing program.

Contact tracing involves helping people newly diagnosed with COVID-19 recall everyone with whom they came in close contact when they might have been infectious, a period beginning 48 hours before symptoms appear, [according to](#) the CDC. For the purpose of COVID-19 contact tracing, the CDC defines close contact as having been within 6 feet of an individual for at least 15 minutes.

Without identifying the cases, specially trained public health workers notify

contacts that they might have been exposed to COVID-19 and advise them to stay home and socially distance themselves for 14 days following their last exposure. Contact tracers keep in touch with contacts to see if they develop disease symptoms and need to isolate themselves and seek medical care.

"If we quarantine people who have been in contact with an infected person, those people will not pass on the infection, whether they are symptomatic or not," Plescia said. "That is what will break the cycle of infection."

In one respect, contact tracing might be easier for COVID-19 than for other diseases, he noted. Unlike COVID-19, "some of the conditions that we have traditionally done contact tracing for are infectious diseases that have stigma attached to them," making it more difficult for contact tracers to elicit information from cases, Plescia explained.

A Time for Contact Tracing

Contact tracing was used with the earliest confirmed US COVID-19 cases, imported by people who had traveled abroad. But the soaring number of cases soon exceeded the reach of contact tracing in most jurisdictions.

"When you get to a place where there's community transmission, you can't do contact tracing anymore," Plescia said. "There are just too many cases. That's certainly where we are in a lot of the big cities."

Although their case numbers might still be too high, state and local health departments must begin planning now for the eventual resumption of contact tracing, he said.

"This is a strategy for a particular point in the evolution of the disease," said Cyrus Shahpar, MD, MPH, MBA, director of the Prevent Epidemics team at Resolve to Save Lives.

"It's a strategy when the cases come down," Shahpar said in an interview. "To relax measures and have people go out again safely, we really have to separate the sick from the well" and quarantine contacts of the sick.

One City's Experience

Thanks to "decisive early leadership," one city that never had to pause contact tracing because of overwhelming case numbers is San Francisco, infectious disease specialist Mike Reid, MD, MPH, said in an interview.

"The mayor called a [public health emergency](#) very early [on March 6]," said Reid, co-leader of the University of California, San Francisco, team that is collaborating with the San Francisco Department of Health on contact tracing. In addition, the city and county of San Francisco, along with 5 other Bay Area counties and the city of Berkeley, issued [stay-at-home orders](#) March 16.

As of May 18, San Francisco, with a population of nearly 900 000, had 2131 confirmed cases and 36 deaths from COVID-19, according to the city [health department](#).

By late April, when 40 to 50 residents were being diagnosed with COVID-19 each day, San Francisco had trained 240 people in contact tracing, Reid said. Pre-COVID-19, the same individuals would both investigate cases and trace contacts, but San Francisco has now divided those tasks, he said.

"We mobilized this workforce from people across the city," Reid said. Training is "a work in progress," he said, but it takes about a week, including 2 days of webinars and 2 days during which trainees shadow contact tracers via Zoom.

The San Francisco contact tracing model borrowed ideas from Wuhan, China, the epicenter of China's COVID-19 outbreak, and a World Health Organization (WHO)-China joint [report](#) published in late February, Reid said. According to the report, Wuhan, with a population of about 11 million, had 1800 teams of epidemiologists, each with at least 5 members, tracing tens of thousands of contacts a day.

For now, the contact tracers work 4-hour, not 8-hour, shifts because of the "fairly intense cognitive load," Reid said. However, he added, when shelter-in-place restrictions ease, the number of new cases each day is expected to rise, so contact tracers will likely work longer shifts. Contact tracing teams each include a clinician, such as a retired physician, a registered nurse, or a medical student.

The goal is to reach 3 contacts per hour, Reid said. Contacts are first sent a text saying, "This is the San Francisco Department of Health. We're going to call you in 5 minutes about a public health issue." Contact tracing has been well-publicized in San Francisco, so people who receive that text generally know what's coming next, he said, although "I'm sure there are some who don't want to take the call."

Contacts receive daily texts asking whether they have any symptoms, and, if they do, a clinician will call to refer them for testing.

"I think there's a lot of misunderstanding about what contact tracing is," Reid said. "We're not surveilling them. We're calling them [and saying] 'We really need you to stay at home for the betterment of our community as well as your own health.'"

"It's not a sophisticated message, but it's an important one," he said.

Helping People Do the Right Thing

For many cases and contacts, spending 2 weeks in isolation or quarantine is easier said than done. They might share a 2-bedroom, 1-bath apartment with 3 or 4 others—if they even have a home. They might be essential workers who couldn't afford groceries if they took 2 weeks off from work. They might fear losing their job altogether.

"We're going to need to make it not hard for people to do the right thing, to essentially do a civil service for the rest of us," Slavitt said.

One component of the plan he and his coauthors laid out in their letter to congressional leaders involves allocating \$4.5 billion to house cases and contacts in hotels that have largely been sitting idle. About 14% of those affected will need accommodation; sheltering them will reduce household transmission and provide a much-needed stimulus for the hospitality industry, the letter noted.

Slavitt and his coauthors also suggested a \$50-per-day stipend—comparable with what jurisdictions pay to people on jury duty—for cases and contacts while in isolation or quarantine. That income support will cost \$30 billion over 18 months, they estimated.

San Francisco already has been paying for marginally housed cases and contacts to move into hotels, Reid said. In addition, recognizing that people might not be able to afford groceries or have family, friends, or neighbors to shop for them while they're in isolation or quarantine, the city launched a [food access initiative](#) in response to COVID-19.

To make those 2 weeks as bearable as possible, Reid said, he's been trying to persuade Amazon to develop a "quarantine box." Depending on where the cases and contacts live, Reid said, the boxes would contain hand sanitizer, masks, essential food,

and maybe free access to Amazon Prime video for 2 weeks. He figures 50 000 boxes ought to be enough for San Francisco for the next 12 months.

Tracing With Technology

Thanks to social distancing, most North Dakota cases have had few contacts during their infectious period, said Levi Schlosser, MPH, respiratory disease epidemiologist at the North Dakota Department of Health. Interviewing cases about their contacts can take anywhere from a half hour to several hours, he said. "On occasion, you do come across people who don't feel comfortable giving up information."

For that reason, and because cases might have faulty recall, contact tracers working with the first 100 cases of COVID-19 in South Korea went beyond simply asking about their contacts. In a recent [article](#), researchers from the Korea Centers for Disease Control and Prevention described the 4 methods used to fill in the gaps resulting from patients' recall and confirmation biases.

First, contact tracers checked cases' history of using medical facilities and visiting pharmacies to estimate when they might have become infected. Then, by accessing the Global Positioning System on cases' cell phones, contact tracers checked whether they had failed to mention any recent trips they had made. The contact tracers also asked patients for their credit card transaction logs to assess the consistency of their movements as described in their initial interview. And finally, contact tracers checked closed-circuit television (CCTV) to see if there might have been a large, unspecified number of contacts (according to one [report](#), South Korea had installed about 1 million CCTV cameras as of 2018, mainly for facility safety and fire and crime prevention; according to another [report](#), the US had 70 million CCTV cameras in 2018).

It's unlikely that people in the US would be as willing to hand over their cell phones and credit card statements to contact tracers, though. "We're just a very, very different society," Plescia said of the US, noting that due to "our concerns about freedom and privacy, we're not going to have the same kinds of use of technology."

However, many countries, including the US, are developing mobile phone apps to support contact tracing. Apple and Google

[announced](#) April 10 that they are working together to develop a Bluetooth-based contact tracing platform. The software would track whether the user had been near someone who'd tested positive for COVID-19. Of course, phone owners would have to download the app first.

"Privacy, transparency, and consent are of utmost importance in this effort," according to Apple's press release.

The North Dakota health department partnered with the creators of the [Bison Tracker app](#)—which tracked North Dakota State University football fans as they traveled to Frisco, Texas, for the national championship—to create the [Care19 app](#). Individuals who download the app receive a random ID number, and the app will anonymously cache locations where they spend at least 10 minutes. If app users test positive for COVID-19, they can grant the health department access to the stored data to assist contact tracers.

An online survey of United Kingdom residents [found](#) that three-quarters of respondents said they would definitely or probably install a contact-tracing app. Even an uptake by less than half of the population, in combination with other measures, would be enough to make an important impact, researchers from the University of Oxford noted in a May 4 [article](#) about the ethics of instant contact tracing using mobile phone apps.

Before people are invited to install a contact-tracing app, though, "they need to be assured that adequate protections and oversight are in place," the authors concluded.

Testing, Testing, Testing

Polymerase chain reaction testing for SARS-CoV-2 is a vital piece of contact tracing. It's impossible to trace contacts without first knowing who is infected.

But many US cities and states fall far short of having the capacity to test every symptomatic individual, let alone every person. As a result, an undetermined number of cases—and, therefore, their contacts—are escaping contact tracers' notice.

That's a problem, especially because people infected with SARS-CoV-2 can spread the virus for several days before developing symptoms.

Transmission of COVID-19 appears to be highest before and for 5 days after the onset of symptoms, according to a [study](#) May 1 in *JAMA Internal Medicine*.

The authors' findings are based on tracing the contacts of the first 100 confirmed COVID-19 cases in Taiwan. The researchers noted that the WHO defines contacts as anyone who was close to an infected person up to 4 days before they developed symptoms; the CDC recommends tracing contacts back only 2 days before a case develops symptoms.

"These findings underscore the pressing public health need for accurate and comprehensive contact tracing and testing," *JAMA Internal Medicine* editor-at-large Robert Steinbrook, MD, wrote in an accompanying [editorial](#). "Testing only those people who are symptomatic will miss many infections and render contact tracing less effective." With limited test availability, even people with mild COVID-19 might go unidentified, Shahpar pointed out.

Certain groups of asymptomatic people as well as those with symptoms should be tested, Shahpar said. "We need to protect people who are going to die if they get it."

In April, Shahpar's organization [outlined](#) how US COVID-19 testing should be prioritized. Medically vulnerable symptomatic individuals should be the highest priority, but the second-highest priority should be asymptomatic residents of congregate facilities such as nursing homes, homeless shelters, and correctional facilities; health care workers; and contacts of cases.

Utah, which is in the minority of states that have the capacity to do more testing, recently expanded its contact tracing efforts to include probable cases of COVID-19, namely the untested but symptomatic close contacts of individuals with laboratory-confirmed disease, said Amelia Prebish, MPH, who leads contact tracing at the Utah Department of Health. "Some people don't want to get tested," she noted, although the state is trying to encourage more testing.

In areas with inadequate test capacity, some have suggested placing a higher priority on testing asymptomatic individuals than symptomatic individuals, who, if their symptoms are suggestive of COVID-19, should be presumed to have the disease. However, Monroe said, a positive test result might be what it takes to convince some people with COVID-19 to isolate themselves and alert their contacts.

"We need to ramp up the testing," she said. "I think everyone agrees with that."

Getting Real

Proponents of contact tracing to rein in COVID-19 are clear-eyed about the tool's potential and its limitations.

"Contact tracing isn't a silver bullet," Reid said.

"Right now, COVID-19 has been a forest fire," Slavitt noted. "We're not going to eliminate any risk of COVID-19, but we want to make them [outbreaks] all the size of campfires."

Cardiologist Harlan Krumholz, MD, SM, director of the Yale Center for Outcomes Research and Evaluation, recently ques-

tioned whether contact tracing can make much of a dent in the spread of SARS-CoV-2, given the inability to test everyone, whether they're symptomatic or not.

"If we test the symptomatic, and people shed for days before becoming symptomatic...and then take a few days to collect and reach contacts...aren't we always chasing our tails...with no real chance of breaking the chain of transmission," Krumholz said in a [tweet](#).

Krumholz raised a valid point, Plescia said. "The more robust the testing capacity the better, and if we could test at will, we

would certainly control this better, but that does not seem realistic right now."

Clearly, using virologic polymerase chain reaction to test only symptomatic individuals will miss many cases of SARS-CoV-2 infection. However, Plescia said, "It's not realistic to seek perfection with contact tracing. My message is that if we seek perfection, we will never even get started. We must treat this with urgency and start to build and then perfect contact tracing if we ever want to get a step ahead." ■

Note: Source references are available through embedded hyperlinks in the article text online.