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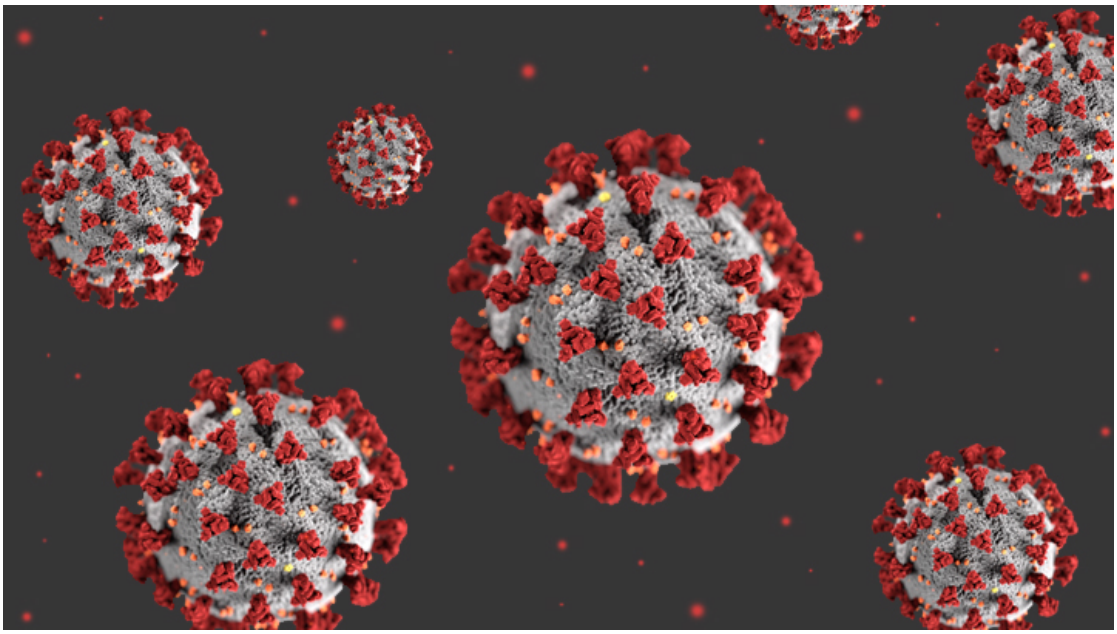
The Challenge of Tracking COVID-19's Stealthy Spread

Posted on April 23rd, 2020 by Dr. Francis Collins



Credit: CDC/ Alissa Eckert, MS; Dan Higgins, MAMS

As our nation looks with hope toward controlling the coronavirus 2019 disease (COVID-19) pandemic, researchers are forging ahead with efforts to develop and implement strategies to prevent future outbreaks. It sounds straightforward. However, several new studies indicate that containing SARS-CoV-2—the novel coronavirus that causes COVID-19—will involve many complex challenges, not the least of which is figuring out ways to use testing technologies to our best advantage in the battle against this stealthy foe.

The first thing that testing may help us do is to identify those SARS-CoV-2-infected individuals who have no symptoms, but who are still capable of transmitting the virus. These individuals, along with their close contacts, will need to be quarantined rapidly to protect others. These kinds of tests detect viral material and generally analyze cells collected via nasal or throat swabs.

The second way we can use testing is to identify individuals who've already been infected with SARS-CoV-2, but who didn't get seriously ill and can no longer transmit the virus to others. These individuals may now be protected against future infections, and, consequently, may be in a good position to care for people with COVID-19 or who are vulnerable to the infection. Such tests use blood samples to detect antibodies, which are blood proteins that our immune systems produce to attack viruses and other foreign invaders.

A new study, published in *Nature Medicine* [1], models what testing of asymptomatic individuals with active SARS-CoV-2 infections may mean for future containment efforts. To develop their model, researchers at China's Guangzhou Medical University and the University of Hong Kong School of Public Health analyzed throat swabs collected from 94 people who were moderately ill and hospitalized with COVID-19. Frequent in-hospital swabbing provided an objective, chronological record—in some cases, for more than a month after a diagnosis—of each patient's viral loads and infectiousness.

The model, which also factored in patients' subjective recollections of when they felt poorly, indicates:

• On average, patients became infectious 2.3 days before onset of symptoms.
• Their highest level of potential viral spreading likely peaked hours before their symptoms appeared.
• Patients became rapidly less infectious within a week, although the virus likely remains in the body for some time.

The researchers then turned to data from a separate, previously published study [2], which documented the timing of 77 person-to-person transmissions of SARS-CoV-2. Comparing the two data sets, the researchers estimated that 44 percent of SARS-CoV-2 transmissions occur before people get sick.

Based on this two-part model, the researchers warned that traditional containment strategies (testing only of people with symptoms, contact tracing, quarantine) will face a stiff challenge keeping up with COVID-19. Indeed, they estimated that if more than 30 percent of new infections come from people who are asymptomatic, and they aren't tested and found positive until 2 or 3 days later, public health officials will need to track down more than 90 percent of their close contacts and get them quarantined quickly to contain the virus.

The researchers also suggested alternate strategies for curbing SARS-CoV-2 transmission fueled by people who are initially asymptomatic. One possibility is digital tracing. It involves creating large networks of people who've agreed to install a special tracing app on their smart phones. If a phone user tests positive for COVID-19, everyone with the app who happened to have come in close contact with that person would be alerted anonymously and advised to shelter at home.

The NIH has a team that's exploring various ways to carry out digital tracing while still protecting personal privacy. The private sector also has been exploring technological solutions, with Apple and Google recently announcing a partnership to develop application programming interfaces (APIs) to allow voluntary digital tracing for COVID-19 [3], The rollout of their first API is expected in May.

Of course, all these approaches depend upon widespread access to point-of-care testing that can give rapid results. The NIH is developing an ambitious program to accelerate the development of such testing technologies; stay tuned for more information about this in a forthcoming blog.

The second crucial piece of the containment puzzle is identifying those individuals who've already been infected by SARS-CoV-2, many unknowingly, but who are no longer infectious. Early results from an ongoing study on residents in Los Angeles County indicated that approximately 4.1 percent tested positive for antibodies against SARS-CoV-2 [4]. That figure is much higher than expected based on the county's number of known COVID-19 cases, but jibes with preliminary findings from a different research group that conducted antibody testing on residents of Santa Clara County, CA [5].

Still, it's important to keep in mind that SARS-CoV-2 antibody tests are just in the development stage. It's possible some of these results might represent false positives—perhaps caused by antibodies to some other less serious coronavirus that's been in the human population for a while.

More work needs to be done to sort this out. In fact, the NIH's National Institute of Allergy and Infectious Diseases (NIAID), which is our lead institute for infectious disease research, recently launched a study to help gauge how many adults in the U. S. with no confirmed history of a SARS-CoV-2 infection have antibodies to the virus. In this investigation, researchers will collect and analyze blood samples from as many as 10,000 volunteers to get a better picture of SARS-CoV-2's prevalence and potential to spread within our country.

There's still an enormous amount to learn about this major public health threat. In fact, NIAID just released its strategic plan for COVID-19 to outline its research priorities. The plan provides more information about the challenges of tracking SARS-CoV-2, as well as about efforts to accelerate research into possible treatments and vaccines. Take a look!

References:

[1] Temporal dynamics in viral shedding and transmissibility of COVID-19. He X, Lau EHY, Wu P, Deng X, Wang J, Hao X, Lau YC, Wong JY, Guan Y, Tan X, Mo X, Chen Y, Liao B, Chen W, Hu F, Zhang Q, Zhong M, Wu Y, Zhao L, Zhang F, Cowling BJ, Li F, Leung GM. Nat Med. 2020 Apr 15. [Epub ahead of publication]

[2] Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. Li, Q. et al. N. Engl. J. Med. 2020 Mar 26;382, 1199–1207.

[3] Apple and Google partner on COVID-19 contact tracing technology. Apple news release, April 10, 2020.

[4] USC-LA County Study: Early Results of Antibody Testing Suggest Number of COVID-19 Infections Far Exceeds Number of Confirmed Cases in Los Angeles County. County of Los Angeles Public Health News Release, April 20, 2020.

[5] COVID-19 Antibody Seroprevalence in Santa Clara County, California. Bendavid E, Mulaney B, Sood N, Sjah S, Ling E, Bromley-Dulfano R, Lai C, Saavedra-Walker R, Tedrow J, Tversky D, Bogan A, Kupiec T, Eichner D, Gupta R, Ioannidis JP, Bhattacharya J. medRxiv, Preprint posted on April 14, 2020.

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8 Comments

Marcos Zambrano **says:**
April 23, 2020 at 10:41 am
We can test for critical patients the same medication we usually applied to patients with Hepatitis B, perhaps the same formulation for Hepatitis B vaccine possible can work against Covid S-2

Reply

H.S. **says:**
April 23, 2020 at 12:09 pm
The potential building and using a detection, tracking, and quarantine system in the future as envisioned and advocated by the medical systems and societies, both in Government and in private industry, will bankrupt the U.S.A., and if put in to operation will demand that all functions of society must first go thru mandatory testing, screening, and categorization, with minutely follow ups before individuals are allowed to do most all major actions or functions in life, e.g., school entrance, starting a job, travel, etc. The second fallacy of all this about the COVID-19 and developing a vaccine is that this virus, like all other virus species, spins off new and totally different virus species which then makes the developed vaccine obsolete, as the process does now for the common flu virus.

Reply

Gerardo Arroyo **says:**
April 23, 2020 at 3:47 pm
What are the recommended tests for IgG and IgM for following the development of the pandemic

Reply

Mr V **says:**
April 23, 2020 at 4:42 pm
Is it reasonable to expect that an airborn pathogen with this level of infection can be contained? Any precedents for that?
How difficult would it be to derive a reasonably reliable prediction of a persons risk to getting seriously ill from covid-19? One that is based on age *and* comorbidity? Is it plausible that a large enough group of people (for instance below 65 and with minimal to no commodities) have a negligible risk factor (for instance less risk than dying in a car accident)?
How likely is it that the (any) containment efforts that are not effective will end up being counter productive, will keep the virus in the environment much longer, give it more time to adapt, increase the chance that it reaches vulnerable people?

Reply

Edgar Bustamante **says:**
April 23, 2020 at 10:05 pm
The approach is good, but it would be convenient to avoid propagation using substances or exposures to UV light, but for a correct use, to determine the concentration and the exposure time, tests should be carried out with infected samples and be certain of their efficacy, thus after quarantine use disinfection cabins with properly tested substances in places of high concentration of people. and know the maximum allowable avoiding harm to health.

Reply

Morris D. Gordin **says:**
April 26, 2020 at 1:56 pm
A delayed-type hypersensitivity skin testing with tuberculin purified protein derivative (PPD) is the standard for tuberculosis screening. Its advantages as a testing method for screening for exposure to TB is the PPD test is easy to administer and provides a response within days that is obvious if a person is positive. In order to assess the extent of the exposure as to those who were asymptomatic and yet may be positive for exposure to SARS-CoV-2, such a skin test that could test for an immune response to SARS-CoV-2 virus would offer obvious advantages for mass screening.

Reply

Saadullah **says:**
May 4, 2020 at 8:54 pm
If we find out which cells more week if we strenghten them with t cells to pass virus to another streghtened cell i think virus cant be enter in weak cells. Am adding one more think that ebola vaccine if we develope ebola vaccine like redmesivir develope for covid 19 i think if we develope ebola vaccine for covid 19

Reply

Zara **says:**
May 5, 2020 at 12:38 am
Thanks for the information.
Is there any indication that SARS-CoV-2, like measles, causes immune amnesia?

Reply

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Francis S. Collins, M.D., Ph.D.

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