Can a new tool for diabetes patients solve the problem of COVID-19 testing?

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Ming Wang, distinguished professor of civil and environmental engineering at Northeastern, developed a testing device to monitor glucose levels using rapid saliva samples. The device, he says, can be tweaked to test for COVID-19. Credit: Matthew Modoono/Northeastern University

When Ming L. Wang developed a new way to test glucose levels in saliva

to monitor diabetes, he wasn't thinking of making COVID-19 tests.

But after he saw the lack of testing options in the U.S. as COVID-19 cases skyrocketed, Wang decided to turn his testing device into something people could use to track the spread of SARS-CoV-2, the coronavirus that causes the illness.

"The current tests sometimes take too long," says Wang, distinguished professor of civil and environmental engineering at Northeastern. "You need to take a few days, and sometimes do the tests many times to minimize false negatives."

For nearly a decade, Wang has been perfecting his glucose testing device, which can perform quick and easy tests from saliva samples. That test kit uses a disposable chip equipped with sensors to detect glucose molecules—no finger pricks, doctors, or pain involved. It was patented in 2018 and is now being tested in preclinical trials, Wang says.

Now, Wang is reconfiguring the device's biosensor to test for SARS-Cov2 molecules in the saliva of people who carry the coronavirus and give an accurate diagnosis within three minutes of testing.

Wang says that device is intended to work even in the early stages of infection, before the onset of COVID-19 symptoms. And it is designed to detect antibodies in an effort to help determine whether someone who has recovered from the disease might be protected from it in the future.

"That's very important," Wang says. "You need to know who has had it to test someone's immunity after contracting the virus."

Testing during the early stages of infection is critical, Wang says, because reports have shown that people can shed the coronavirus before showing some of the most common symptoms of COVID-19, even

without ever displaying them.

Wang's tests are intended to be accurate enough to be used in healthcare facilities, but also practical enough to be used at home and without the need for healthcare personnel.

As scientists around the world speed up their research to learn more about the unknowns behind the coronavirus—about immunity and transmission, for example—Wang says rapid home tests can help people answer one of the most important questions of the COVID-19 pandemic: How do I know if I've got the virus?

Recent estimates in the U.S. suggest that the coronavirus has been spreading far more widely and efficiently than health officials thought, suggesting it moves silently amongst people who haven't yet developed symptoms. Those estimates underscore the importance of having a quick and accurate tool that people can use at home, Wang says.

The biosensor within the device is designed to use gold nanoparticles to read tiny signals produced as the coronavirus interacts with key protein molecules to hijack human cells and replicate into millions more of itself. The sensor then reads the signals released by those interactions to detect the coronavirus.

Wang says he is focusing on sampling saliva because the method produces fast results without being invasive.

The most common tests for COVID-19 first insert a cotton swab into a person's throat, lungs, or nose to sample the genetic material of the coronavirus, and then rely on a technique called polymerase chain reaction, which involves making millions of copies of the genetic material to determine the presence of the coronavirus. The entire process can take several hours or days to complete.

And while new methods have been recently developed to help healthcare personnel test for the coronavirus using saliva, the key is in using a simple electronic device that relies on the chemistry within saliva to test in minutes and without specialized biotechnicians, Wang says.

"You could use it for port entry facilities, you could use it for physician offices, urgent care centers, nursing facilities," he says. "It takes about two-three minutes to complete, and about $10 per test."

Wang's coronavirus testing kits will take at least six months to develop. Still, he is hopeful they will come out during a time when there is an urgent need for new technology that can serve as the basis for future tests to help prevent other global health emergencies such as COVID-19—or recurring ones.

"We could be expecting the second or third run of COVID-19 to come next winter in 2021, maybe up to 2022 or beyond," Wang says. "Once this platform is set and we can use it, we can redesign the sensor for other viral infections."

Provided by Northeastern University

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