Contact Tracing Apps to Identify Potential Exposure to SARS-CoV-2

Contact tracing is a public health intervention that prevents the spread of infectious diseases like COVID-19 by identifying, educating, and monitoring individuals who have been in close contact with infected persons. Traditionally, contact tracing is performed manually, which is time-consuming and resource-intensive. New digital contact tracing tools that use smartphone apps to complement existing methods are emerging and may be a technological aide in the prevention of new SARS-CoV-2 (the virus that causes COVID-19) infections.

Use of contact tracing apps is being explored by governments across Canada.

How It Works

Contact tracing apps use technologies in a smartphone to determine where the users have been or with whom they have been in contact. While contract tracing apps that use a smartphone’s GPS to track movement or require the user to produce a Quick Response, or QR, barcode to show they are healthy have been developed or are in use globally, apps that use Bluetooth are emerging as a preferred and less intrusive option for public health authorities.

Alberta’s ABTraceTogether is one app that uses Bluetooth. Users turn on the app whenever they leave their home. The app uses Bluetooth to detect other phones using the app and exchanges unique encrypted codes between the devices. If the user later tests positive for COVID-19, they are contacted by public health officials and asked to voluntarily upload the app’s encrypted data from the last 21 days to Alberta Health Services. Public health officials then use the encrypted data to identify probable close contacts and reach out to the contacts using the phone number provided when setting up the app.

To help standardize the development and approval of apps, Google and Apple created a set of requirements governments must meet when developing contact tracing apps for Android smartphones and iPhones. Groups in the European Union and at the Massachusetts Institute of Technology have also released design recommendations and standards.

Who Might Benefit?

Contact tracing apps are intended to complement existing contact tracing systems. They are not intended to replace existing methods of contact tracing, nor are they to be used in the absence of these methods. Rather, the apps are designed to augment the ability of public health officials to identify potential cases of COVID-19 and take appropriate follow-up actions to prevent further spread of the disease.

Availability in Canada

As of May 7, 2020, only Alberta has begun implementing a contact tracing app for COVID-19 — ABTraceTogether. Officials in New Brunswick and Newfoundland and Labrador have also publicly begun exploring the use of contact tracing apps. Globally, contact tracing apps have been developed for use in Australia, China, Egypt, India, Israel, Singapore, and South Korea.

What Does It Cost?

Our literature search did not identify any information about the costs of developing contact tracing apps or costs associated with their implementation, nor information about the impact contact tracing apps may have on the health care costs associated with COVID-19.

Digital contact tracing using smartphone apps is thought to be less costly compared with traditional contact tracing methods, in part due to their ability to automate manual processes and to scale up in large populations. However, it is uncertain whether contact tracing apps are effective without being used with traditional contact tracing methods.

In Alberta, ABTraceTogether is free to download and use for iPhone and Android smartphones. The app requires a smartphone with an active data plan.

Current Practice
The current standard for identifying individuals who have potentially been exposed to SARS-CoV-2 is traditional or manual contact tracing.\textsuperscript{11,13} Traditional contact tracing uses public health service employees or volunteers to conduct phone or community outreach.\textsuperscript{11} Traditional contact tracing processes for potential SARS-CoV-2 exposure may vary by jurisdiction\textsuperscript{11} but follow the three general steps described by the WHO:\textsuperscript{14}

- identify an infected individual
- list all the people the infected individual has encountered
- monitor and follow up with these contacts for symptoms, and testing for infection.

In the case of SARS-CoV-2, traditional contact tracing processes appear most concerned with people who have been in “close contact” with an infected person and encourage these contacts to self-isolate regardless of symptoms.\textsuperscript{11}

Limitations to traditional contact tracing methods include the time and human resources required to effectively identify contacts and the ability of individuals to remember where they have been and with whom they have been in contact — up to 14 days for SARS-CoV-2 exposure.\textsuperscript{1,11} The quick rate at which SARS-CoV-2 spreads before signs or symptoms appear also poses challenges to traditional contact tracing approaches.\textsuperscript{13}

A CADTH Rapid Response (published on May 1, 2020) found no evidence-based guidelines, systematic reviews, or health technology assessments for contact tracing for potential exposure to SARS-CoV-2.\textsuperscript{15}

**What Is the Evidence?**

Our literature search identified two rapid reviews\textsuperscript{2,11} and one scoping review (pre-publication, not yet peer-reviewed)\textsuperscript{16} about contact tracing apps or digital contact tracing to identify potential exposure to SARS-CoV-2.

The first rapid review (published on April 20, 2020) found insufficient evidence to support the use of digital contact tracing.\textsuperscript{2} The authors recommended that readiness for implementing a contact tracing app take into consideration evidence of a need for the technology, availability of widespread testing for the public, the ability of the app to be used consistently by 60% of the population, and an understanding of how the app uses the data it acquires.\textsuperscript{2} The authors also found that a contact tracing app would only be effective if it is used in addition to manual contact tracing and if it is based on a confirmed diagnostic test for SARS-CoV-2, as opposed to the self-reporting of symptoms.\textsuperscript{2}

The second rapid review (published on April 24, 2020), while largely descriptive, found little published literature on contact tracing apps at that time.\textsuperscript{11} The authors also noted that a lack of available testing may be slowing the potential impact of contact tracing apps.\textsuperscript{11}

Authors of the scoping review found there was no evidence on uptake and engagement with apps, and a “dearth of evidence” on barriers and facilitators to uptake and engagement.\textsuperscript{16}

**Safety**

No evidence on the safety of contact tracing apps was identified in our literature search.

**Issues to Consider**

Several important issues about the use of contact tracing apps have been raised.\textsuperscript{11,12} Contact tracing is predicated on widespread availability of accurate testing.\textsuperscript{11} Additional issues to consider when implementing this technology include accuracy, uptake, data privacy and security, and health equity.\textsuperscript{2,11,12}

**Accuracy**

The accuracy of contact tracing apps that use Bluetooth has been raised as a potential impediment to their effectiveness.\textsuperscript{11} Bluetooth has a range of 10 metres to 30 metres and it is possible that contact tracing apps may connect with devices outside the “close contact” range of two metres. Bluetooth signals can also penetrate walls, and older smartphones may have difficulty determining the user’s orientation to other people.\textsuperscript{11} Each of these issues creates the potential for false-positive contacts.\textsuperscript{11} Accuracy may also be impacted should a fractured market of different contact tracing apps emerge.\textsuperscript{2}

**Uptake**
The successful application of contact tracing apps also depends on widespread, consistent use in the population. As of May 5, 2020, only approximately 3% of Alberta’s population had downloaded ABTraceTogether below the estimated 56% to 60% necessary for contact tracing apps to be effective. Greater adoption may be driven by public trust and confidence, which may in turn be driven by transparent rules and limits for the collection, use, and destruction of data, independent oversight, and legislation. The mandatory use of contact tracing apps may be necessary to achieve a sufficient level of uptake but may in turn discourage their use.

**Data Privacy and Security**

Concern has been expressed that, given the extraordinary nature of the COVID-19 pandemic, government actions such as implementing contact tracing apps may have significant impact on the privacy and fundamental rights of individuals. To balance the right to privacy with the need to prevent the spread of COVID-19, the case for implementing contact tracing apps could be strengthened by minimizing any privacy intrusions, ensuring high standards for data security oversight and protection, and being transparent about how the data collected is used. To this end, recommendations for data privacy and security for contact tracing apps have been produced by groups around the world.

Steps taken to protect user privacy include an announcement from Apple and Google that the companies intend to allow only public health authorities to develop contact tracing apps and will bar the use of GPS in any apps developed for their platforms.

**Health Equity**

Implementing contact tracing apps that require the user to have a smartphone and know how to use a smartphone may exacerbate existing issues of health equity, particularly in groups at higher risk, such as older adults and people with chronic conditions who may be less likely to use the app.

**Related Developments**

Other strategies being explored to improve the ability to trace potential cases of SARS-CoV-2 include:

- training non-public health staff and volunteers to perform contact tracing
- repurposing existing resources such as call centres or hotlines
- enhancing traditional contact tracing methods using digital tools for data collection.

**Looking Ahead**

Digital contact tracing is only one part of an holistic public health system.

Success of digital technologies in the COVID-19 context, including contact tracing apps, may depend on the ability of governments to demonstrate transparency and foster public trust through regulation and oversight in the development, deployment, and phasing out of these solutions.

By Jeff Mason

**References**

Saliva-Based Tests to Detect Active Severe Acute Respiratory Syndrome Coronavirus 2 Infection

New saliva-based tests for severe acute respiratory syndrome coronavirus 2 are more comfortable for individuals being tested and may pose less risk to health care workers than alternative tests

Nasopharyngeal, deep nasal, and throat swabs are commonly used to collect the sample needed for testing to detect diseases of the upper respiratory tract like severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). However, widespread testing using traditional nasopharyngeal swabs has proven to be challenging given shortages of critical testing supplies such as swabs and reagents, as well as shortages of personal protective equipment for the health care practitioners who perform the tests. In addition to these shortages, nasopharyngeal, deep nasal, and throat swabs are difficult to perform and can be quite uncomfortable for the individual undergoing testing.

Saliva-based tests for SARS-CoV-2 are an emerging alternative to traditional testing. These tests require different supplies than the standard swabs, which could help ease medical supply shortages. Additionally, some saliva tests can be self-collected, so they may result in less risk of exposure to the SARS-CoV-2 pathogen for health care workers. They are also easier to obtain and less invasive than standard nasopharyngeal, deep nasal, and throat swabs. If proven to be effective and accurate, these tests could be a component of the robust testing strategy necessary for controlling the COVID-19 pandemic.

How It Works

There are two saliva- or oral fluid–based tests that have received Emergency Use Authorization (EUA) from the FDA to diagnose active SARS-CoV-2 infection: the Rutgers Clinical Genomics Laboratory TaqPath SARS-CoV-2 Assay (the Rutgers test) and the Curative-Korva SARS-CoV-2 Assay (the Curative-Korva test). They are both molecular reverse transcriptase polymerase chain reaction tests that detect the virus’s genetic material in a specimen provided by an individual deemed by their health care provider to be at risk for COVID-19.
The first saliva test to receive EUA by the FDA was the Rutgers test. This test can be used to detect SARS-CoV-2 in multiple sample types, including a saliva sample. The assay is designed as a diagnostic test to detect ribonucleic acid from SARS-CoV-2 in respiratory droplets from patients with suspected COVID-19. For saliva sample testing, the sample must be collected using the Spectrum Solutions LLC SDNA-1000 Saliva Collection Device. Under an update to the original EUA, the saliva specimen can be self-collected. To collect the sample, the individual spits directly into the collection device. The sample is then stored and transported to the Rutgers clinical genomics laboratory for testing. Testing of the specimen must take place within 48 hours of collection.

The Curative-Korva test also received EUA by the FDA. The test can be used to detect SARS-CoV-2 in respiratory specimens from a variety of sample types, including oral fluid specimens. Unlike the Rutgers test, the Curative-Korva test requires the oral fluid specimens to be collected using a swab. In general, the collection of samples for swab-based oral fluid tests usually involves having an individual cough several times before swabbing the inside of both cheeks for several seconds. Although the specimens can be self-collected according to the EUA, the specimens must be collected under the supervision of a trained health care worker. The swab containing the specimen is then sealed in a tube for transportation to KorvaLabs where it can be tested.

Who Might Benefit?

The benefits of these types of tests vary depending on how they are deployed. As samples can be self-collected, the tests do not require the same degree of direct contact between a health care worker and an individual suspected of having COVID-19 that a traditional nasopharyngeal swab requires. This is a potential benefit to health care workers as they would have less risk of exposure to the SARS-CoV-2 pathogen.

Another group that might benefit from these new saliva-based tests would be individuals who are symptomatic for COVID-19 and require testing for a diagnosis. Increased availability of tests could result in increased testing capacity, which may lead to shorter waiting times for testing. Furthermore, providing a saliva sample is more comfortable and less invasive than a nasopharyngeal swab, which might decrease the stress experienced by an individual being tested for the pathogen that causes COVID-19.

Finally, if these new saliva-based tests are proven to be accurate, the additional tests could contribute to an increased capacity for widespread testing. The ability to test large groups of people with or without COVID-19 symptoms is a necessary part of a public health strategy to manage the pandemic.

Availability in Canada

At the time of this report, neither the Rutgers test or the Curative-Korva test are authorized for use in Canada as a testing device for use against COVID-19, nor does either test appear on the list of applications received by Health Canada for diagnostic devices for use against COVID-19.

What Does It Cost?

The Rutgers test is available in New Jersey at a cost between US$65 and US$100 per test. No cost information about the Curative-Korva test was found.

The availability of multiple types of diagnostic tests for SARS-CoV-2 might help to reduce costs for the health care system as multiple tests could reduce shortages of testing supplies, which may prevent surge pricing. Additionally, tests that allow for self-collection could contribute to reduced costs as some do not require the presence of a trained health care worker for specimen collection.

Current Practice

In Canada, diagnostic testing for SARS-CoV-2 has been done by the National Microbiology Laboratory in close collaboration with provincial and territorial public health laboratories. Criteria for testing varies by jurisdiction and has changed over time. While nasopharyngeal swabs are often used for diagnosing active SARS-CoV-2 infection, testing may be performed in a variety of ways and could be based on several specimen types such as nasopharyngeal swab, deep nasal swab, throat swab, or sputum sample.

What Is the Evidence?
Testing for an Individual Diagnosis

Saliva samples can be used to detect diseases of the upper respiratory tract and scientists have theorized that saliva-based tests might be useful for detecting SARS-CoV-2. There are some published studies that report on the detection of the SARS-CoV-2 pathogen in saliva and oral fluids, however, due to the novelty of the pathogen, the body of research is limited, and study populations are very small. It should be noted that while SARS-CoV-2 can be detected in saliva, there is evidence that suggests that different specimen types from the same individual can yield conflicting results. In addition to these studies, there are several ongoing clinical trials to evaluate tests that use saliva to detect SARS-CoV-2.

Due to the nature of the COVID-19 pandemic, there is a push to make research about the topic accessible. In some cases, publishers have made information about COVID-19 accessible by not putting this research behind a paywall. Another way research results are more accessible during the pandemic is by posting online before peer review. While posting before peer review can speed up the time frame for access to emerging COVID-19 research, it may also have the effect of compromising the quality of the research. There are several preliminary reports on testing saliva for SARS-CoV-2 infection that have not yet been peer reviewed. The early results of these non-peer reviewed studies support the use of saliva-based testing to detect SARS-CoV-2; however, it is important to note that many of these studies report that different types of tests had conflicting results. The same individual might test both positive and negative for SARS-CoV-2 based on different specimen types, and none of the sample types was able to detect all instances of SARS-CoV-2.

Screening of the General Population

There is no universally agreed upon gold standard or reference test for diagnosing the SARS-CoV-2 pathogen because it is so new. It is difficult to establish the diagnostic accuracy of any new test without a reference standard test. While information about diagnostic accuracy and disease prevalence are linked, when the prevalence of a disease is low, even small imperfections in test accuracy lead to substantial numbers of misdiagnoses. In order to discover the prevalence of COVID-19 cases in a population, it is necessary to test a random sample of both symptomatic and asymptomatic people. Critically, the saliva tests that are available are expressly meant to be used to test individuals who are symptomatic. More data is needed to establish a reference test or gold standard for the diagnosis of COVID-19, saliva-based or otherwise, in order to establish prevalence of COVID-19 in the population. One protocol was identified that proposes to validate home specimen collection methods for SARS-CoV-2. This research is intended to contribute to the evidence base to guide public health responses to the COVID-19 pandemic.

Issues to Consider

Scalability

The saliva-based tests that have received FDA EUA are proprietary, and all specimens collected for each test must be processed by the lab that created the assay. This could make scaling up difficult as the number of tests would be limited by how many tests an individual lab can process each day.

Comparing Test Results

There is emerging evidence that different types of samples collected may yield different results in the same individual being tested. This finding makes it difficult to directly compare test results of different tests.

When to Test

There is evidence emerging that viral loads of SARS-CoV-2 in saliva are highest during the initial phase of infection (the first week) and decline over time. This is consistent with other data that suggests pharyngeal virus shedding is highest in the first week of symptoms. It is therefore likely important to use these types of tests in the initial stage of infection.

Related Developments

In addition to the previously mentioned saliva-based tests, there are at-home tests for COVID-19 emerging. The nasal swab test created by Laboratory Corporation of America (LabCorp) is an at-home nasal swab test that can be self-administered. The
Pixel test was the first at-home test granted EUA by the FDA. As the Pixel is a reverse transcriptase polymerase chain reaction test that detects genetic material from the SARS-CoV-2 virus in upper and lower respiratory specimens, As the Pixel test can be used with a home specimen collection method, this test does not need to be performed in the presence of a health care worker. Like the Rutgers test and the Curative-Korva test, the Pixel test is designed to diagnose an individual whose health care provider suspects they have contracted COVID-19. The test is performed by collecting a nasal swab from just inside both nostrils. After the specimen has been collected, the swab is placed in a collection tube and stored in a biohazard specimen bag for transportation to LabCorp for testing. The testing kits by LabCorp cost US$119.

Looking Ahead

There is information emerging that shows that saliva tests may be useful for making an individual COVID-19 diagnosis. Saliva-based tests may result in safer and more comfortable testing for health care workers and those being tested. However, more research is needed about the diagnostic accuracy of these tests in order for them to be deployed for widespread testing of the population.

Author: Sarah Jones

References