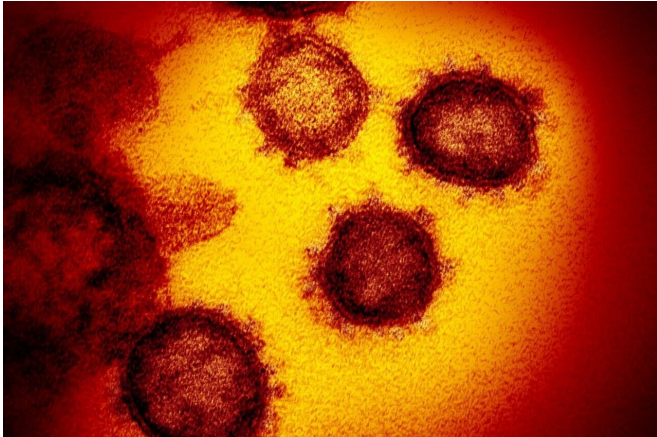


Suppressing the impact of COVID-19 using controlled testing and isolation

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Transmission electron microscope image of SARS-CoV-2, the virus that causes COVID-19, emerging from human cells. Credit: NIAID

The outbreak of COVID-19 has revealed the widespread effects a pandemic can have on all spheres of life from health, to social life, to the economy. The main thrust of efforts to control the spread has been to decrease the reproduction rate to flatten the curve of the total number of infected individuals per day in order to reduce overload on the health system. The most widely implemented response to the exponential growth of the infection has been widespread quarantine and lockdown. While isolation is an effective tool to decelerate the spread, repeatedly imposing complete quarantine for a relatively long period of time until the virus is suppressed has negative effects on people's lives and on the economy. Moreover, if proper population monitoring is not enforced further waves of the disease may ensue. Therefore, early detection of positive test results is of paramount importance to suppress the spread of COVID-19 as soon as possible.

A second component in fighting the pandemic is to devise better testing policy. Today, health systems

around the world prioritize the administration of tests to people who have had direct contact with an infected person or who are symptomatic. Some countries are implementing extensive resources to test people widely and randomly to detect areas where the pandemic is likely to spread. Nevertheless, these strategies do not use resources effectively.

A recent study, published in the journal *Scientific Reports* by Prof. Amir Leshem, from the Kofkin Faculty of Engineering at Bar-Ilan University, and Dr. Kobi Cohen, of Ben-Gurion University, offers a more effective method for the prioritization of tests using a feedback methodology. The key to the proposed method is to test individuals with a high probability of being infected and identify them before symptoms appear. The probability of individuals being infected acts as an input to selecting additional individuals for testing. Those with the highest probability of infection are selected. Their test results then act as feedback to update the probability of other individuals being infected, and so on.

By reducing the lapse in time between contact with an infected person and taking a COVID-19 test, it has been demonstrated that the proposed method, when combined with contact tracing, may reduce the rate of isolation and mortality by up to 50% compared to existing methods. The key is to test individuals with a high probability of being infected before symptoms appear. These probabilities are updated based on contact tracing and test results. Proper use of the controlled testing methodology significantly improves the outcome for any testing capacity. However, the most significant results are when daily testing capacity is between 0.3% of the population and 3% of the population.

The authors also demonstrated that for small, new outbreaks, controlled testing can prevent the large spread of new waves. Tracing and quarantining only those at risk—for instance those in close

contact with an infected individual, depending on the duration of contact and distance—can contain epidemics without using aggressive lockdowns using surveillance," says Prof. Leshem. "There are two elements to halting epidemics: quarantine and testing," explains Prof. Leshem. "One approach is to test only those who have symptoms, as was done during Israel's first lockdown, but this proved ineffective. Another approach is to randomly perform as many tests as possible. According to calculations, random tests will only be effective if 5% of the population is tested. In our article we propose acceleration by initiating the test rather than waiting for people to do them. Technological means, such as contact tracing, can facilitate this." If within a day people suspected of being infected were called in for testing based on data regarding their proximity to someone known to have contracted the virus, infection rates and morbidity would be reduced, unnecessary tests would not be performed and less unnecessary isolation would be imposed.

Prof. Leshem and Dr. Cohen propose the use of technology that is not based on GPS and does not involve tracking geographical locations, but rather depends on proximity between devices that transmit waves at short distances, such as Bluetooth. With this less-intrusive method, the individual's identity is random and stored in the device, and is "exposed" only if he has been in the vicinity of a person who has tested positive within his Bluetooth range. People will be called in for a [test](#) based on the number of infected people who have been around them and the length of time they were in the same vicinity. The risk will be calculated using a dedicated algorithm.

Furthermore, the adoption of control testing methods may prevent new outbreaks (as a result of variants or other viruses) in the early stages and in widespread outbreaks. For example, in a scenario of a single outbreak in a population of 100,000 people, which takes into account that only 70% of the population will comply with the isolation provisions and that the tests are only 80% reliable. Existing methods have been found to require more than a million cumulative days of isolation until the spread is completely eradicated, while mortality reaches about 2,000 people. In contrast, the

method proposed by Leshem and Cohen found that only half a million days of isolation were required until the spread was completely eradicated, while mortality reached only about 1,000 people. While existing policies taken by governments around the world have failed to control the outbreak and led to full lockdowns, in terms of the economic cost, the proposed method can save around 8 percent of GDP, for each month of full lockdown that can be saved.

More information: Kobi Cohen et al, Suppressing the impact of the COVID-19 pandemic using controlled testing and isolation, *Scientific Reports* (2021). [DOI: 10.1038/s41598-021-85458-1](https://doi.org/10.1038/s41598-021-85458-1)

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