

# Rapid paper-strip COVID contagiousness tests can reopen schools and the economy

To suppress the SARS-CoV-2 virus and reopen schools and the economy, we need to break transmission chains and prevent contagious students and teachers from entering school. The risk of keeping schools open will only increase as we enter fall and winter, when conditions become more amenable for increased transmission of the virus, akin to other seasonal coronaviruses. Rapid testing using lateral flow paper strips provides a powerful and cost-effective tool uniquely suited for this task.

Rapid paper-strip testing is very accurate at detecting virus during the peak of infection, when people are contagious, allowing people to isolate so they do not infect others<sup>1</sup>. When combined with masks and social distancing, rapid tests provide a critical added layer of protection – one that will be needed to keep the economy and schools open while minimizing the risk of outbreaks.

To safely reopen all K-8 schools, the U.S. will need 10-20 million of these tests every day. Tests should be rolled out with an initial focus on schools in communities where prevalence is high. In these areas, tests might be used on a daily or twice-weekly basis. In communities with low prevalence, tests could be used on a weekly basis, and scaled up if cases increase. An investment in rapid paper-strip tests would pay for itself hundreds of times over. The technology exists and we should deploy it immediately.

## A massive return on investment that helps families

A K-8 testing program using paper strips would cost between \$8B and \$10B<sup>2</sup>, including \$1B to \$2B for development of manufacturing capacity. Such a program would provide significant emotional, educational, and financial benefits to American parents and students. The program would more than pay for itself. According to the Brookings Institute, the cost to future earnings of four months of lost education is \$2.5 trillion<sup>3</sup>, which could be salvaged by a rapid testing program. There are also *immediate* advantages to the economic output of the parents, which we conservatively estimate to be \$300 billion<sup>4</sup>. In short, a K-8 testing program provides a 40X return on investment in the current year and a 300X return on investment in future years. Even larger benefits could be obtained by extending these testing programs to grades 9-12, colleges, and businesses authorized to remain open by state and local health authorities.

## Why current approvals are not enough to open schools

The FDA has recently approved some rapid medical diagnostic tests. Most of these approved tests require expensive and unscalable electronic devices. While useful for some purposes, these tests cannot be produced at the rate needed to reopen schools. More recently, the FDA

approved an encased paper-strip antigen test<sup>5</sup>, which has high sensitivity (98%) for contagious cases. However, these tests are currently available only by prescription, and are not approved for at-home or at-school use to screen students and teachers. Even if that changes, these tests will only be produced at 1 million per day, which is not enough.



Rapid test with  
electronic device



Encased paper-strip



Basic paper-strip

Epidemiologists have shown that for rapid tests to be effective at suppressing outbreaks, they should be used at least twice a week. Anything less will miss too many contagious people. To test all K-8 students at this rate for a full school year, we will need 10 million tests per day. If we want to reopen other businesses, our target should be closer to 20 million. A good way to hit that target would be to start or incentivize the production of basic paper-strip tests, which can be produced at a rate of 10 million per day, and that can be paired with smart phones or reusable plastic cassettes for improved usability. As their far higher production volume will allow frequent repeat testing, basic paper strips will detect far more contagious people than any current testing programs could possibly attain. The importance cannot be overstated. Simply put, you can't find people who are contagious if you are not testing them. This is especially true for children in the K-8 age range, who rarely show symptoms of COVID-19.

## Federal government actions

- Approve a regulatory pathway to evaluate and approve tests that are specifically intended for public health rather than medical diagnostic use.
- Appropriate funds to facilitate massive increases in the manufacturing capacity of these tests, aiming for 10 million to 20 million per day.
- Require that each package of rapid tests include several confirmatory and orthogonal rapid tests (similar tests that identify distinct viral antigens). The confirmatory tests will keep the false positive rate low, which would help maintain public trust in the tests.
- Distribute the test to states, focusing on hot spots.
- Work with public health agencies and media to inform consumers that these are public health screening tests, not medical diagnostic tests, and are not intended to catch all cases, especially non-contagious cases. Those who test positive should consult their doctor immediately.

## State and local government actions

- Distribute the tests first to schools, nursing homes, and other facilities that need them most.
- While production is still ramping up, concentrate distribution in a small number of equitably chosen sites to allow frequent testing. Testing less than twice a week in hot spots is inadequate.
- Since no test is perfect, continue to encourage or require masks, social distancing, and adequate ventilation or air filtration.

## Authors

This paper was written by members of RapidTests.org, an all-volunteer advocacy group for rapid tests.

## Footnotes

<sup>1</sup>[Larremore et al. \(2020\)](#)

<sup>2</sup>Assumes 35 million K-8 students (Source: [Department of Education](#)) tested twice a week for 40 weeks, at \$3 per test. If we assume basic paper strips, which could be sold for \$1, the total cost would drop to \$3 billion.

<sup>3</sup>Source: [Brookings Institute](#)

<sup>4</sup>Total GDP is \$20 trillion (source: [Federal Reserve](#)). If we assume that K-8 parents contribute 15% of US economic output and if we conservatively assume that homebound children reduce the output of their parents by 10%, a program that brings kids back to school will preserve \$300 billion in GDP.

<sup>5</sup>Source: [FDA EUA of Abbott BinaxNOW](#)