

Testing only the unvaccinated may do little to curb spread of omicron

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Nearly two years into the pandemic, as countries, institutions and businesses work to stay open, a common refrain has begun to emerge among leaders: Get vaccinated or face weekly testing.

But new University of Colorado Boulder research suggests while these unvaccinated-only testing policies make sense when the unvaccinated population is large, they have little impact on transmission when there are few remaining [unvaccinated people](#) to [test](#). The study also finds that in highly vaccinated regions, including Colorado, most infections will soon be [breakthrough cases](#)—particularly with the arrival of the omicron variant.

"Our findings suggest that once you reach [vaccination rates](#) above 80 or 90 percent, the money spent on testing the unvaccinated could probably be better spent on other public health measures," said senior author Dan Larremore, an assistant professor in the Department of Computer Science. "That's because in places where 8 out of 10 people are vaccinated, not only will a majority of infections be vaccine breakthroughs, but most of the transmission will be coming from the vaccinated, not the holdouts."

Math confirms it: Vaccines work

Larremore and colleagues at the BioFrontiers Institute used computer modeling to simulate how SARS-CoV-2 would spread in a community of 20,000 under different scenarios, with varying degrees of vaccination, vaccine efficacy, infection acquired immunity, mitigation and testing.

First and foremost, the models show that vaccines work, protecting communities by reducing transmission.

"Across all scenarios, we found that the more vaccination there is, the fewer infections there are in a community, even if vaccine effectiveness has waned somewhat," said Casey Middleton, a graduate student in the Interdisciplinary Quantitative Biology program and one of the study's two lead authors.

They also found that as the proportion of vaccinated individuals rose, even as total cases declined, the percentage of vaccine-breakthrough cases increased.

While this may surprise some people, mathematically, the explanation is simple:

"When no one is vaccinated, of course infections are going to be 100% unvaccinated. Likewise, when everyone is vaccinated, any infections that do occur are going to be 100% breakthroughs," said Larremore. "So somewhere in between, there's got to be a vaccination rate where infections are half breakthroughs and half unvaccinated. We wanted to understand that point."

Modeling a vaccine with the effectiveness of two mRNA doses, and with about a third of people with partial immunity from prior infection, this 50-50 tipping point occurred when 68% of individuals were vaccinated. Many U.S. states, including Colorado, are nearing or have exceeded that threshold—a threshold expected to be lower for the omicron variant.

"We all see news stories that talk about [vaccine](#) breakthrough infections as if they are an unexpected phenomenon, but our analysis changes expectations," said Middleton. "We shouldn't be surprised by breakthroughs when most individuals are vaccinated."

Because vaccines provide some protection against passing the virus to others, the tipping point for transmission was higher. Once eight in 10 people were vaccinated, more than half of transmission came from the vaccinated.

This creates a hurdle for testing programs, Middleton notes:

"Unvaccinated-only testing policies operate under the assumption that

the majority of transmissions are coming from the unvaccinated. That's usually true, but not if almost everyone is vaccinated."

Their study found that in highly vaccinated communities, testing only the unvaccinated with a highly-sensitive polymerase chain reaction (PCR) test with a quick one-day turnaround would have "little impact on community spread." For instance, on a college campus where only 1 in 20 remain unvaccinated, there's little impact in focusing an expensive testing program on a tiny fraction of the population, notes Larremore.

Compliance and frequency key

Modeling showed that unvaccinated testing programs were worthwhile in communities with lower vaccination rates—typically under 80 percent—and in situations where social distancing and masking are not widespread. Even then, however, testing programs were successful only if people were tested at least once a week, and compliance was very high. At many institutions, voluntary COVID-19 testing has yielded about 50% compliance, too low to have a large effect.

The study did not assess the impact of testing everyone, regardless of vaccination status, but previous research shows that universal testing is also most useful in populations with lower vaccination rates and with high frequency and compliance.

Notably, the study was completed before the omicron variant swept the world. If vaccines are less effective at preventing omicron infections, as early data suggest, the authors note that the tipping points for both [infection](#) and transmission would occur at even lower vaccination rates.

The takeaway now: People should not be surprised to hear about more breakthrough infections and should remember that the vaccines also protect against severe disease and hospitalization.

And as policymakers consider testing protocols, they should realize there is no one-size-fits all approach.

"We have locations like CU that are extremely highly vaccinated and others around the country that are only at about 50%," said Kate Bubar, a [graduate student](#) in the Interdisciplinary Quantitative Biology program and the study's other lead author. "These populations are very different, and those differences need to be taken into consideration when policies are made."

This study has been submitted for publication in a peer-reviewed journal, but due to the quickly-evolving situation with COVID-19, the authors posted it online in advance.

More information: Kate M. Bubar et al, SARS-CoV-2 Transmission and Impacts of Unvaccinated-Only Testing in Populations of Mixed Vaccination Status (2021). [DOI: 10.1101/2021.10.19.21265231](https://doi.org/10.1101/2021.10.19.21265231)

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