

To stop a pandemic in its tracks, coordinate across borders

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On March 16, 2020, the governors of New York, New Jersey, and Connecticut announced "a regional approach to combatting COVID-19," citing an absence of federal leadership and national standards. Pennsylvania joined two days later. By mid-April, Delaware, Rhode Island, and Massachusetts were part of the coalition.

"This is not a war that can be won alone," said New York Governor Andrew Cuomo.

A new study shows just how right that sentiment was. The research, co-authored by Yale SOM assistant professor Paul Goldsmith-Pinkham and published in the *Proceedings of the National Academy of Sciences*, demonstrates the powerful benefit of coordinating containment policies across borders in the early stages of an epidemic like COVID-19. By sharing information, predicting the transmission of cases, and synchronizing lockdowns with neighboring jurisdictions, states and countries can dramatically decrease spread.

"Once a disease gets going in a network, you're already behind, trying to play whack-a-mole," says Goldsmith-Pinkham. "The more you can lock things down quickly based on outside information, the more you can halt the spread before it's started."

Goldsmith-Pinkham and his co-authors, Samuel Thau of Harvard University and Arun Chandrasekhar and Matthew Jackson of Stanford University, used a model of disease transmission to study the spread of a COVID-like virus. The model simulates 40 independent jurisdictions, each with a population of 3,500 people—the equivalent of small towns in a regional network. The researchers ran thousands of simulations to understand patterns of transmission based on two general containment policies. Under a "reactive" policy, each of the 40 jurisdictions responds to cases only once they've arrived within their borders. Under a "proactive" policy, neighboring jurisdictions share information and coordinate policies to prevent the spread of the virus based on the regional outlook.

They find that reactive policies to a disease like COVID-19 result, on average, in about 30% of a population getting infected. If jurisdictions are instead proactive about containment, meaning that they make

decisions based on [infection rates](#) beyond their borders, less than 2% of their population is infected.

"An effective proactive [policy](#) is one that identifies when neighboring jurisdictions have cases and shuts down in anticipation," Goldsmith-Pinkham says. "Because infections can grow exponentially, there are high returns to preventing initial spread and coordinating when lockdowns occur rather than having one location lock down and the virus escape and then subsequent locations lock down and so on."

That said, Goldsmith-Pinkham notes that even coordinated regional policies are difficult to execute well. As rates of infection fall, infections become more difficult to detect. A disease like COVID-19 presents particular challenges, given that roughly half of cases are asymptomatic. Moreover, people don't always stay at home when they are told to. Taken together, these variables make it easy for infections to leak beyond containment zones and spark problems in geographically distant regions.

"The point that needs to be emphasized is that there cannot be any leakage. Detection is a really big deal, and we really need good enforcement," Goldsmith-Pinkham says. "If there is any leakage, then that undermines the effectiveness of regional-style policies, as, all of a sudden, we can get hops along the network and very big nonlinear effects down the line."

While the model focused on the initial phase of an epidemic, it still has important lessons for the ongoing response to COVID-19—and especially how governments should be thinking about cooperation across borders.

For instance, the ricocheting spread of [infection](#) in the model bolsters the case for international vaccination efforts. Infections in far-flung countries, Goldsmith Pinkham says, will likely come back to haunt us.

"Simply put, if we spend money on other people, we will be better off than if we don't," he says. "Everyone is in the same boat and spillovers end up imposing really big costs across the board."

More information: Arun G. Chandrasekhar et al, Interacting regional policies in containing a disease, *Proceedings of the National Academy of Sciences* (2021). [DOI: 10.1073/pnas.2021520118](https://doi.org/10.1073/pnas.2021520118)

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