3 different countries, 1 result: Stay-at-home orders work

Enlarge / Classes have restarted in France following the lifting of restrictions.
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The various forms of social restrictions, from distancing to stay-at-home orders, seem like a radical departure to most of us. But faced with a pathogen that spreads through human interactions, they’re an obvious potential solution to limit that spread. And a variety of epidemiological models have indicated that various combinations of these approaches should be effective.

But do they actually work in the real, messy, interconnected modern world, and against this specific pathogen? It’s important to try to confirm that the models accurately project real-world results, and epidemiologists are doing exactly that. So far, the results are good: across several countries and contexts, restrictions were associated with significant drops in the spread of SARS-CoV-2. The bad news is that more severe restrictions may be necessary to keep the number of infections from increasing.

Good news from France

France was one of a number of countries that went for a lockdown, with anyone found outside their home expected to have a permit explaining why they needed to travel. The country has only just started to ease these restrictions following a period in which the total number of infected individuals has fallen. An international team of researchers has now looked at the dynamics of SARS-CoV-2's spread in the time before and after the lockdown was started on March 17.

The researchers built a model using a combination of data from France overall and from a cruise ship on which every infection was traced. They used the French data, which included over 95,000 hospitalizations, to develop national and regional models that accurately reproduced stats like the rate of hospital admissions and ICU treatment.

The model suggests that, just prior to the lockdown, each individual who became infected passed the virus on to nearly three additional people (put technically, the R_0 was 2.9) After the lockdown, there was only a two-thirds chance that an infected individual would pass the virus on to anyone (the R_0 was 0.67). This latter figure means that the rate of spread is insufficient to maintain the outbreak and is consistent with the decline in cases seen in France.

The researchers estimate that by the time restrictions were lifted, about 4 percent of the French population will have been infected. That, they say, is consistent with the finding that about three percent of the French blood donors have been testing positive for past infections. But that also means that the French population will remain very vulnerable to a return of the outbreak, which the authors argue means that many restrictions will have to stay in place (which is currently the plan in France).

Better and better in Germany

Germany put restrictions into place more gradually than its neighbor. The first thing to go was large public gatherings, which were halted in early March. Schools were closed about a week later in mid-March, and a strict person-to-person contact ban was put in place on March 22. A research team based in Germany took national statistics and plugged them into a standard epidemiological model called SIR, for susceptible-infected-recovered, to see how these restrictions influenced the spread of the pandemic.

Instead of trying to infer the properties of Germany's outbreak—the virus's infectivity, the length of the pre-symptomatic period, etc.—the team used a method of testing random values and identifying those that produced a good fit for their data. With the model trained, the researchers then examined the behavior of the model to explore whether there were any changes in the trajectory of the outbreak—in essence, looking for points at which the rates of infection changed.

Those were present, but they lagged the timing of changes in policy. Of course, that's exactly what you'd expect—there would be a lag period where those infected before the change in policy would need to have the infection take hold, and then some delay as they sought out and received testing.

The authors find a model with three transitions fits somewhat better than with two, and they calculate the changes associated with each time the policy was tightened. They found the growth rate of the outbreak started at about 30 percent, and the combination of school closings and a ban on large public gatherings cut that down to 12 percent. But it took the ban on interpersonal contact to drop the growth rate down to two percent, reaching the point where exponential growth of new infections isn't a concern.

In the heartland

There’s no real way to analyze what’s happening in the US in terms of policy, as it’s a patchwork of state and local rules. But some researchers have figured out a way to get some idea of what state-level policies are doing by looking at counties on the border of two states that are doing fairly different things. Iowa and Illinois share a border but do not share pandemic policies: Illinois issued a stay-at-home order, while Iowa hasn’t—although Iowa has closed schools, banned large gatherings, and closed some businesses. So the researchers looked at what’s happened in a set of border counties with a total population of over 700,000 residents.

Prior to March 21, the day Illinois’ order took effect, the counties in these states were on a similar trajectory: every 10 days, there were roughly an additional five cases for every 10,000 residents. But after Illinois put its stay-at-home order in place, there was a small but growing difference between the two. By 20 days after the order, Illinois saw 1.15 fewer cases per 10,000 residents. By 30 days, that difference approached five fewer cases.

In one month, the researchers estimate that the lack of a stay-at-home order resulted in an excess of 217 cases in Iowa compared to what it might have had otherwise. That may not sound like much, but it is nearly a third of the total cases seen in this area.

Overall, the three studies paint a consistent picture: across countries, the restrictions being put in place by governments are effective to slow the pandemic. This will surprise no one in the public health field, given that a combination of modeling and experience with past outbreaks had already indicated that this is exactly what should happen. But it’s always nice to have these sorts of expectations confirmed. And given that existing restrictions are increasingly being

opposed by a vocal minority within the US, this confirmation can help bolster the majority’s case for continuing to limit the spread of the pandemic.

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