

## The unseen and pervasive threat of COVID-19 throughout the US

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### Abstract

For each US county, we calculated the probability of an ongoing COVID-19 epidemic that may not yet be apparent. Based on confirmed cases as of April 15, 2020, COVID-19 is likely spreading in 86% of counties containing 97% of US population. Proactive measures before two cases are confirmed are prudent.

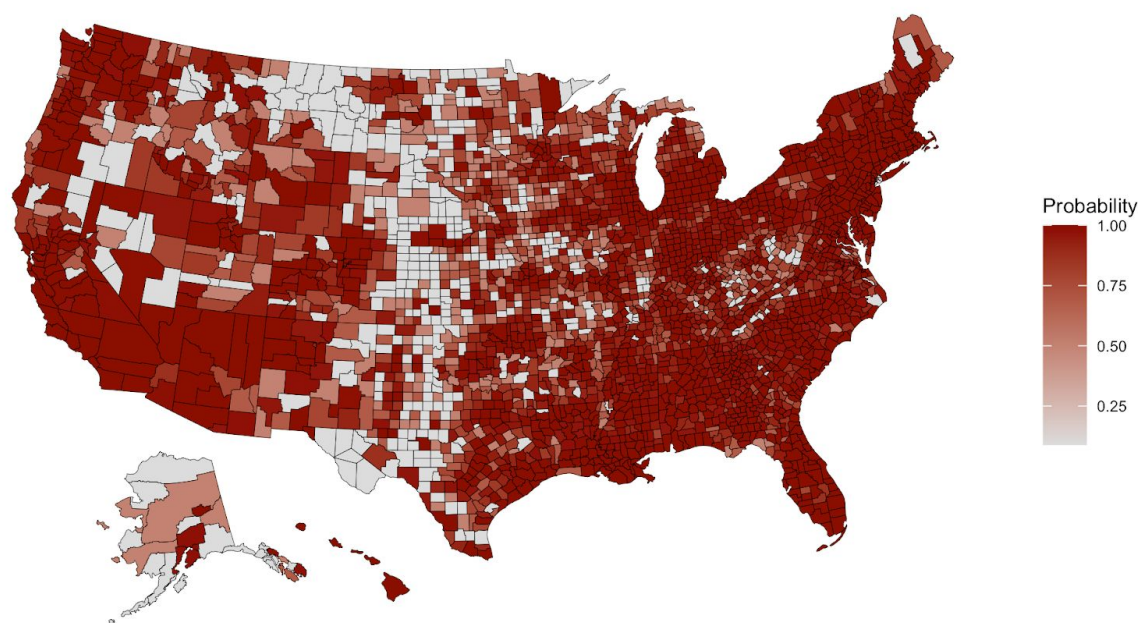
### Research Letter

The unprecedented threat of COVID-19 could kill hundreds of thousands to millions of Americans (1,2). Over the course of a few weeks, it has emerged in all 50 US states (3). Officials are weighing the potentially enormous economic and societal costs of strict social distancing measures against the *unseen* risks of COVID-19 hospitalizations and mortality in their communities. To support decision making, we have estimated the likelihood that each county in the US already has extensive community transmission (Figure).

To make these risk assessments, we applied a model that we developed for another *silent spreader*—Zika—which threatened to emerge in southern US states in 2016 (4). Using stochastic simulations, we determine the probability that a county already has an ongoing COVID-19 epidemic by the time the county reports just one, two, three or more cases. The levels of risk displayed in Figure 1 are based on reported cases as of April 15, 2020 (5) and account for under-reporting, the uncertainty in the transmission rate of COVID-19, the likelihood of super-spreading events—like those that fueled SARS outbreaks in 2003 and have been reported recently for COVID-19 (6)—and the impact of social distancing measures that have been enacted across the US in recent weeks (Appendix).

By the time a first case of COVID-19 is reported in the county, we estimate that there is over a 50% chance that a full-blown epidemic is underway. As of April 15, 2020, we found 86% of US counties with 97% of the national population have reported at least one case (Figure). Even counties that have not *yet* reported a confirmed case have an estimated 9% chance of sustained local transmission. If an epidemic is indeed underway, then our model predicts a delay of 7.5 (95% CI 3.9-16.3) weeks between the first reported case and the total number of COVID-19 exceeding 1,000; by the time the tenth case has been reported this lead time shrinks to 4.4 (95% CI 2.1-11.4) weeks (Appendix).

Given the speed and stealth with which COVID-19 spreads (7), the entire map will likely be fully red within a week or two. Proactive social distancing can block community transmission, avert catastrophic surges in hospitalizations, and save lives (8). For those still weighing if, when, and how aggressively to act, there is little time for delay.



**Figure.** Probability of ongoing COVID-19 epidemics in the 3142 counties of the United States as of April 15, 2020. The risk of an unseen epidemic in a county with only a single reported case is 50%. The risk in counties that have not yet reported cases is 9%.

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