Answering the "what-if" questions on COVID interventions with MEDIAN

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With the COVID-19 pandemic bringing masses of uncertainty and variability, it's essential for the government policy makers to understand the many variations of biological, policy, sociological and infrastructure responses. How much testing is enough? How much of a problem are false-negative results? Does contact tracing really help? How long will this go on?

This is where Los Alamos shines, in assessing complex data and making sense of it for decision-makers. Los Alamos' Modeling Epidemics for Decision Support with Infrastructure Analysis (MEDIAN) project evolved to help identify asymptomatic people in the population, understanding the balances between maintaining critical infrastructures and public health measures such as contact tracing and diagnostics.

"With the significant asymptomatic spread of the virus, plus without a vaccine (yet) and pharmaceuticals, the best feasible strategies for testing and diagnostics, contact tracing and quarantine need to be explored and used to the best advantage," said project lead Jeanne Fair (Biosecurity & Public Health Group).

"With false-negative test results, infected people are not enrolled in contact trace programs or may not be quarantined," she said. "Similarly, without broad testing, untested asymptomatic people are not identified and quarantined — they're loose in the community and have no way of knowing that they're spreading the disease."

To account for that situation and others, the MEDIAN team is using an interconnected system dynamics model, Fair said, to optimize strategies for mitigations during a pandemic. The team members are Jeanne Fair, Rene LeClaire, Lori Dauelsberg, Donatella Pasqualini, Mary Ewers, Will Rosenberger, Andrew Bartlow, and Tim Cleland.

"We use a variety of computer models within public health that include data on hospitals, intensive care units, masks, contact tracing, social distancing," Fair said. "We also have recently developed a new testing and diagnostics model to investigate the uncertainties with testing and to optimize strategies for detecting and diagnosing infected people."

The team has run thousands of simulations with different scenarios and ranges of variables for such things as the percent of asymptomatic people, testing strategies, and social distancing. "There is variation we see around the country for how many people are tested and the accuracy of the test results," Fair said, "depending on if the tests were administered within the limited window of viral shedding for tests to be positive.

Then there is also variation in how many people get contact traced and then finally the fraction of people that self-isolate and quarantine."

How can we flatten the curve and spread it out to buy time?

"The epidemic can be reduced proportionately, to the fraction of people contact traced and quarantined," Fair said. "Our results show that widespread testing, contact tracing and quarantine can curtail the pandemic through the essential path of identifying asymptomatic people in the population," she said.

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