Public Health Measures Can Contain SARS, Two Modeling Studies Suggest

The SARS virus is contagious enough to cause a very large epidemic if left unchecked, but could nonetheless be controlled with rigorous public health measures, two research teams report. These results are being released today by the journal Science, published by the American Association for the Advancement of Science (AAAS).

Both teams used data about recent SARS cases to make projections about how the epidemic will proceed under various circumstances. They found that the SARS virus seems to be moderately rather than highly contagious and could thus be controlled by careful interventions that, for example, reduced contacts by infected people, or helped them receive treatment more quickly.

In one of the studies, U.S. and Canadian researchers used their model to investigate how effective different control measures could be. The possibilities they considered -- including early case detection, reducing each patient's infectiousness, and quarantine -- could all have major impacts on the epidemic, especially when used in combination, the scientists found.

The second study, by U.K. and Hong Kong researchers, focused specifically on Hong Kong, and found that public health efforts currently seem to have brought the epidemic under control. Reduced contact rates in both hospitals and the community were primarily responsible for this success, with rapid hospitalization playing a less important
role, according to study.

"It’s difficult to predict, this early on, how an epidemic will spread, especially when it’s caused by a previously unknown virus. Modeling studies like these -- while preliminary -- suggest that we are headed in the right direction to stop the epidemic," said Caroline Ash, a microbiologist and Science editor working in Cambridge, U.K.

"Modeling studies can give us important information about the quantitative aspects of the epidemic -- how many people are infected, on average by each case; how many people would potentially be infected if the epidemic is not controlled; and how intense the public health measures will need to be to contain SARS," said Marc Lipsitch of the Harvard School of Public Health, who is a member of the U.S.-Canadian team.

"Many factors influence travel advice, some of which are addressed in our work. We show that the number of infectious individuals in Hong Kong is much smaller now than at previous points during the epidemic," said Steven Riley of Imperial College London, who co-led the Hong Kong study with Christophe Fraser of Imperial College London.

"Therefore, the risk to visitors to Hong Kong from SARS is much reduced although not yet zero," Riley said.

Both research teams used so-called "SEIR" models, which track individuals who are susceptible (S), exposed (E), infectious (I), and recovered (R). Using the models, the researchers considered key factors that would influence the course of an epidemic, including how long the presymptomatic and infectious periods last, and how many new infections one infected person could cause.

The Hong Kong study found that each case generated between two and three additional cases, on average, at the start of the epidemic. In their study, Lipsitch and his colleagues estimated that each case generated 2.2 - 3.6 additional cases, in the absence of any interventions.

The researchers used current data on actual SARS cases to make their models describe how the epidemic has spread thus far. Next, they examined how other variables might be affecting the outcome.

Riley's team estimated that a complete ban on
travel between districts in Hong Kong could have reduced transmission, excluding so-called “super-spreaders,” by three quarters. Thus, in resource-poor regions where the time between infection and being admitted to a hospital is relatively long, movement restrictions might be a useful control measure, the authors suggest.

Lipsitch’s team also examined how the epidemic might proceed without any interventions, and found that a global pandemic could result.

A related Perspective article accompanies the two reports.

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Lipsitch’s co-authors are Ted Cohen, Ben Cooper, James M. Robins, and Megan Murray, at the Harvard School of Public Health, in Boston, MA; Megan Murray also at Massachusetts General Hospital, in Boston, MA; Stefan Ma, Lyn James, Gowri Gopalakrishna, Suok Kai Chew, and Chorch Chuan Tan of the Ministry of Health, in Singapore; Matthew H. Samore at McMaster University, in Hamilton, Ontario; David Fisman at the City of Hamilton Public Health and Community Service Department, in Hamilton, Ontario and the University of Utah, in Salt Lake City, UT, The study was funded by the Ellison Foundation and the National Institutes of Health.

Riley’s co-authors are Christophe Fraser, Christl A. Donnelly, Azra C. Ghani, Laith J. Abu-Raddad, Neil M. Ferguson, and Roy M. Anderson of Imperial College London, in London, U.K.; Anthony J. Hedley, Gabriel M. Leung, Lai-Ming Ho, Tai-Hing Lam, Thuan Q. Thach, Patsy Chau, King-Pan Chan, and Su-Viu Lo at the University of Hong Kong, in Hong Kong; Pak-Yin Leung and Thomas Tsang at the Health, Welfare and Food Bureau, Government of the Hong Kong Special Administrative Region, in Hong Kong; Willam Ho and Koon-Hung Lee at the Hong Kong Hospital Authority, in Hong Kong; and Edith M.C. Lau at the Department of Health, Government of the Hong Kong Special Administrative Region, in Hong Kong. The study was funded by the Howard Hughes Medical Institute, the Royal Society, the Medical Research Council, and the Wellcome Trust.

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