TIMELY IDENTIFICATION OF OPTIMAL CONTROL STRATEGIES FOR EMERGING INFECTIOUS DISEASES

Zhilan Feng

ABSTRACT
Health authorities must rely on quarantine, isolation, and other non-pharmaceutical interventions to contain outbreaks of newly emerging human diseases. A system of differential equations is used to model a generic disease caused by a pathogen apparently transmitted by close interpersonal contact, but about which little else is known. An expression for $R_c$, the control reproduction number, is derived, which provides threshold conditions for disease control. The sensitivity of $R_c$ to control parameters is analyzed with biological parameters for SARS estimated from the initial case series in Hong Kong and infection rates from hospitalizations in Singapore. Using these parameter values in the model, we examined the effects of various control strategies on the reduction of both the reproductive number $R_c$ and the final epidemic size. The results suggest that it should be possible to identify the optimal intervention early enough to facilitate effective decision-making.

(Joint work with Yiding Yang, Dashun Xu, Pei Zhang, Mary McCauley, and John Glasser)