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The role of outcome preferences in optimizing heterogenous disease control strategies.

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ABSTRACT

As infectious diseases spread, they do not observe city, state, regional or national boundaries. As such, underlying susceptible population has a patchy structure which suggests metapopulation approach to epidemic modeling. When the patches of the metapopulation are managed by different public health authorities, it is natural to consider heterogeneous disease control strategies. For deterministic models, the basic reproduction number, $\mathcal{R}_0$, is typically a sharp threshold separating the extinction or persistence of the disease. When comparing two control strategies, the one which minimizes $\mathcal{R}_0$ is optimal. Stochastic epidemic models are necessary to account for inherent randomness in the initial phase of an outbreak. In this case, the disease is considered persistent if the probability of extinction is less than 1. This probability is often approximated by branching process techniques. It has been shown that $\mathcal{R}_0$ is also a threshold in the case of branching processes. The probability of extinction is a hitting probability. In this talk, a case is made to consider other hitting probabilities to measure the effectiveness of control strategies when outcome preferences are biased by public health authorities. A technique to approximate these probabilities is presented. Results are compared to standard techniques.