Stochastic Models of Superspreading in Epidemics

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ABSTRACT: A superspreader is an individual who is highly infectious and spreads an infection to many others. Typhoid Mary is a well-known case of a superspreader working in New York City as a cook in the early 1900s that spread typhoid fever to numerous others before being identified as infectious. More recently in 2002 and 2003, superspreaders were identified in outbreaks of severe acute respiratory syndrome (SARS) in hospital settings in China, South Korea, and Canada. Our goal is to use a stochastic epidemic model to study the effect of superspreaders in the initiation of an outbreak. A continuous-time Markov chain is formulated for a population containing a fixed proportion of superspreaders. Theory from branching processes is used to approximate the probability of an outbreak when one infectious superspreader is introduced into the population. As a superspreader has either a high transmission rate or a long duration of infection, the probability of an outbreak increases significantly when initiated by a superspreader.