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Branching process approach for epidemics in dynamic partnership network

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Abstract

We study the spread of sexually transmitted infections (STIs) and other infectious diseases on a dynamic network by using a branching process approach. The nodes in the network represent the sexually active individuals, while connections represent sexual partnerships. This network is dynamic as partnerships are formed and broken over time and individuals enter and leave the sexual active population due to demography. We assume that individuals enter the sexually active network with a random number of partners, chosen according to a suitable distribution. We discuss branching process approximation for the initial stages of an outbreak of the STI and characterize the basic reproduction number, R_0 and the probability of extinction. In addition, we expose the dependencies between individuals and show how these dependencies complicate the branching process approximation. We illustrate these complications through computations of the probability of a minor outbreak.

Keywords Epidemic Model; Branching process; Basic reproduction number; dynamic network