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Epidemic dynamics on a risk-based evolving social network
SHADRACK ANTWI, LEAH SHAW, College of William and Mary — Social network models have been used to study how behavior affects the dynamics of an infection in a population. Motivated by HIV, we consider how a trade-off between benefits and risks of sexual connections determine network structure and disease prevalence. We define a stochastic network model with formation and breaking of links as changes in sexual contacts. Each node has an intrinsic benefit its neighbors derive from connecting to it. Nodes' infection status is not apparent to others, but nodes with more connections (higher degree) are assumed more likely to be infected. The probability to form and break links is determined by a payoff computed from the benefit and degree-dependent risk. The disease is represented by a SI (susceptible-infected) model. We study network and epidemic evolution via Monte Carlo simulation and analytically predict the behavior with a heterogeneous mean field approach. The dependence of network connectivity and infection threshold on parameters is determined, and steady state degree distribution and epidemic levels are obtained. We also study a situation where system-wide infection levels alter perception of risk and cause nodes to adjust their behavior. This is a case of an adaptive network, where node status feeds back to change network geometry.

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