Epidemics on random networks with tunable clustering, degree correlation and degree distribution

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The study of epidemics on social networks has attracted considerable attention recently. In this talk a random network model, which allows for tunable, quite general forms of clustering, degree correlation and degree distribution, is presented. A stochastic SIR (susceptible $\rightarrow$ infective $\rightarrow$ removed) epidemic model is defined on the network. Asymptotic properties of both the network and the epidemic, as the population size tends to infinity, are derived: the degree distribution, degree correlation and clustering coefficient, as well as a reproduction number R_*, which determines whether or not an epidemic with few initial infectives can become established and lead to a major outbreak, the probability of a major outbreak and the relative size of such an outbreak. The theory is illustrated by simulations and numerical studies, which demonstrate that (i) the asymptotic approximations work well, even for only moderately sized networks, (ii) clustering tends to decrease the spread of disease, (iii) the effect of degree correlation is appreciably greater when the disease is close to threshold than when it is well above threshold and (iv) disease spread tends to increase with degree correlation ρ when R_* is just above its threshold value of one and decrease with ρ when R_* is well above one.

Reference

Ball, F. G., Britton, T. and Sirl, D. (2013) A network model with tunable clustering, degree correlation and degree distribution, and an epidemic thereon. *J. Math. Biol.* **66**, 979–1019.