Epidemic models on social networks
– with inference

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Abstract

Consider stochastic models for the spread of an infection in a structured community, where this structured community is itself described by a random network model. Some common network models and transmission models are defined and large population proporties of them are presented. Focus is then shifted to statistical methodology: what can be estimated and how, depending on the underlying network, transmission model and the available data? This survey paper discusses several different scenarios, also giving references to publications where more details can be found.

Keywords: random networks, epidemic models, control measures, statistical inference, incidence data, sequence data.

1   Introduction

In the current paper we are concerned with stochastic models for how an infectious diseases spreads in a community, where the social structure of relevance for the disease spreading is described by a random network model.

In certain cases the underlying social structure is known, the presence of households being the prime example. Here we put more focus on the case where the underlying structure is not entirely known, which explains why a random network model is advocated.

Which network model to use will depend on the infectious disease under consideration and the community upon which it spreads. If considering diseases with airborne spreading like influenza and childhood diseases, the network should reflect pairs of individuals being in proximity of each other on regular basis (preferably also adding random contacts). If spreading occurs through close physical contact such as Ebola, the network edges connect pairs of individuals having such contacts on regular basis, and if considering a sexually transmitted infection (STI) the underlying network will be that of sexual contacts.

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