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Dynamics of epidemics outbreaks in heterogeneous populations
DIRK BROCKMANN, ALEJANDRO MORALES-GALLARDO, THEO GEISEL, MPI for Dynamics and Self-Organization — The dynamics of epidemic outbreaks have been investigated in recent years within two alternative theoretical paradigms. The key parameter of mean field type of models such as the SIR model is the basic reproduction number R_0, the average number of secondary infections caused by one infected individual. Recently, scale free network models have received much attention as they account for the high variability in the number of social contacts involved. These models predict an infinite basic reproduction number in some cases. We investigate the impact of heterogeneities of contact rates in a generic model for epidemic outbreaks. We present a system in which both the time periods of being infectious and the time periods between transmissions are Poissonian processes. The heterogeneities are introduced by means of strongly variable contact rates. In contrast to scale free network models we observe a finite basic reproduction number and, counterintuitively a smaller overall epidemic outbreak as compared to the homogeneous system. Our study thus reveals that heterogeneities in contact rates do not necessarily facilitate the spread to infectious disease but may well attenuate it.

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