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Social contact processes and the partner model

We consider a version of the contact process on the complete graph with N vertices in which edges open and close dynamically, in this case modelling formation and breakup of monogamous partnerships. We obtain a formula for the basic reproduction number R_0, and show that if $R_0 < 1$ the extinction time for the infection is of order $\log N$ while if $R_0 > 1$ the extinction time is at least $e^{\gamma N}$ for some $\gamma > 0$. Analyzing the mean-field equations, we find a unique and globally attracting (except for the disease-free state) endemic state when $R_0 > 1$ which is also attracting (up to small constant fluctuation in proportion with probability $\geq 1 - e^{-\gamma N}$ up to time $e^{\gamma N}$) for the stochastic model whenever the initial proportion of infectious individuals is positive. Finally, when $R_0 = 1$ the extinction time appears to be of order $\sqrt{N}$, and we give some informal arguments to support this claim.