Title:	Emergence of Persistent Infection due to Heterogeneity
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Abstract:	We explore the emergence of persistent infection in a closed region where the disease progression of the individuals is given by the SIRS model, with an individual becoming infected on contact with another infected individual. We investigate the persistence of contagion qualitatively and quantitatively, under increasing heterogeneity in the partitioning of the population into different disease compartments, as well as increasing heterogeneity in the phases of the disease among individuals within a compartment. We observe that when the initial population is uniform, consisting of individuals at the same stage of disease progression, infection arising from a contagious seed does not persist. However when the initial population consists of randomly distributed refractory and susceptible individuals, a single source of infection can lead to sustained infection in the population, as heterogeneity facilitates the de-synchronization of the phases in the disease cycle of the individuals. We also show how the average size of the window of persistence of infection depends on the degree of heterogeneity in the initial composition of the population. In particular, we show that the infection eventually dies out when the entire initial population is susceptible, while even a few susceptibles among an heterogeneous refractory population gives rise to a large persistent infected set.
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