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Dynamic models of infectious diseases as regulators of population sizes. (English)

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Summary: Five SIRS epidemiological models for populations of varying size are considered. The incidences of infections are given by mass action terms involving the number of infectives and either the number of susceptibles or the fraction of the population which is susceptible. When the population dynamics are immigration and deaths, thresholds are found which determine whether the disease dies out or approaches an endemic equilibrium. When the population dynamics are unbalanced births and deaths proportional to the population size, thresholds are found which determine whether the desease dies out or remains endemic and whether the population declines to zero, remains finite or grows exponentially.

In these models the persistence of the disease and disease-related deaths can reduce the asymptotic population size or change the asymptotic behavior from exponential growth to exponential decay or approach to an equilibrium population size.

MSC:

92D30 Epidemiology
34C23 Bifurcation theory for ordinary differential equations
34D99 Stability theory for ordinary differential equations

Keywords:

Hopf bifurcation; SIRS epidemiological models; populations of varying size; mass action terms; immigration; deaths; thresholds; endemic equilibrium; unbalanced births; persistence; asymptotic population size