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Varying total population enhances disease persistence: Qualitative analysis on a diffusive SIS epidemic model ☆

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Abstract

This paper performs qualitative analysis on an SIS epidemic reaction–diffusion system with a linear source in spatially heterogeneous environment. The main feature of our model lies in that its total population number varies, compared to its counterpart proposed by Allen et al. [2]. The uniform bounds of solutions are derived, based on which, the threshold dynamics in terms of the basic reproduction number is established and the global stability of the unique endemic equilibrium is discussed when spatial environment is homogeneous. In particular, the asymptotic profile of endemic equilibria is determined if the diffusion rate of the susceptible or infected population is small or large. The theoretical results show that a varying total population can enhance persistence of infectious disease, and therefore the disease becomes more threatening and harder to control.

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