

Dynamical Analysis of a Stage-Structured Model for Lyme Disease with two delays

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Abstract. In this paper, a nonlinear stage-structured model for Lyme disease is considered. The model is a system of differential equations with two time delays. The basic reproductive rate, $R_0(\tau_1, \tau_2)$, is derived. If $R_0(\tau_1, \tau_2) < 1$, then the boundary equilibrium is globally asymptotically stable. If $R_0(\tau_1, \tau_2) > 1$, then there exists a unique positive equilibrium whose local asymptotical stability and the existence of Hopf bifurcations are established by analyzing the distribution of the characteristic values. An explicit algorithm for determining the direction of Hopf bifurcations and the stability of the bifurcating periodic solutions is derived by using the normal form and the center manifold theory. Some numerical simulations are performed to confirm the correctness of theoretical analysis. At last, some conclusions are given.