Busenberg, S.; **van den Driessche, P.**

Analysis of a disease transmission model in a population with varying size. (English)

Zbl 0725.92021
J. Math. Biol. 28, No. 3, 257-270 (1990).

A new result is given to establish the nonexistence of periodic solutions which includes the criteria of Bendixson and Dulac as special cases. The authors discuss a SIRS epidemiological model with vital dynamics in a population of varying size:

$$dS/dt = bN - dS - \lambda SI/N + eR, \quad dI/dt = -(d + \epsilon + c)I + \lambda SI/N, \quad dR/dt = -(d + \delta + e)R + cI,$$

N= $S + I + R$ and the parameters b,d,ϵ,δ,c,e and λ are nonnegative.

A complete global analysis is given which uses the new result to establish the nonexistence of periodic solutions. Results are discussed in terms of three threshold parameters which respectively govern the increase of the total population, the existence and stability of an endemic proportion equilibrium and the growth of the infective population.

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MSC:

92D30 Epidemiology
34C25 Periodic solutions to ordinary differential equations
34C05 Topological structure of integral curves, singular points, limit cycles of ordinary differential equations

Keywords:

global stability; Bendixson's criterion; Dulac's criterion; nonexistence of periodic solutions; SIRS epidemiological model; population of varying size; threshold parameters; endemic proportion

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