
JACQUES BELAIR, Université de Montréal, CP 6128, Succ. centre-ville, Montréal, QC, H3C 3J7

Stability in an Epidemiological Model with Two Transmission Rates and Application to Antibiotic Resistance in Commensal Bacteria

Drug-resistant bacteria often emerge when antibiotics are employed, including for prophylactic use in livestock feed. We derive a deterministic compartmental model to analyze the spread of resistance in swine population of constant size. We separate the uninfected from the infected, dividing the latter according to the consequences of the infection on the individual behaviour, and thus on the transmission rate of the disease. The specificity of the model resides in the separation of the infected individuals depending on whether there occurs a transformation in the behaviour of either the individual or the disease itself, thus affecting the transmission of the disease. A global stability result is obtained using Lyapunov techniques. Convergence to the stable equilibrium is shown to depend on the value of a parameter associated to a reproduction number. The model is applied to the epidemiology of bacterial resistance in commensal bacteria, relating colonized individuals to the infected class, with antibiotics modifying the incidence rate of resistant mutants.

The objective of such formulation is to provide epidemiologists with a tool to analyze and control the impact of the two transmission rates on the dynamics of the disease.