
JULIEN ARINO, University of Manitoba

Backward bifurcation in an SLIARS model with vaccination

Backward bifurcations are known to occur in a variety of epidemic models when treatment or vaccination are taken into account. In a backward bifurcation situation, there can exist subthreshold endemic equilibria, leading to a bistable situation where the behaviour of the system is initial conditions-dependent. The situation is easy to characterise in a deterministic setting, but more complicated in a stochastic one. To investigate this, we considered an endemic (i.e., including demography) SLIARS model for a disease presenting symptomatic and asymptomatic stages, to which we added vaccination. We showed that the deterministic version of the model can undergo backward bifurcations. We then studied numerically the equivalent (stochastic) continuous-time Markov chain and observed that a backward bifurcation was observable also in this context. Interestingly, a branching process approximation of the stochastic process was unable to pick up the same characteristic. This is joint work with Evan Milliken (U of Louisville).