

Discrete Stochastic Metapopulation Model with Arbitrarily Distributed Infectious Period

Nancy Hernandez-Ceron, Jonathan A. Chavez-Casillas, Zhilan Feng
Purdue University, United States
hernann@purdue.edu, jchavezc@math.purdue.edu,
zfeng@math.purdue.edu

Keywords: SIR Epidemic Model, Probability of Minor and Major Epidemic, Basic Reproduction Number, Arbitrarily Distributed Infectious Period.

In this talk, a stochastic discrete-time model is introduced to study the spread of an infectious disease in an n -patch environment. The model includes an arbitrary distribution of the (random) infectious period T , and the results are used to investigate how the distribution of T may influence the model outcomes. Specific distributions including Geometric, Negative Binomial, Poisson and Uniform distributions are compared both numerically and analytically. The measures used in model comparisons include (i) the basic and control reproduction numbers \mathcal{R} ; (ii) probability of a minor epidemic (or probability of disease extinction) \mathbb{P}_0 ; (iii) final epidemic size; and (iv) duration of the epidemic. The results are illustrated for the case of two patches. It is also shown analytically that the reproduction numbers corresponding to different distributions of T can be ordered based on the probability generating function ϕ_T of T .