

Abstract Submitted
for the MAR16 Meeting of
The American Physical Society

Outbreak and Extinction Dynamics in a Stochastic Ebola Model

GARRETT NIEDDU, Montclair State University, SIMONE BIANCO, IBM Almaden Research Center, LORA BILLINGS, Montclair State University and National Science Foundation, ERIC FORGOSTON, Montclair State University, JAMES KAUFMAN, IBM Almaden Research Center — A zoonotic disease is a disease that can be passed between animals and humans. In many cases zoonotic diseases can persist in the animal population even if there are no infections in the human population. In this case we call the infected animal population the reservoir for the disease. Ebola virus disease (EVD) and SARS are both notable examples of such diseases. There is little work devoted to understanding stochastic disease extinction and reintroduction in the presence of a reservoir. Here we build a stochastic model for EVD and explicitly consider the presence of an animal reservoir. Using a master equation approach and a WKB ansatz, we determine the associated Hamiltonian of the system. Hamilton's equations are then used to numerically compute the 12-dimensional optimal path to extinction, which is then used to estimate mean extinction times. We also numerically investigate the behavior of the model for dynamic population size. Our results provide an improved understanding of outbreak and extinction dynamics in diseases like EVD.

Garrett Nieddu
Montclair State University

Date submitted: 02 Nov 2015

Electronic form version 1.4