Xueying Wang, Texas A&M University, College Station, TX, USA
Raju Gautam, Pablo J. Pinedo, Renata Ivanek, Texas A&M University, College Station, TX, USA

A stochastic model for transmission, extinction and outbreak of *Escherichia coli* O157:H7 in cattle as affected by ambient temperature and pathogen cleaning practices

Many important infectious agents transmit through contaminated environment where they may persist. Their persistence in the environment is determined by the temperature dependent rates of their growth (replication) and by cleaning (sanitation) modulated rates of their clearance from the environment. To elucidate the effect of these factors on the infection transmission dynamics, extinction and outbreak, while accounting for the random nature of the infection transmission process, this study proposes a stochastic-differential-equation model as an approximation to a Markov jump process model, using *Escherichia coli* O157:H7 in cattle as a model system. In the model, the within host population infection dynamics are described using the standard susceptible-infected-susceptible framework, and the *E. coli* O157:H7 population in the environment is represented by a compartment that measures the free-living pathogen size. In this work, the Kolmogorov backward equations that determine the probability distribution and the expectation of the first passage time were rigorously derived in general settings. As an application of the theoretical results to *E. coli* O157:H7 infection in cattle, the first infection extinction and outbreak were investigated by numerically evaluating the Kolmogorov equations that solve the associated probability density function of the process governed by the corresponding stochastic model and the associated mean of the corresponding stopping time. The results provided an insight into *E. coli* O157:H7 transmission, and suggested ways of controlling the spread of infection in a cattle herd. Specifically, the study indicates importance of ambient temperature and cleaning during summer season.