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Characterizing the permanence and stationary distribution for a family of malaria stochastic models

Divine Wanduku
dwanduku@georgiasouthern.edu

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Divine Wanduku, Ph.D.
Department of Mathematical Sciences,
Georgia Southern University,
64 Georgia Avenue, Statesboro, GA 30460, U.S.A.
Email: dwanduku@georgiasouthern.edu;

According to WHO estimates released in December 2016, about 212 million cases of malaria occurred in 2015 resulting in about 429 thousand deaths. The highest mortality rates were recorded for sub-Saharan African countries, where nearly 90% of the global malaria cases occurred, and approximately 75% of the global malaria deaths. Several studies suggest the existence of temporal and spatial variations in malaria transmission rates, where climatic drivers such as temperature, rainfall, and vegetation indices etc. are culprits for the observed variability. This talk presents the stochastic permanence of malaria and the existence of a stationary distribution for a malaria SEIRS system of stochastic differential equation model. Malaria spreads in a very noisy environment with variability of white noise type in the disease transmission and death rates. A general nonlinear incidence rate defines a family for the malaria models. The mosquito and human dynamics are presented. Improved analytical techniques and local martingale characterizations are applied to describe the character of the sample paths of the solution process of the system in the neighborhood of an endemic equilibrium. Emphasis is laid on examination of the impacts of the noises in the system on the stochastic permanence of malaria, and on the existence of a stationary distribution for the solution process over sufficiently long time. The model is applied to P. vivax malaria, and attempt is made to numerically approximate the stationary distribution, and the statistical properties of the states of the solution process over sufficiently ling time.