

Applied Dynamical Systems Seminar

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**Wednesday, October 19, 2016
HH-3017 from 2:00-3:00 p.m.**

A climate-based malaria model with the use of bed nets

Abstract:

Insecticide-treated bed nets (ITNs) are among the most important and effective intervention measures against malaria. In order to investigate the impact of bed net use on disease control, we formulate a periodic vector-bias malaria model incorporating the juvenile stage of mosquitoes and the use of ITNs. We derive the vector reproduction ratio R_v and the basic reproduction ratio R_0 . We show that the global dynamics of the model is completely determined by these two reproduction ratios. More precisely, the mosquito-free periodic solution is globally attractive if $R_v < 1$; the unique disease-free periodic solution is globally attractive if $R_v > 1$ and $R_0 < 1$; and the model admits a unique positive periodic solution and it is globally attractive if $R_v > 1$ and $R_0 > 1$. Numerically, we study the malaria transmission case in Port Harcourt, Nigeria. Our findings show that the use of ITNs has a positive effect on reducing R_0 , and that malaria may be eliminated from this area if over 75% of the human population were to use ITNs. The simulation about the long term behavior of solutions has good agreement with the obtained analytic result. Moreover, we find that the ignorance of the vector-bias effect may result in underestimation of the basic reproduction ratio R_0 . Another notable result is that the infection risk would be underestimated if the basic reproduction ratio $[R_0]$ of the time-averaged autonomous system were used. This talk is based on a joint work with Dr. Xiaoqiang Zhao.