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Mosquito demography and nourishment habits can account for observed patterns in malaria transmission

A deterministic SEIRS model for malaria that accounts for mosquito demography and nourishment habits is developed and studied. The model differs from classical SEIRS malaria models in that the mosquito population involved in disease transmission is identified and well-accounted for. We show that the model can exhibit disease-free and endemic equilibrium solutions and investigate whether naturally occuring fluctuations and oscillations that characterize the mosquito population dynamics can drive the full model system to oscillate over time, thereby accounting for observed patterns in malaria prevalence. A sensitivity analysis is carried out to identify important parameters of the model. The possibility of a backward bifurcation, a phenomenon that is essential in designing control strategies is explored, and various malaria control strategies are examined through two threshold parameters, one associated with mosquito dynamics and the other associated with disease dynamics.