Consider a RM style model that has the following assumptions about latent periods: mosquitoes experience a deterministic latent period of τ_{EIP} days prior to infectiousness, and humans experience a similar latent period of τ_{LEP} (liver emergence period) days.

If we represent the incubating mosquitoes E_V and humans E_H explicitly, then we get a system of 6 DDE:

$$N(t) = S_H(t) + E_H + I_H(t)$$

$$X(t) = \frac{I_H(t)}{N(t)}$$

$$Z(t) = \frac{S_H(t)}{N(t)}$$

$$\dot{S}_V(t) = \lambda - acX(t)S_V(t) - gS_V(t)$$
$$\dot{E}_V(t) = acX(t)S_V(t) - acX(t-\tau_{EIP})S_V(t-\tau_{EIP})e^{-\tau_{EIP}\,g} - gE_V(t)$$
$$\dot{I}_V(t) = acX(t-\tau_{EIP})S_V(t-\tau_{EIP})e^{-\tau_{EIP}\,g} - gI_V(t)$$

$$\dot{S}_H(t) = rI_H(t) - abI_V(t)Z(t)$$
$$\dot{E}_H(t) = abI_V(t)Z(t) - abI_V(t-\tau_{LEP})Z(t-\tau_{LEP})e^{-\mu\tau_{LEP}}$$
$$\dot{I}_H(t) = abI_V(t-\tau_{LEP})Z(t-\tau_{LEP})e^{-\mu\tau_{LEP}} - rI_H(t)$$

Let's say we want to solve the system at equilibrium when we know 2 things, the prevalence in humans and the total human population size (I_H, N). With the constraint of constant human population, we only need to find one of the two S_H, E_H. Let's say then we want to solve for this set of unknowns that gives that equilibrium number of infectious humans: $(\lambda, S_V, E_V, I_V, E_H)$

How to do that? The set of human equations has a lot of redundant information. For example $\dot{E}_H(t)$ will be zero at equilibrium. So despite having 3 DDE, there is really only one balance equation (rates of infection equaling recovery) to be fulfilled at equilibrium.

However, as one can see by setting up the corresponding delay stochastic model in a Gillespie simulator, there is clear stationary distribution with nonzero mean for all state variables: