Understanding Vector Borne Diseases - A Mathematical Perspective for the case of Malaria

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Abstract

Just like the Zika-Virus, malaria is a vector-borne disease with three interacting population components. These are the parasite component, the vector component and the human component. The behavioral dynamics of each of these components play an integral role in the transmission dynamics of malaria. For example, there is a reproductive gain that accrue to the mosquito's population as a result of its lifestyle, feeding and reproductive habits, and its interaction with the human population. In particular, the interaction between mosquitoes and humans introduce variability in the density of the mosquito's population and this impacts the dynamics of the malaria disease. This variability is affected by the mosquito's ability to interact with humans and animals in order to draw blood needed for the maturation of the mosquito's eggs, a process essential for reproduction. Moreover, a blood drawn with no transmissible parasite forms has a zero probability of rendering the mosquito infectious. Thus, the ability of the malaria parasite to propagate within a human leading to the formation of the transmissible forms of the parasite that can be picked up by a feeding mosquito that feeds on an infectious human, is integral to the success of the parasite and for the successful continuation of the parasite's life-cycle. I will discuss how these interacting components introduce interesting dynamics in a model, in more detail.