Optimal Control and Temperature Variations of Malaria Transmission Dynamics

Folashade Agusto

Ecology and Evolutionary Biology, University of Kansas, Lawrence Kansas, USA
fbagusto@gmail.com

In this seminar, I will present the results obtained from investigating the optimal control strategies for malaria in the presence of temperature variation using a temperature dependent malaria model. A 2015 study by Agusto et al. [1] identified the suitable temperature ranges for mosquitoes in four different geographical regions of Sub-Saharan Africa as [22.61^{o}C - 28.58^{o}C] in West African cities, [16.68^{o}C - 27.92^{o}C] in Central African cities, [19.04^{o}C - 26.75^{o}C] in East African cities, and [16.66^{o}C - 25.32^{o}C] in Southern Africa. The optimal control strategies in these temperature ranges suggest on average a high usage of both larviciding and adulticiding followed by a moderate usage of personal protection such as insecticide-treated bednet. The average optimal bednet usage mimics the trajectory of the mosquitoes as the mosquitoes respond to temperature variations. These results triggered the investigation of the impact of insecticide resistance mosquitoes on disease burden in the face of temperature variations. The results indicate that optimal bednet usage on average is higher in the presence of insecticide resistance mosquitoes. Furthermore, on average bednet usage increases as temperature increases to the optimal temperature suitable for mosquitoes and it decreases thereafter, a pattern similar to earlier results involving insecticide sensitive mosquitoes.

References

[1] Agusto, F.B., Gumel, A.B., & Parham, P. E. (2015). Qualitative assessment of the role of temperature variations on malaria transmission dynamics. Journal of Biological Systems, 23(04), 1550030.

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