

Gaff, Holly D., Elsa Schaefer, and Suzanne Lenhart. 2011. Use of optimal control models to predict treatment time for managing tick-borne disease. *Journal of Biological Dynamics*. 5(5): 517-530.

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Abstract: Tick-borne diseases have been on the rise recently, and correspondingly, there is an increased interest in implementing control measures to decrease the risk. Optimal control provides an ideal tool to identify the best method for reducing risk while accounting for the associated costs. Using a previously published model, a variety of frameworks are assessed to identify the key factors influencing mitigation strategies. The level and duration of tick-reducing efforts are key metrics for understanding the successful reduction in tick-borne disease incidence. The results show that the punctuated nature of the tick's life history plays a critical role in reducing risk without the need for a permanent treatment programme. This work suggests that across a variety of optimal control frameworks and objective functionals within a closed environment, similar strategies are created, all suggesting that the tick-borne disease risk can be reduced to near zero without completely eliminating the tick population.

Keywords: tick model, ehrlichiosis, optimal control, bang bang control, nonlinear, system