

# OPTIMAL BED NET USE FOR A DENGUE DISEASE MODEL WITH MOSQUITO SEASONAL PATTERN

Bruno Buonomo<sup>1</sup> and Rossella Della Marca<sup>2\*</sup>

<sup>1</sup>Department of Mathematics and Applications, University of Naples Federico II

<sup>2</sup>Department of Mathematical, Physical and Computer Sciences, University of Parma

buonomo@unina.it, rossella.dellamarca@unipr.it (\*corresponding author)

We consider a mathematical model of dengue transmission where the use by individuals of insecticide-treated bed nets is taken into account, combined or not with insecticide spraying [1]. Furthermore, as climatic factors play a key role in mosquito-borne diseases, we model the effect of seasonality through a periodic mosquito birth rate. We numerically investigate some specific scenarios according to different rainfall and mean temperature values. We set an optimal control problem to minimize the number of human infections and the cost of efforts placed into bed net adoption and maintenance and insecticide spraying. To assess the most appropriate strategy to eliminate dengue with minimum costs, we perform a comparative cost-effectiveness analysis, which also shows how the cost-benefit of intervention efforts is affected by changes in the amplitude of seasonal variation. One general result is that in any case the combination of bed net use and insecticide spraying produces the highest ratio of infections averted, whereas in terms of cost-benefit only spraying campaigns should be implemented in control programs for regions with no large seasonality.

## References

- [1] Buonomo, B. and Della Marca, R. (2017). *Optimal bed net use for a dengue disease model with mosquito seasonal pattern*, *Mathematical Methods in the Applied Sciences*, 1–20. <https://doi.org/10.1002/mma.4629>