

# The probability of extinction in a dengue epidemic in the presence of *Wolbachia*

Meksianis Z. Ndi<sup>1</sup>, Asep K. Supriatna<sup>2</sup>

<sup>1</sup> Department of Mathematics, University of Nusa Cendana, Kupang-NTT, Indonesia

<sup>2</sup> Department of Mathematics, Padjadjaran University, Jatinangor-Indonesia  
mekisianis.ndii@staf.undana.ac.id, aksupriatna@gmail.com

*Keywords: Wolbachia, dengue, probability of extinction*

The introduction of *Wolbachia*-carrying mosquitoes into the population has been proposed as an innovative new strategy against dengue transmission. In this paper, we analysed the effects of *Wolbachia* on dengue transmission dynamics using a deterministic and stochastic epidemic model. The reduction in the reproduction number and the probability of disease extinction are determined. We found that *Wolbachia* can reduce the reproduction number by up to 64%. We also found that the probability of extinction is around 90% although the reproduction number is slightly above one. However, if the reproduction number is too high, which indicates higher transmission level, the probability of disease extinction is smaller. Consequently, an outbreak is likely to take off. The results suggest that the *Wolbachia* can be effective to reduce dengue transmission particularly in areas with low to moderate transmission level.

## References

- [1] Hoffmann, A. A., Montgomery, B. L., Popovici, J., Iturbe-Ormaetxe, I., Johnson, P. H., Muzzi, F., Greenfield, M., Durkan, M., Leong, Y. S., Dong, Y., Cook, H., Axford, J., Callahan, A. G., Kenny, N., Omodei, C., McGraw, E. A., Ryan, P. A., Ritchie, S. A., Turelli, M. & O'Neill, S. L. 2011. Successful establishment of *Wolbachia* in *Aedes* populations to suppress dengue transmission. *Nature*, 476, 454-457.
- [2] Ndi, M. Z., Allingham, D., Hickson, R. I. & Glass, K. 2016a. The effect of *Wolbachia* on dengue dynamics in the presence of two serotypes of dengue: symmetric and asymmetric epidemiological characteristics. *Epidemiology and Infection*, 144, 2874-2882.
- [3] Ndi, M. Z., Allingham, D., Hickson, R. I. & Glass, K. 2016b. The effect of *Wolbachia* on dengue outbreaks when dengue is repeatedly introduced. *Theoretical Population Biology*, 111, 9-15.
- [4] Supriatna, A. K. & Anggriani, N. 2012. System Dynamics Model of *Wolbachia* Infection in Dengue Transmission. *Procedia Engineering*, 50, 12-18.