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Balancing Economic Cost and Disease Impact: Optimization Models for Wolbachia-Based Dengue Control

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Dengue, which affects millions of people each year, is one of the most common diseases transmitted by infected *Aedes aegypti* mosquitoes. In the Philippines, the annual economic cost of dengue infections is estimated at around PHP 17 billion. Previous studies have shown that controlling the population of mosquitoes capable of transmitting the dengue virus can effectively reduce dengue infection rates. This study explores the use of *Wolbachia* as a strategy for dengue control by targeting mosquitoes. Since the release of *Wolbachia*-infected mosquitoes involves substantial costs, careful planning is necessary to balance disease control with the associated economic burden. To address this, we propose a mathematical model that captures the dynamics of releasing *Wolbachia*-carrying mosquitoes and the transmission of dengue in a population. We formulate single- and multi-objective optimization frameworks to minimize the economic costs associated with releasing *Wolbachia*-infected mosquitoes and the hospitalization costs resulting from dengue infections. This study aims to provide insights into the practical application of *Wolbachia*-based interventions for controlling dengue transmission. While the analysis is grounded in the Philippine context, the approach is general enough to be applicable to other dengue-endemic countries.

Keywords: Dengue, *Wolbachia*, Optimization

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