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Set a thief to catch a thief: can we make use of parasites to control vector-borne diseases?

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ABSTRACT

Experiments and field trials have shown that the intracellular bacterium *Wolbachia* may be introduced into populations of the mosquito *Aedes aegypti*, the primary vector for dengue fever. In the absence of *Wolbachia*, a mosquito acquiring the dengue virus from an infected human enters an exposed (infected but not infectious) period before becoming infectious itself. A *Wolbachia*-infected mosquito that acquires dengue (i) may have a reduced lifespan, so that it is less likely to survive the exposed period and become infectious, and (ii) may have a reduced ability to transmit dengue, even if it has survived the exposed period. *Wolbachia* introduction has therefore been suggested as a potential dengue control measure. We set up a mathematical model for the system to investigate this suggestion and to evaluate the desirable properties of the *Wolbachia* strain to be introduced. We show that *Wolbachia* has excellent potential for dengue control in areas where R_0 is not too large. However, if R_0 is large, *Wolbachia* strains that reduce but do not eliminate dengue transmission have little effect on endemic steady states or epidemic sizes. Unless control measures to reduce R_0 by reducing mosquito populations are also put in place, it may be worth the extra effort in such cases to introduce *Wolbachia* strains that eliminate dengue transmission completely.