Density-dependent development impacts the success of Wolbachia-based mosquito control programs

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Density-dependent development impacts the success of *Wolbachia*-based mosquito control programs

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The mosquito species *Aedes aegypti* is responsible for transmitting arboviruses such as Zika virus and dengue. Since traditional control measures have not been successful in eliminating *Ae. aegypti* populations and the viruses they transmit, much attention has been focused on novel control measures. One such measures proposes the release of mosquitos infected with the bacterium *Wolbachia*, which is known to block transmission of some viruses in mosquitoes. Control measures that involve the release of additional mosquitoes into a population interact directly and indirectly with natural life processes, in particular those processes that are density-dependent. In *Ae. aegypti*, both survival and development of juveniles is regulated by density dependence, and most work focuses on the impacts of density-dependent survival; however, evidence is building that the influence of density-dependent development may be equally important. In this work, we developed an ordinary differential equations model to investigate the influence of density-dependent population regulation on control strategies involving the release of *Wolbachia*-infected mosquitoes. We explore the differential effects of density on both population reduction and population regulation strategies aimed at reducing transmission of viruses by *Ae. aegypti* populations. We found that, while some releases of *Wolbachia* into wild type populations lead to reduction in vectors capable of transmitting viruses (competent vectors), there are a number of scenarios in which releases result in an increase of the competent vector population, either temporarily or in the long-term, particularly when considering the impact of density-dependent development. We discuss our findings in the context of *Ae. aegypti* mosquito control efforts to reduce arbovirus transmission.