

# Stemming the rising tide of global dengue

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## Context

Dengue is the world's fastest growing vector-borne disease,<sup>[1]</sup> and is the second most important mosquito-borne public health threat after malaria.<sup>[2]</sup> Approximately half of the world's population is at risk — 30 times more than 50 years ago — and children under the age of 10 are most vulnerable. The number of symptomatic dengue infections have more than doubled every decade since 1990.<sup>[3]</sup> Increased global travel, and trade and urbanisation are all contributing factors: as the population density rises and slums expand, the potential number of people exposed to and the breeding conditions for *Aedes* mosquitoes grow. Today, around 390 million people contract the viral infection every year, nearly 70 percent of whom reside in Asia.<sup>[4]</sup> Of the 500,000 people who go on to develop severe dengue, an estimated 25,000 die.

Like malaria, dengue is common in rural settings, but it is also common in urban contexts. It can be caused by four different serotypes — or strains — of the dengue virus,<sup>[5]</sup> and several of these strains can co-exist in one locality or region. Infection will lead to life-long immunity to that particular serotype, but subsequent infection with another strain increases the risk of developing severe dengue.

Dengue is asymptomatic in most cases, but often manifests in flu-like symptoms, such as high fever, severe headaches, joint and muscle pain, pain behind the eyes, fatigue, nausea, vomiting and skin rashes.<sup>[2]</sup> In addition to causing health problems, the disease also has a huge economic cost: communities cannot prosper when sick children cannot attend school and their parents cannot work.



## Options for tackling dengue

As we currently do not have a vaccine to prevent or drugs to treat dengue, the best way to fight the disease is to target its vectors: the *A. aegypti* and *A. albopictus* mosquitoes.<sup>[6,7]</sup> Insecticide-treated nets are unable to play a meaningful role in prevention as these mosquitoes bite during the day.<sup>[8]</sup> High levels of resistance to commonly-used insecticides — such as pyrethroids and organophosphates — also render **chemical control** efforts problematic and in need of regular monitoring for susceptibility,<sup>[9]</sup> although additional options of bio-insecticides should be assessed for cost-effectiveness and social acceptance.

**Biological and genetic options** offer a great deal of promise, although their affordability and sustainability vary. For example, while larvivorous fish and certain predatory crustaceans appear to provide a good cost-benefit solution and can be sustainable (see box),<sup>[10,11]</sup> the Sterile Insect Technique — where mass releases of irradiated male mosquitoes outcompete their fertile wild counterparts for access to wild females — or other laboratory-manipulated mosquitoes are expensive and require expert input over extended periods.

**Activities that target the breeding sites** of choice for dengue-carrying mosquitoes — small quantities of water, such as that present in water storage jars or rainwater that has collected in discarded tins, bottles, coconut husks and tires — are particularly effective.<sup>[6]</sup> While mosquito traps work, they are unaffordable for most rural people. Encouraging and training communities to store water safely, regularly clean out storage jars to remove eggs and/or larvae, maintain pumps and piped water to avoid spillages, eliminate standing water and manage solid waste appropriately is, therefore, crucial.

## Community-driven vector control in Cambodia

In 2018–2020, Malaria Consortium designed and delivered a package of tailored, community-driven vector control activities in 30 village clusters in Cambodia. We launched information campaigns about the causes of and ways to prevent dengue (e.g. disposing of potential breeding containers such as unwanted cans), taught community groups to produce homemade mosquito traps from recycled plastic bottles, and encouraged community members to collect free larvivorous guppy fish (*Poecilia reticulata*) from farms we had established at schools and community centres to place in their domestic water storage containers.

Not only were these activities culturally acceptable to the nearly 5,000 households that participated, but they were also inexpensive and greatly reduced the number of dengue vectors in the project area. This study supports the findings of other studies that communities can engage in self-help vector control activities with good potential for long-term sustainability.<sup>[10]</sup>



## Our position

Based on our technical expertise and our experience supporting community-led vector control activities, we believe the following are urgently required.

- **Greater funding of vaccine development:** increased funding and efforts directed at vaccines effective against all four serotypes, but this will likely take many years as evidenced by the challenges that have constrained previous attempts.
- **Improved real-time case surveillance systems:** knowing where the main pockets of dengue infection exist would allow for better targeting of control interventions, but these are difficult to identify as most people do not show significant symptoms and attend hospital, so surveillance

data based on cases diagnosed at medical facilities hugely under-estimate the true extent of prevalence. We need random surveys within communities during the peak transmission season (wet season) to understand where dengue is most prevalent and target interventions at those areas.

- **Strengthened vector control tools:** our existing repository of mosquito traps and other tools that target day-biting and outdoor-biting *Aedes* mosquitoes are not adequate and we need new approaches and technologies.
- **Amplified community engagement, particularly during outbreaks:** despite its debilitating effect, dengue is not given high priority by governments or within communities because it is not as lethal as malaria for example, and the other challenges of poverty are more important so dengue gets neglected. Community awareness regarding simple and inexpensive self-help vector reduction strategies — such as stocking water storage jars with attractive small fish — can go a long way towards reducing the burden. Schools should be targeted for such interventions because dengue has its greatest impact in the early years of life. During outbreaks, intensified vector control at all levels of society are crucial.
- **Increased global commitment and collaboration:** dengue is on the rise, rapidly and widely across the planet, and will in time overtake malaria as the number one global public health threat transmitted by mosquitoes. The rate of annual increase is alarming and we need to develop coordinated global strategies. As such, we support the global call for an annual World Dengue Day; this would encourage greater focus on and international, cross-sectoral collaboration to target the escalating global public health threat posed by dengue.

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Contact: [info@malariaconsortium.org](mailto:info@malariaconsortium.org)



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