

Challenges of Dengue Control

We refer to Dr Ong Siew Chey's letter "Dengue Fever Outbreak: Prevention Possible", published in the recent September issue of *Annals*.

According to the World Health Organisation, dengue has become the fastest growing mosquito-borne disease¹ in an expanding list of countries. Our status as a travel hub results in a continual influx of genetically diverse dengue virus strains into Singapore.² Our vector control efforts have kept our mosquito population relatively low and our population has low herd immunity. This makes us especially susceptible to viral strains with higher epidemic potential. A virus capable of replicating faster in the mosquito vector or human host will be selectively amplified over other strains.

Singapore's current outbreak is driven by a new strain of DENV1, which was first detected last year. This has replaced DENV2 as the predominant serotype since early this year. A serotype change has been a typical lead indicator of past epidemics.³ As a result of the strain replacement, there has been a record number of confirmed dengue cases this year (19,553 as at 11 November 2013). Nevertheless, taking into account our low herd immunity, we are likely to continue to face the dengue threat for an extended period of time. The long-term solution is the development of a safe vaccine that is simultaneously effective against all dengue serotypes. Until this is achieved, the key strategy for disease control remains vector suppression.

We share Dr Ong's hope that a small highly urbanised island could theoretically be able to eliminate all mosquito breeding sites. However, the challenge of controlling *Aedes aegypti*, the primary dengue vector, cannot be underestimated.⁴ The mosquito is well adapted to our urban environment. It breeds predominantly in artificial containers found in human habitats, rests in cool and dark places within indoor environments, has a flight range as far as 300 metres and can traverse high-rise buildings.⁵ The eggs withstand desiccation for up to a year and are usually laid in small numbers in each container, which enhances the survivability of the mosquito.⁶ It takes only 7 days to complete a breeding cycle.

Concerted Efforts by All Stakeholders

Controlling *Ae. aegypti* therefore requires the concerted efforts of all stakeholders. An inter-agency task force, including the National Environment Agency (NEA), Public

Utility Board (PUB), National Parks (NParks), Singapore Land Authority (SLA), Land Transport Authority (LTA) and Housing Development Board (HDB), co-ordinates the maintenance of areas under their respective charge. A new Department of Public Cleanliness under the NEA is currently consolidating the cleaning and maintenance contracts of all public agencies to ensure that there are no boundary gaps. NParks is reviewing the choice of trees and vegetation planted to reduce the risk of mosquito breeding; HDB's design of new flats has abolished bamboo pole holders; BCA has since 2005 banned roof gutters in new developments. As suggested by Dr Ong, scupper drains have been progressively covered. Drop inlet chambers have been redesigned, and the maintenance regime for drains has been stepped up.

NEA has an inspection regimen that focuses both on the elimination of breeding habitats in high risk areas and education of the general public. More than 4 million inspections have been conducted this year and close to 18,000 breeding sites were destroyed. NEA has legislative authority for compulsory inspection of premises, including vacant ones. Enforcement action and fines are levied to underline the seriousness of the threat. However, it is not feasible for NEA to inspect every home, worksite, drain and receptacle every week. It is worth emphasising that if everybody took adequate precautions in homes, worksites and public areas, dengue could one day become only an imported disease, like malaria. Unfortunately, this has not yet been achieved.

Addressing Areas of Special Risk

We recognise the risk posed by construction sites and vacant premises. This year we detected mosquito breeding in 10% of the construction sites inspected. Tougher penalties have been instituted against errant contractors, including immediate stop-work orders and prosecution in court. We have introduced additional measures, including requiring the larger construction sites to employ an Environmental Control Officer (ECO).

We are currently reviewing our regime, including penalties, to ensure that contractors strengthen environmental management at their worksites.

Extensive efforts are made to contact the owner of vacant properties. In situations where the owners do not make

the premises accessible within a reasonable time, the law provides for NEA officers to gain entry to the premises, accompanied by Police Officers and witnesses.

The Challenges Ahead

Bioinformatics, mathematical models, molecular tools and entomological research are an integral part of our control programme. NEA deploys gravitraps, that were developed in-house, to lure and trap adult *Aedes* mosquitoes.⁷ These gravitraps are also used for monitoring mosquito and viral distribution. We are also studying the implications of *Wolbachia* on mosquitoes' population size and their propensity to transmit dengue. However, field trials will not be done unless safety can be proven in our urban environment.

In conclusion, we reiterate Dr Ong's point that effective dengue control requires everyone to exercise vigilance in order to achieve vector elimination. This is a current and urgent priority.

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