Dengue and travellers: implications for doctors in Australia

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Awareness of the problem is the first step towards control

The study by Tai and colleagues reported in this issue of the *MJA* highlights the risk of dengue in Australia posed by the endemic *Aedes aegypti* and *A. albopictus* vectors, together with increasing travel by Australians to dengue-endemic destinations.[1] From 1991 to 2012, most cases of notified dengue in Australia were related to overseas travel, with respective increases in 2010 and 2011 of 298% and 155% above the 5-year mean notification rate; the risk of dengue in travellers returning from Indonesia between 2000 and 2011 was 8.3 times that for travellers returning from all other destinations.[2] The global trade in used tyres (believed to facilitate the distribution of eggs and immature forms of mosquito vectors), rapid urbanisation in Asia and Latin America, more frequent international travel, and ineffective vector control have each contributed to the increasing global prevalence of dengue.[3] It is pertinent to consider the threat of dengue in Australia with respect to travel and climatic factors.

During 1993–2005, a decrease in the average Southern Oscillation Index (that is, warmer conditions) over the preceding 3–12 months was significantly associated with increasing monthly numbers of dengue cases in Queensland.[4] Sequencing data for dengue virus envelope protein genes in symptomatic travellers returning to Queensland during 2002–2010 indicated that there was an elevated risk of imported dengue associated with travel to Asia and Papua New Guinea.[5]

The impact of socio-ecological factors on local and imported cases of dengue should also be evaluated. A study in Queensland during 2002–2005 found that the number of patients with locally acquired dengue increased by 6% for each 1 mm increase in average monthly rainfall and by 61% for each 1°C increase in monthly maximum temperature; for imported dengue, the increase was by 1% per 1 mm increase in average monthly rainfall and 1% per single unit increase in average socio-economic index.[6] A study in Cairns, 2000–2009, found that the monthly incidence of locally acquired dengue was significantly positively correlated with the monthly number of imported cases, as well as with monthly minimum temperature, monthly relative humidity, and standard deviation of daily relative humidity; it was negatively linked with monthly rainfall levels.[7]

However, other factors determine the risk of dengue in Australia, including human behaviour. Increased use of water storage tanks in response to drought conditions has increased the geographic distribution of *A. aegypti* beyond the expansion attributable to climate change.[8] A dynamic life table simulation model that assessed the impact of climate change on *A. aegypti* distribution, based on current (1991–2011) and future (2046–2065) climate scenarios, predicted decreasing mosquito numbers in a scenario that included increasing atmospheric carbon dioxide levels and higher global temperature, but increasing mosquito abundance with more moderate increases in global carbon dioxide and temperature levels. The body weight of *A. aegypti* and the extrinsic incubation period of the dengue virus (ie, period between infection of the mosquito and its ability to transmit the virus) were reduced in both scenarios, and the rate of mosquito eggs deposition increased.[9] Nevertheless, the probability of dengue in Australia outside northern Queensland is low according to a formal modelling framework that took into account the current distribution of dengue, rainfall, temperature, and urbanisation.[10]

In the absence of highly effective dengue vaccines and effective therapeutics, three elements of the global strategy for dengue prevention and control should be emphasised: surveillance for planning and response; reducing the disease burden; and changing behaviour to improve vector control.[11] Dengue virus surveillance has helped mitigate dengue outbreaks in Singapore by providing early warning of impending outbreaks, allowing time to intensify vector control.[12] Chemical control with larvicides and adulticide surface sprays in water stored for domestic use, and biological control agents such as larvivorous fish can be useful. Environmental management strategies include source reduction, clean-up campaigns, regular water container emptying in households and public spaces, installation of water supply systems, solid waste disposal management, and appropriate urban planning, all aimed at reducing *A. aegypti* breeding levels. Finally, social mobilisation through public education may enhance the effectiveness of vector control strategies.[11] Promising future strategies include the introduction of genetically modified male mosquitoes that sterilise wild-type female mosquitoes, and of *Wolbachia*-infected *A. aegypti*, which are resistant to dengue infection.[3]

Doctors in Australia must be alert to the possibility of dengue in their differential diagnosis of febrile conditions in returned travellers. Referral for specialist opinion and confirmation of dengue virus infection by rapid diagnostic tests, such as non-structural

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antigen 1 assay, are appropriate when there is doubt about the diagnosis.[11] Triage for admission to hospital should be based on the World Health Organization dengue guidelines,[13] with particular attention to the warning signs of severe dengue. These signs were recorded for 40% of patients in the study by Tai and colleagues.[1] Education of hospital doctors about these guidelines may well be needed, as the study also found that a strict fluid balance chart was not kept for 86% of the patients diagnosed and treated for dengue, 27% of patients received probably unnecessary antibiotics and blood products were administered to 15%, and potentially harmful non-steroidal anti-inflammatory drugs were prescribed for 22%.[1]

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