



EDITORIAL

Dengue fever: is it endemic in Australia?

It is instructive to look at our early colonial history for insights as to what factors may be involved with the re-emergence of diseases once considered endemic in Australia. Malaria, for example, was responsible for large epidemics in the Northern Territory and the Gulf of Carpentaria, and was the reason for the desertion of the town of Port Essington, north of Darwin, in 1849.¹ The north Queensland coast was considered endemic for malaria with a large epidemic in 1942 leading to the establishment of a malaria research unit in Cairns under the guidance of Colonel Neil Hamilton Fairley. The combination of effective malaria control in the allied forces combined with civilian mosquito control measures led to the disappearance of malaria soon after World War II, although sporadic epidemics, linked to introduced cases, have occurred since.^{2,3}

The first mention of dengue in Australia was the recording of cases on board a ship that arrived from Mauritius in 1873.⁴ Transmission of dengue fever as epidemics is said to have occurred 'not infrequently' in the 1870s in Charters Towers.⁵ An epidemic in Townsville occurred in 1879 and there are accounts of an extensive epidemic in Charters Towers and Rockhampton in 1885.^{4,5} The first death ascribed to dengue occurred during this epidemic in Charters Towers.⁶

Dengue caused widespread epidemics in the 1890s, including recorded epidemics on Thursday Island in 1894, Townsville in 1895, Charters Towers, Rockhampton and Southern Queensland in 1897, and northern New South Wales (NSW) in 1898.⁴ In Brisbane alone there was a series of epidemics in 1895, 1896, 1897, 1899, 1901 and 1904–1905.^{4,7} Thomas Bancroft implicated *Aedes aegypti* as the mosquito vector of dengue fever in the 1905 epidemic.⁸

Reporting on the 1897 epidemic in Charters Towers Hare describes what appears to be good evidence of endemicity. 'At Charters Towers it was frequently observed that a few cold days were followed by a sensible diminution in the number of new cases, and that a recrudescence succeeded a recurrence of warm weather. In previous years the epidemic has ceased by the beginning of June. Last year, however, there was an almost total absence of really cold weather, consequently odd cases continued to occur through the winter into the present

summer.'⁵ The frequency of epidemics in Brisbane raises the possibility of endemicity there as well, although annual introductions of the virus from north Queensland is a more likely explanation.

It could not have been appreciated by Hare that there were four serotypes of dengue; however, accounts of multiple attacks of dengue in the same individuals suggest the co-circulation of multiple dengue serotypes. Hare's paper is remarkable not only for his description, for the first time, of what later becomes known as dengue haemorrhagic fever (DHF), but also for observations of the epidemiological context in which this condition occurs: 'It has been observed that as epidemic succeeds epidemic, the disease appears to become more severe, and fatal cases more frequent.'⁵

The number of deaths due to dengue fever was remarkable in these early epidemics, 60 deaths in Charters Towers in 1897 and 94 in Brisbane in the 1905 epidemic, although in later reviews the number of deaths in Brisbane was reported as 201.^{9–11} It is likely that the mortality was due to DHF; the age distribution and clinical descriptions were consistent with the epidemiology of modern DHF epidemics.¹² The population of Brisbane in 1905 was 125 672, similar to today's population of Cairns. It was estimated that over 75% of the population was affected by dengue and that 36.7% of the deaths were in children less than 5 years old.⁹

Dengue fever epidemics continued to be documented at regular intervals, particularly in Queensland and northern NSW. A notable epidemic occurred in 1916, during which Cleland and Bradley collected mosquitoes to conduct human transmission experiments in Sydney which was 'a town in which indigenous cases of the disease have never been known to arise'.¹⁰ In 1925–1926 an epidemic extended as far south as Gosford. There are also good records of dengue epidemics in the northern parts of Western Australia and in Darwin until about 1930.⁴

After the 1926 epidemic, it was assumed that dengue fever continued to occur annually in north Queensland until 1931¹³ and 'frequently' until 1942.⁴ The 1942–1943 epidemic of dengue was extensive and again spread to northern NSW.⁴

World War II marks the end of the epidemiologic pattern of both endemicity for dengue in north

Queensland and the frequent epidemics further south. There were only two significant epidemics of dengue, restricted to north Queensland, between 1943 and 1990.^{14,15}

Both Cairns and Townsville experienced significant growth in the 1980s and Cairns International Airport was officially opened in 1984 – marking the beginning of a dramatic increase in visitor numbers to the region. A large epidemic of dengue in 1992–1993 in Townsville and Charters Towers marked the beginning of the next wave of epidemics in north Queensland that continues to the present day. An estimated 26% of the population of Charters Towers was infected in 1993.¹⁶

From 1990 to the end of 2009, there have been 31 epidemics of dengue fever recorded in north Queensland. The epidemics have ranged in size from one case to 915 cases in Cairns in 2009.^{17,18} An epidemic of one to several cases (13 of the epidemics had 10 or fewer cases) occurs when there are confirmed cases of dengue fever in people who have not travelled outside of Australia for at least several weeks before onset of symptoms. Some epidemics, however, have been very significant in terms of numbers and duration. There have been three epidemics which have ‘over wintered’ and caused infection in two consecutive summers: Townsville 1992–1993 (Dengue 2), Cairns region 1997–1999 (Dengue 3) and the Torres Strait islands, Cairns and Townsville in 2003–2004 (Dengue 2). This last epidemic displayed some worrying signs, affecting several centres, over a prolonged period. Phylogenetic analyses of viral isolates revealed, however, that this epidemic was actually three concurrent epidemics caused by distinct genotypes of Dengue 2.¹⁹ The epidemic was also notable for the first reports of deaths due to DHF since the early 19th century.²⁰

The epidemic of dengue fever in north Queensland, 2009, comprised five separate epidemics, with all four serotypes of dengue represented and caused significant disruption in Cairns, Innisfail and Townsville. Two additional small epidemics of dengue occurred in Townsville in late 2009 and autochthonous transmission has been recorded this year (2010) in Tully.¹⁷

Despite the current frequency of epidemics being reminiscent of the days of dengue endemicity at the turn of the last century, there are important differences. Effective vector control strategies in the modern era have, in every epidemic, managed to interrupt the transmission of dengue and in between epidemics, Australia is free of dengue.^{21,22} In this respect, dengue cannot be considered endemic in Australia. Deaths due to dengue are now rare. This may be due, in part, to better clinical management; however, it is known that sequential epidemics are a risk factor for DHF.²³ To date, the number of DHF cases has been low. As exposure to dengue infections in the

population of the region increases, more cases of DHF will likely be seen.

Improvements in public health reporting and improved diagnostic methods have given rise to an impression that current epidemics are on the scale of those of the past, yet a reading of the historical literature describe epidemics that clinically affected a much higher proportion of the population than is currently observed.

North Queensland remains highly vulnerable to damaging dengue epidemics but there is cause for hope. Significant progress is being observed with candidate dengue vaccines, some of which are entering phase 3 human studies.²⁴ Exciting research with the bacterium, Wolbachia, a life-shortening symbiont in the *A. aegypti* mosquito vector, is also being conducted in Brisbane and Cairns. This bacterium has also been shown to interfere with the replication of the dengue virus in the mosquito.²⁵ The fight against dengue is intensifying. Let’s hope the current situation in north Queensland is the storm before the calm.

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