The airborne spread of disease is quickly coming to get us, and the climate isn't helping!

Figure 1. Courtesy Shutterstock February 2024

Climate change has presented us with an unprecedented series of extreme weather events. In Far North Queensland, this has presented us with back-to-back heat waves and inundations, with these climatic impacts reaching wider areas being threatened with the expectation of increasing intensity in the future.

These changing climatic conditions are causing an increasing surge in vector-borne diseases. In the northern part of the Australian continent, the vector-borne illness of Dengue fever (DF) has had a more prominent effect on human health alongside other climate-related stressors in the Pacific region, as identified in Figure 1.

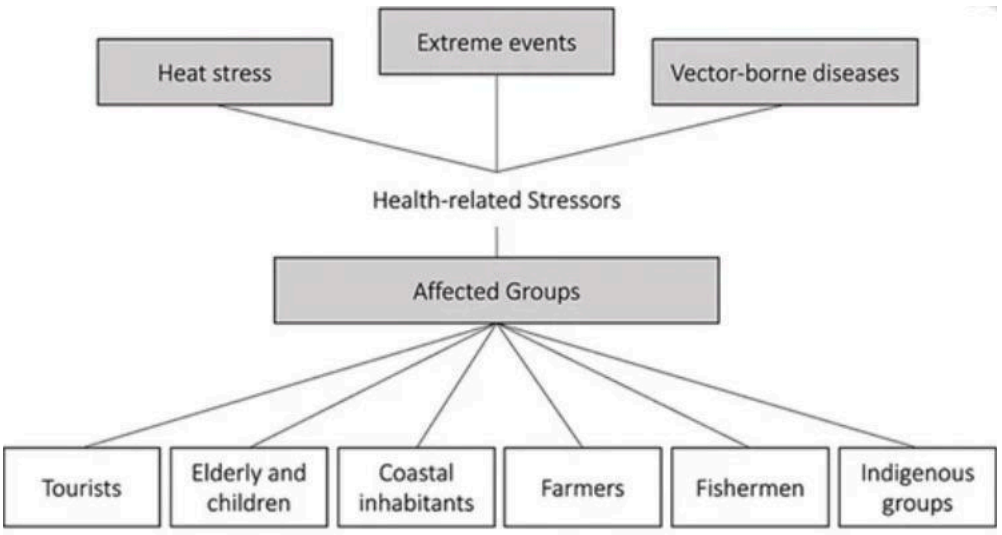

Figure 1. Some of the climate related stressors and affected groups in the Pacific region, Filho et al. 2019, p.7.

Dengue fever is not naturally endemic to Australia. Still, one of its vectors, *Ae.aegypti*, is commonly associated with northern Queensland, indicating that rapidly changing climatic conditions exacerbate DF's emergence.

However, disease emergence involves more than just ecological change. Our knowledge regarding disease emergence is "multifactorial", including what Farmer, an iconic medical anthropologist, states as "human demographic changes and behaviour; travel and commerce; technology and industry; microbial adaptation and change; and breakdown of public health measures" also implying that in the public health sector of the nation-state, concerns regarding organisms such as dengue virus are not considered relevant. Reflecting on the scale of climate extremes and other probable crises, vector-borne illnesses could still appear to be of somewhat minor concern, but the increasing climate variability could establish this concern as a more significant threat to the health of Australia's population.

Presently, epidemic dengue is limited to Queensland regions, but with frequent outbreaks constantly increasing. In one Global Association of Risk Professionals (GARP) model using current (2009) climatic conditions, the mosquito *Ae. Aegypti*, the primary dengue carrier, could co-exist with what GARP avers as up to 95% of the

Australian population under the 2030 and 2050 climate change scenarios. In confirmation of this, it has been suggested as a certainty that globalisation and changes to the climate have exacerbated the emergence and spread of arboviruses via vectors like the *Ae. Aegypti* mosquitoes and become potential pandemic drivers.

Earlier, in 2009, the WHO had undertaken a study of future possible dengue fever transmission and avers that "climate change is likely to increase the land area with a climate suitable for dengue fever transmission in Australia, and an increased number of people are expected to live in the dengue-risk region", as illustrated in Figure 2. that follows; this indicates estimates of spread up to 2050. Recent studies have partially confirmed this report, indicating the southward movement of Dengue outbreaks.

Estimated population at risk of dengue transmission under current and projected conditions in 2050.

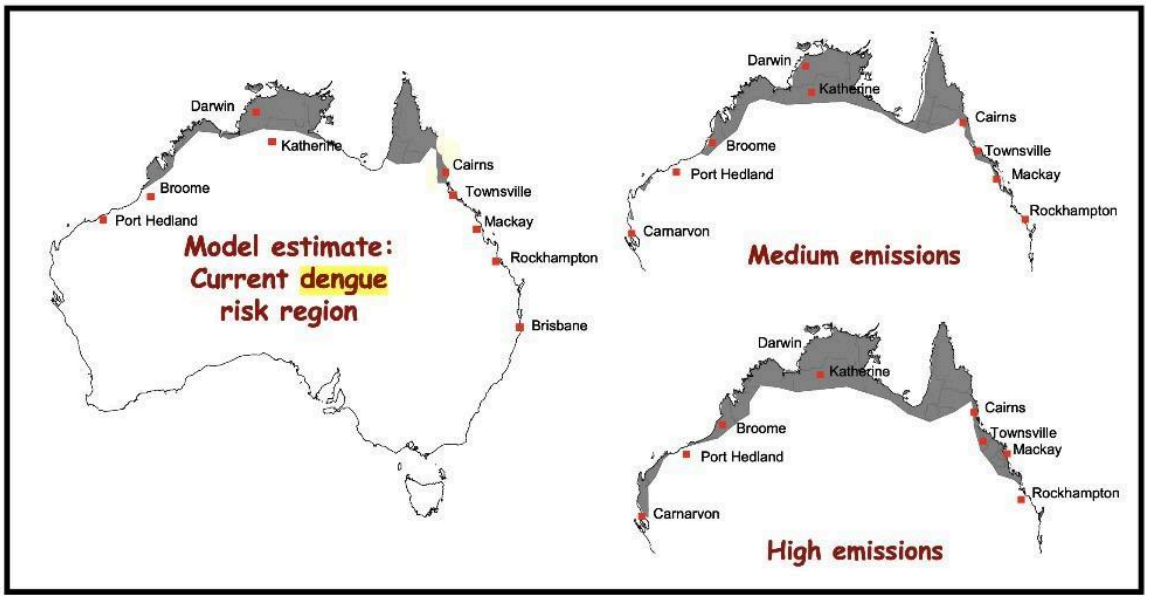

Figure 2. *Results of a logistic regression model with vapour pressure (humidity) as the predictor of dengue fever risk (Hales et al., 2002). Adapted from Figure 7. WHO (2007) Climate Change: Quantifying the health impact at national and local levels.*

The Asia Pacific Dengue Strategic Plan for both regions (2008–2015) emphasised that Australia was considered one of the most vulnerable developed countries requiring disaster risk and adaptation policies. But in 2008-2009, the largest outbreak

in Australia had already occurred in Cairns, far northern Queensland, with more than 1000 reported cases, which overloaded the ability of the local Dengue Action Response Team with the necessity of employing an additional 50–60 field personnel to control the situation.
In reflecting on this action, Farmer avers that experience and history have shown us that “what was not examined during an epidemic is often as important as what was and that social inequalities could indicate essential contours of past disease emergence”. However, in this particular event, not necessarily so, as there was no indication of any area being favoured over others.

Still, the event in Cairns partially supported Farmer’s contention. The population was quite unprepared for the aerial onslaught, and it is questionable as to whether the actual number of sufferers was counted as I knew several who did not seek medical attention, and it could be assumed that these individuals were not on their own; the situation had probably been worse than indicated in the official reports.

Some of the results from an investigation at that time identified cases in previously uninfected suburbs, each remote from suburbs where there was active transmission. This showed that not only was the disease transmitted from human to human, but worse, as it is airborne, seemingly random, and had no apparent discrimination as to who it infected. This implied that all, and not any minority group within the total population, needed more information and education on consequences.

This event thus highlighted greater involvement was required of those overseeing this type of problem, reflecting either prior tardiness to action or ignorance of some of the conclusions that Farmer asserted when citing medical anthropologists Eisenberg and Kleinman:

> the key task of medicine is not to diminish the role of the biomedical sciences in the theory and practice of medicine but to supplement them with an equal application of the social sciences to provide both a more comprehensive understanding of disease and better care of the patient. The problem is not too much science but too narrow a view of the sciences relevant to medicine.

The social sciences implied could be recognised as the integral need for involvement of medical anthropological practice. This way forward could be recognised, in part, by further work that was performed in the production of the Queensland Dengue Management Plan" (2015 —2020), which gives comprehensive information and guidance on vector management response — risk assessment, mosquito control, disease surveillance and control, managing dengue outbreaks and efforts towards greater public awareness and community engagement. This has indeed concerned itself with a greater understanding of societal needs with individual visitations to residents, personally informing them of mitigation activities, such as identifying breeding areas that may appear as insignificant puddles of water captured in fallen palm fronds. It also provided improved local educational strategies for rural and urban communities. Further, community participation strategies are ongoing.

Relatively recent promise in mitigation strategies has also been evidenced through bioengineering over the last decade by the WMP (World Mosquito Program), which introduced *Wolbachia*-infected *Ae. aegypti* into North Queensland as a virus blocker. So far, this method has successfully reduced *Aedes*-borne disease transmission risk and can be considered a significant method for disease minimisation. However, looking further afield, the recent dengue surge in Brazil has been considered so serious that authorities are supporting a vaccination campaign to reduce the impact of the virus's spread. The realisation of this increasing spread of the disease due to climate change could likely also happen in Australia, and vaccination warrants consideration as an integral part of our future "Action Plans".

Drought, excess heat, flooding, and excess precipitation are becoming frequent, leading to a broader, southward spreading of mosquito habitation. The concern of public health authorities has, however, certainly improved, proactively working at mitigation activities to counter the increasing spread of ideal breeding grounds for this animal. But even with this and the more recent promise of bioengineering and better education, earlier management plans must be consistently reviewed with more emphasis on causes and social implications.

For those who have suffered through an episode of this sickness, the physical and mental anguish is torturous to both self and friends and families, and the prospects of its further airborne invasion, without improved interventions throughout the Australian continent, may not be optimised unless medical anthropology is inclusive and being applied.

References

Akter, R., Naish, S., Gatton, M., Bambrick, H., Hu, W. and Tong, S., 2019. Spatial and temporal analysis of dengue infections in Queensland, Australia: Recent trend and perspectives. *PloS one*, *14*(7), p.e0220134.

Allen, T, Crouch, A, Russell, TL & Topp, SM 2023, Factors influencing the community participation approaches used in Aedes mosquito management in the Torres Strait, Australia, *BMC Public Health*, vol.23, no.1, p.1993.

Bannister-Tyrrell, M, Williams, C, Ritchie, SA, Rau, G, Lindesay, J, Mercer, G. & Harley, D 2013, Weather-driven variation in dengue activity in Australia examined using a process-based modeling approach, *The American Journal of Tropical Medicine and Hygiene*, vol.88, no.1, p.65.

Farmer, P 2016, Social inequalities and emerging infectious diseases, *Understanding and applying medical anthropology*, pp.118-126.

Filho, WL, Scheday, S, Boenecke, J, Gogoi, A, Maharaj, A & Korovou, S 2019, Climate change, health and mosquito-borne diseases: Trends and implications to the pacific region, *International journal of environmental research and public health*, vol.16, no.24, p.5114.

Lenharo, M 2024, Brazil's record dengue surge: why a vaccine campaign is unlikely to stop it, *Nature*.

Lwande, OW, Obanda, V, Lindström, A, Ahlm, C, Evander, M, Näslund, J & Bucht, G 2020, Globe-trotting Aedes aegypti and Aedes albopictus: risk factors for arbovirus pandemics, *Vector-Borne and Zoonotic Diseases*, vol.20, no.2, pp.71-81.

Monash University, 2024, World Mosquito Program, viewed 01 March 2024 < https://www.worldmosquitoprogram.org>.
Queensland Health, 2015, *Queensland dengue management plan 2015–2020*, viewed 11 February 2024, <https://www.health.qld.gov.au/__data/assets/pdf_file/0022/444433/dengue-mgt-plan.pdf>.

Ripple, WJ, Wolf, C, Gregg, JW, Rockström, J, Newsome, TM, Law, BE, Marques, L, Lenton, TM, Xu, C, Huq, S & Simons, L 2023, The 2023 state of the climate report: Entering uncharted territory, *BioScience*, vol.73, no.12, pp.841-850.

Ritchie, SA, Pyke, AT, Hall-Mendelin, S, Day, A, Mores, CN, Christofferson, RC, Gubler, DJ, Bennett, SN & van den Hurk,AF 2013, An explosive epidemic of DENV-3 in Cairns, Australia, *PloS one*, vol.8, no.7, pe68137.

Whiteford, LM 1997, The ethnoecology of dengue fever, *Medical anthropology quarterly*, vol.11, no.2, pp.202-223.

World Health Organization, Special Programme for Research, Training in Tropical Diseases, World Health Organization. Department of Control of Neglected Tropical Diseases, World Health Organization. Epidemic and Pandemic Alert 2009, *Dengue: guidelines for diagnosis, treatment, prevention and control*, World Health Organization.

World Health Organization, *The dengue strategic plan for the Asia-Pacific region 2008-2015*; 2008.