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Beyond the 'back yard': Lay knowledge about *Aedes aegypti* in northern Australia and its implications for policy and practice

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ABSTRACT

Controlling dengue fever in Australia and internationally, relies heavily upon the actions of residents as well as community education and awareness of the risks. Although it has been well established in medical anthropology that the success of health interventions is highly dependent upon a clear grasp of lay knowledge of disease, limited attention has been given to lay understandings of dengue fever and its vectors in the extant literature. We begin addressing this hiatus through an examination of north Queensland residents' knowledge of the breeding habitats of *Aedes aegypti* mosquitoes. Building on the insights of earlier social research, we use factor analysis to examine the results of a series of randomly selected telephone surveys and compare responses over time and between cities.

Our analysis confirms that many people assume that *Ae. aegypti* is ubiquitous in the landscape, that it lives and breeds *not only* around the home, but also in a variety of geographical spaces located beyond the suburban 'backyard', and beyond the control of local residents. Lay understandings appear to be placing people at risk from dengue, influencing the mosquito management practices of local residents and acting as a source of resistance to public health messages that focus on individual responsibility. A way forward through the provision of new information that challenges key assumptions is provided in the discussion. We argue that rather than dismissing lay understandings as ignorance, strategies, practices and policy based on a detailed understanding of this knowledge will mean that practitioners are better able to address these assumptions and will likely be more effective at educating the public of the risks posed by dengue.

1. Introduction

In recent decades, dengue fever has made a dramatic reappearance worldwide and is occurring in areas once thought to be free of the disease. Approximately 2.5 billion people worldwide, or 40% of the world's population, are thought to be at risk from the disease which is now endemic in more than 100 countries (Gubler, 2002; Halstead, 2007). Globally, an estimated 50–100 million cases occur each year, of which as many as 500,000 result in dengue haemorrhagic fever (DHF) and dengue shock syndrome (DSS) (Halstead, 2007). Dengue fever is now recognised internationally "as the most important arboviral disease of humans" (Gubler, 2002; Halstead, 2007; World Health Organization, 2000, 2002, 2004).

Dengue has a long history in north Queensland, Australia. Like malaria, it made sporadic appearances in the region from as early as 1879 (Black, 1972; Derrick, 1957; Douglas, 1994; Dyson, 1889; Hare, 1898; Kay et al., 1984; Spark et al., 1994; Spencer, 1994) with infection rates of up to 85% (1940–41 outbreak) in some parts of the region (Kay et al., 1984: 264; Queensland Government, 1942). From the 1950s to the early 1980s, dengue fever disappeared from the region for more than 26 years, due to the growing use of residual insecticides (including DDT) and introduction of reticulated water among other things (Kay et al., 1984: 264). At the time of writing there have been 3 fatalities from dengue fever and 27 outbreaks in the region since 1990 during which time all four serotypes have been recorded.

In Queensland, mosquito control is the responsibility of local government authorities. The increasing incidence of dengue in the region led to the development of Dengue Fever Management Plans in the early 1990s (see for example Queensland Health, 2005) and the creation of the Dengue Action Response Team (DART)—a

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skilled, specialist group that utilises house-to-house inspections and focuses on disease and vector surveillance, vector control and education (Montgomery and Ritchie, 2002; Ritchie, 2005; Ritchie et al., 2001).

Education campaigns have also been at the forefront of dengue prevention in north Queensland. For the most part, they have sought to alert the public both to the risk of dengue fever and to preventive measures, notably the identification and removal of potential breeding containers from around the suburban home. Evaluations of campaigns undertaken in the 1980s (Kay et al., 1984) and 1990s (Spark et al., 1994) suggest that while greater public awareness of the disease was achieved, this did not always translate into action—notably the removal of mosquito breeding sites.

At present, there is no vaccine for dengue fever. Reducing exposure to the mosquito vector through the use of repellent, insect screens and the removal of potential breeding sites, remain the most common forms of prevention. In northern Australia, dengue fever is vectored by the mosquito *Aedes aegypti*, a highly domesticated species that breeds in a variety of water-holding containers located in and around the home and other humanised buildings in suburban areas (i.e. offices, construction sites, vases in cemeteries) (Montgomery and Ritchie, 2002). The most common breeding sites are containers that have a straight edge for the mosquito to lay its eggs on, namely discarded items, old tyres, potted plant bases, vases, plastic tarpaulins, boats, blocked roofing gutters, buckets, pet bowls, watering cans and fallen palm tree fronds (Montgomery and Ritchie, 2002; Ritchie, 2005; Ritchie et al., 2001).

It is generally accepted then that the mosquito is not found and does not breed in creeks, swamps, lagoons, rivers or puddles of water. The type of houses in the region examined here range from low set brick or block homes to highset or two story 'Queenslander' style timber homes, as well as multi-story brick apartments. Yard sizes vary considerably in the region and have been deceasing in size in recent decades. The 2003–2004 average site area of new houses in was 735 sqm (ABS, 2005).

The female mosquitoes require a blood meal to provide protein for their eggs, and humans are their preferred source (Russell et al., 2005). Furthermore, *Ae. aegypti* do not fly far, with local studies suggesting 100–200 m at most (Russell et al., 2005). Critically, control of dengue fever and such a human-focused mosquito is heavily reliant upon the actions of residents and public awareness of the risks—where the mosquito breeds and how the disease is transmitted.

Anthropology's central contribution to knowledge in the last century has been in establishing that all "human knowledge is culturally and historically shaped and constituted" (Good, 1990) including people's understandings of disease, illness, cure and preventive measures (Kleinman et al., 1978; Koss, 1988; Scheper-Hughes and Lock, 1987). In recent years, these insights have led many to suggest that health interventions have been failing, in part, because they are based on a limited awareness of the complexity of lay understandings and the socio-political and cultural contexts in which this knowledge has emerged (Good, 1990: 26). These concerns have also been taken up in number of groundbreaking studies into public understandings of malaria and its vectors, which in several cases have led to improvements in public awareness and action (see for example Agyepong, 1992; Kamat, 2006; Williams and Jones, 2004; Winch et al., 1994, 1996).

The key lesson from these and other similar studies, is that it is essential to know how the disease and its vector is understood by the public if we are to communicate effectively and reduce the incidence of disease. Significantly, there only a few published accounts of lay knowledge of dengue fever (see for example Gordon, 1988, 1990; Kendall, 1998; Kendall et al., 1991; Koss, 1988; Suarez et al., 2005; van Benthem et al., 2002; Whiteford, 1997; Winch et al., 1991) and even fewer of the mosquito's that vector it (Kendall, 1998; Slosek, 1986; Suarez et al., 2005; Whiteford, 1997). As Suarez et al. (2005: 496) have argued ". . .we still do not know what dengue is culturally and what it means for individuals in their everyday lives" (see also Gubler and Meltzer, 1999; Slosek, 1986), while even less is known about lay understandings of mosquito vectors and how this may be effecting dengue control.

In recognition of this significant hiatus in the extant literature, anthropological research into lay understandings of dengue fever and its local vector *Ae. aegypti*, began in north Queensland in 2008. This research was part of a broader study – funded by the Foundation for the National Institutes of Health, through the Grand Challenges in Global Health Initiative – into community attitudes towards the use of the bacterial symbiont *Wolbachia* as a bio-control strategy for the elimination of dengue fever (www.eliminatedengue.com). Utilising an ethnographic research design it includes ongoing participant observation, focus groups (20) and in-depth, semi-structured interviews (50) with Cairns residents. The results of this research, reported elsewhere, (McNaughton, unpublished data) suggest that many people believed that *Ae. aegypti* were ubiquitous in the landscape—that they live and breed *not only* around the home, but also in a variety of geographical spaces located beyond the suburban 'backyard', and beyond the control of local residents. For many people, the logic of this thinking went as follows: no matter how much effort you go to at home, these mosquitoes are ubiquitous in the landscape, they breed around people's homes (your and others) and in the numerous freshwater swamps, creeks, puddles and palm fronds located in the 'bush'.

The aim of this paper is not to restate these findings however, but to examine them further, through an analysis of existing public health survey data from three randomly selected telephone surveys ($n = 1200$) and to address the question: "What do north Queensland residents know about the breeding habits and habitats of the *Ae. aegypti* mosquito?".

2. Methods

2.1. Setting

Townsville and Cairns are the largest cities in tropical northern Australia (Cairns 16°55′32″S, 145°46′31″E and Townsville 19°15′23″S, 146°49′6″E). The former is located in the dry tropics, has a population of 147,044 (Australian Government, 2006) and was established as a port in 1864 on the homelands ('Country') of the Bindal, Juru Wulgurukaba, and Nawagi Peoples. Cairns is located to the north of Townsville in the wet tropics. It has a population of 127,438 (Australian Government, 2006) and was founded as a port in 1876 on the homelands ('Country') of the Djabugay (west), Yirrganydji (north) and Gimuy Yidinji (south) Peoples. Both cities have distinct dry and wet seasons, with mosquitoes being particularly abundant and visible during the wetter months (November–March). Many residential suburbs in both cities are located near beaches, swamps, rivers and creeks and both cities have a highly mobile and growing population (Australian Government, 2006).[1]

2.2. Survey instrument

Data are available from randomly selected telephone interview surveys conducted in Cairns and Townsville in 2004 ($n = 400$), 2007 ($n = 400$) and 2008 ($n = 400$), developed by staff at the Trop-

[1] According to 2006 National Census, 50% of the population of Cairns were living at a different address in 2001, with many new residents arriving from cooler, southern states where dengue fever does not currently occur.