



Mosquito politics: Local vector control policies and the spread of West Nile Virus in the Chicago region

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ABSTRACT

Differences in mosquito control practices at the local level involve the interplay of place, scale and politics. During the Chicago West Nile Virus (WNV) outbreak of 2002, mosquito abatement districts represent distinct suburban clusters of human WNV cases, independent of characteristics of the local population, housing and physical environment. We examine how the contrasting actions of four districts reveal a distinct local politics of mosquito control that may have contributed to local-scale geographic differences in WNV incidence. This politics is rooted in political, economic and philosophical differences within and between administrative boundaries.

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1. Introduction

West Nile Virus (WNV) is a mosquito-vector-borne pathogen that causes considerable mortality and morbidity in birds, humans and other mammals. Widely distributed in parts of Africa, Asia and Europe, WNV was first identified in the United States in New York City in 1999. The disease spread rapidly but unevenly across the US, reaching the West coast by 2003. The uneven geographic expansion of WNV has been widely documented at the national and regional scales, where it reflects geographic and environmental factors that affect vector and host populations (Sugumaran et al., 2009; Allan et al., 2008; Landesman et al., 2007); however, there is also considerable local variation in disease incidence, even within places that share the same broad environmental conditions (LaBeaud et al., 2008; Ozdenerol et al., 2008; Ruiz et al., 2004). This local variation is rooted not only in micro-scale environmental conditions – micro-climates, drainage patterns and the like – but also in place-based political and social practices that facilitate or inhibit disease spread, in essence, the *local political ecology* of disease. This research examines the local political ecology of WNV during the 2002 outbreak in the Chicago

metropolitan region. Specifically, we investigate how local mosquito control practices and policies during a particularly challenging year shaped the uneven spread of the disease and the roles of place-based economic, political and cultural factors.

2. Place, health and the political ecology of West Nile Virus

It is unclear how or why WNV spread to humans originally, but its modern transmission cycle has been well documented (Nash et al., 2001; Komar, 2003; Hayes et al., 2005; Centers for Disease Control and Prevention (CDC), 2010). Infected birds transmit the virus to feeding (*Culex*) mosquitoes. Mosquitoes then transmit the infection to susceptible birds to maintain the cycle (Komar, 2003). Human infection results when an infected mosquito bites a human. Humans are a dead-end host because they usually do not reach a sufficient viral load to pass the infection back to a new mosquito vector. Within a locality, the number of infected mosquitoes and human hosts and the degree of contact between humans and mosquitoes are critically important in determining the risk of human infection.

While background information about the virus itself is well known, the ecology of disease transmission is less clear. Distributed over three zoogeographic zones around the world, WNV is adaptable to a broad range of environmental conditions (Hayes, 1989), making it a global emerging disease of great importance. Increases in summer temperature and changing precipitation patterns are also believed to increase reproduction

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of the *Culex* mosquito, its flight activity, and the rate of virus replication in the mosquito, which can lead to an increased disease transmission and an increased risk to humans. This is especially troubling as climate change trends predict hotter summer temperatures in many cities, where WNV is prevalent, increasing the risk of infection (Paz and Albersheim, 2008).

Ecological studies of WNV focus primarily on environmental indicators of mosquito habitat, often combining geographic information systems (GIS) overlays of data to determine possible habitat (Brown et al., 2008; Diuk-Wasser et al., 2006; Zou et al., 2006; Beck et al., 1994). Diverse environmental factors have been examined including landscape characteristics, climate, topography, housing quality/age and vegetation (Rogers et al., 2002; Tachiiri et al., 2006; Gibbs et al., 2006; Liu and Weng, 2008; Ozdenerol et al., 2008; Winters et al., 2008; Reisen et al., 2009; Ward et al., 2009). Demographic and socio-economic characteristics that make certain populations more vulnerable to mosquito contact have also been investigated (Tackett et al., 2006; Meyer et al., 2007). In addition, researchers are combining ecological data with statistical models to forecast the spread of WNV and assist surveillance efforts (Brownstein et al., 2002; Theophilides et al., 2003).

Although the associations between environmental factors and WNV incidence have been widely investigated, the roles of institutional and political-economic influences have been largely ignored. For WNV, the varying responses of residents and local public health authorities to the epidemic are critically important in affecting how and why the disease emerges in particular localities and its uneven impacts on people and places. Such responses vary substantially from place to place, rooted in local economies, populations and cultures.

We adopt a political ecology framework to better understand the social and spatial complexities of the WNV outbreak in Chicago, Illinois. Mayer (1996) defines political ecology as an integration of “cultural ecology and political economy into one coherent analytical framework” (p. 446). Drawing upon pioneering research by Turshen (1977) and others, he emphasizes the need to consider how the interactions among economic, socio-political and environmental forces shape disease landscapes. Political influences on infectious disease distributions and the roles of power, politics and human-environment interactions are emphasized (Mayer, 1996, 2000).

An important element in political ecology investigations is the recognition that the political, economic and ecological processes that shape infectious diseases are place-specific. Local populations, institutions, histories and environments are important. Viewing local environments as ‘risk spaces,’ Fitzpatrick and LaGory (2000) discuss how socio-political dimensions of place impact public health policies, which in turn affect disease incidence and spread. Cutchin (2007) makes a similar call for geographers to bridge the gap between social epidemiology and the analysis of place to examine how and why people experience health differently in different places. Integrating place with political ecology means considering how local processes intersect with those at the regional, national or global scales.

Research focused on understanding infectious disease outbreaks, using a political ecology framework has often been undertaken in developing countries—for example, HIV in Africa (Kalipeni and Oppong, 1998) colonialism and infectious disease in Tanzania (Turshen, 1984) and dengue fever in Latin America (Whiteford and Hill, 2005). Political ecology has also provided a framework for examining socio-spatial inequalities in exposure to environmental hazards, such as lead poisoning (Hanchette, 2008). While many political ecology studies emphasize how macro-scale processes, such as poverty and colonialism impact health disparities, local-scale processes such as cultural practices,

uneven economic development, stigmatization and local politics are also attracting attention (Keil and Ali, 2007; Hanchette, 2008; Raude and Setbon, 2009).

For mosquito-borne diseases like West Nile, a critically important local process centers on how local public health organizations respond to the disease, more specifically, their mosquito control practices and other efforts at limiting transmission. Mosquito control is often highly controversial, particularly when it involves the use of pesticides or biological controls that have their own potentially serious health and environmental impacts. Local officials, activists and residents often have varying perspectives on control strategies, resulting in local ‘narratives’ of control (Suarez et al., 2005). A study comparing cross border differences in dengue infection concluded that political will to invest in mosquito abatement techniques and community education in Mexico can reduce disease transmission to levels seen in ecologically similar Texas (Brunkard et al., 2007). Although not at the local scale, a study by Thrupp (1988) showed major differences in pest control strategies between Costa Rica and Nicaragua, two countries with similar locations and histories. Suarez et al. (2005) described socially defined ‘narratives’ of dengue control in rural Colombia that poorly reflected people’s everyday contacts with the mosquito vector. In the U.S., disease control policies are often formulated and implemented by local government agencies, and community organizations and local residents are important in shaping the local response. A recent study comparing mosquito control practices in two Arizona cities found that the communities had substantially different local vector management practices that represented varying institutional settings, political and economic contexts and knowledge regimes (Shaw et al., 2010).

In this paper, we use a political ecology framework to explore how the local politics of mosquito control affected the spread of WNV in the Chicago metropolitan area during the 2002 outbreak. In the Chicago area, mosquito control policies are largely determined by local districts called Mosquito Abatement Districts (MADs). The Illinois Department of Public Health provides guidance, but each district sets its own abatement policies and schedules, and has an independent surveillance and control program. MADs differ in many important ways. The insecticides a district uses, the locations targeted for control, the amount of mosquito surveillance conducted prior to the outbreak, and the time scale for chemical applications, all affect the success or failure of a MAD’s mosquito control efforts. In addition, opposition from local community members to some abatement practices, such as adulticide spraying may influence the ability of a MAD to successfully protect a community from WNV. The ‘local politics’ of mosquito control is the main focus of our research. Through interviews with local and state health department officials, mosquito abatement managers, mayors and community members, a better understanding of the interconnected socio-political dynamics of WNV emerges.

3. Data and methods

We focus on mosquito control practices in four MADs in the Chicago metropolitan region in Illinois during the WNV outbreak of 2002. In 2002, Illinois recorded an unprecedented number of WNV cases, including 884 human cases and 66 deaths. Most of these cases were concentrated in the Chicago region, specifically Cook and DuPage counties (Illinois Department of Public Health (IDPH), 2010). Examination of the spatial distribution of human cases within the counties showed that there was a non-random spatial clustering of the disease (Ruiz et al., 2004). Two large clusters of cases appeared in the Chicago suburbs, one located north of the city and the other

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