



Seasonality, disease and behavior: Using multiple methods to explore socio-environmental health risks in the Mekong Delta

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ABSTRACT

Any analysis of how changing environmental hazards impact on public health is fundamentally constrained unless it recognizes the centrality of the social and behavioral dimensions of risk. This paper reports on a research project conducted among low-income peri-urban households in the Mekong Delta of Vietnam. The research was based on cross-disciplinary inputs to develop a multi-layered understanding of the implications of a dynamic seasonal environment for diarrheal disease risk. It is a widely held assumption that the major changes in the abundance of surface water between the flood and dry seasons in the Mekong Delta are likely to be reflected in the changing patterns of disease risk, especially for poorer households that tend to rely heavily on river water for domestic water use. Therefore, this study investigated seasonal patterns in the contamination of environmental water, incidences of diarrheal illnesses, water use and hygiene behavior, together with perceptions of health risks and seasonality. During the period of October 2007 to October 2008, the UK and Vietnamese research team worked with a total of 120 households in four low-income sites around the city of Long Xuyen to conduct water testing; administer questionnaires on self-reported health, risk perceptions and behavior; and conduct semi-structured interviews. The research team found no overall evidence of a systematic seasonal risk pattern. At the population level, marginal temporal variations in water quality in the environment failed to translate into health outcomes. A complex risk narrative emerged from the interweaving data elements, demonstrating major inter- and intra-household variations in risk perceptions, hygiene behavior, seasonal behavior and other risk factors. It is suggested that these complexities of human behavior and transmission routes challenge simplistic assumptions about change in health outcomes as a result of seasonal environmental changes. These findings demonstrate the key role social science can play in a holistic and critical analysis of environment and health interactions.

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Introduction

In many developing countries, seasonal changes in environmental conditions have important but, as yet, poorly specified implications for human health (Altizer et al., 2006; Mutisya, Orindi, Emina, Zulu, & Ye, 2010; Pascual & Dobson, 2005). On major flood plains, both extensive seasonal flooding in the wet and low-water conditions in the dry season have the potential to heighten the risk of diarrheal disease. For example, these extremes can have an impact on drinking and washing water supplies or can lead to contamination of the local environment by human waste and other pollutants (Hashizume et al., 2008; Lin et al., 2000; Singh et al., 2001). However, even if seasonal changes alter environmental

hazards (e.g., elevated concentrations of fecal contamination), it is too deterministic to suggest that this will necessarily increase the levels of disease in the population. Not only are the factors that shape transmission of many environment-related diseases, such as diarrheal disease, typically complex (Curtis, Cairncross, & Yonli, 2000), but it is also important to consider the wider links between climate and people's lives. Seasonal changes may affect behavior (e.g., main occupation or choice of drinking water source), which may, in turn, affect the risk of an individual developing disease.

This paper reports on a research project that attempted to illuminate this multi-dimensionality of disease risk through an analysis of seasonality and diarrheal disease in the Mekong Delta in southern Vietnam. In this report, risk refers to the likelihood of disease outcomes resulting from a health hazard, and to understand the production of risk, we have to look at the mechanisms or pathways

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through which the presence of a hazard can lead to health outcomes. In terms of pathogens, this means understanding the transmission pathways associated with exposure and infection and the way that these pathways are shaped both socially and environmentally (Few, 2007). Despite the global importance of waterborne infectious disease, significant gaps remain in our understanding of the epidemiology and transmission dynamics of these diseases (Hunter, MacDonald, & Carter, 2010), in large part because so many factors interact to facilitate or limit transmission. Existing research certainly underlines the fundamental importance of environmental pathways for diarrheal disease (e.g., Pruss, Kay, Fewtrell, & Bartram, 2002). However, as noted by Batterman et al. (2009) “the social, ecologic, engineering, economic/political, and public health domains that together determine water and health outcomes are complex, interactive, nonlinear, and dynamic” (p.1027). The multiplicity of different transmission pathways available to most waterborne pathogens (through drinking water, recreational water exposure, poor sanitation, direct person-to-person transmission and even airborne transmission) only add to this complexity.

For diarrheal disease in developing countries, people's behavior in terms of water use and hygiene practices is generally seen as a central risk factor in transmission (Bostoen, Kolsky, & Hunt, 2007; Osumanu, 2007) and is associated not just with human agency but also with the structural contexts in which the behavior is embedded (Curtis et al., 1995). Socio-behavioral analysis therefore has a key role to play in the design of effective interventions in environmental health and health promotion, which requires an understanding of how people living under conditions of poverty perceive, prioritize and respond to health hazards (Curtis et al., 2000; Emch, 1999; Halvorson, 2004). An epistemological challenge in this respect is the integration of qualitative methods into environmental health research (Brown, 2003), which, as Scammell (2010) argues, has the key capacity to “improve understanding of complex exposure pathways, including the influence of social factors on environmental health, and health outcomes” (p. 1152).

This exploratory cross-disciplinary research project was designed from the outset not just as a mixed methods study but as a study placing equal analytical emphasis on positivist and interpretivist contributions (Scammell, 2010). Hence, local residents' perceptions of risk were considered as central to the project as the ‘hard’ data more traditionally collected in environmental epidemiology. Multiple data elements were intended to work in support of one another to facilitate the triangulation of the findings. On the one hand, this multi-layering of data sources was designed to enhance the validity of a relatively low-cost study that was not able to draw on high-quality, extensive surveillance data. However, it was also designed to provide a greater depth of understanding of the environmental and health interactions through the integration of social science approaches. As the project proceeded, the value of such approaches for both of these aspects became increasingly evident.

Study area

In Vietnam, the Mekong River Delta covers approximately 39,600 sq. km and is home to 16.1 million people. This represents one-eighth of the land area and one-fifth of the total population of Vietnam. The Mekong River Delta was chosen for this study because the monsoonal climate of the Mekong River basin produces pronounced seasonal variations in river flow.

Within the delta, the study was focused on the city of Long Xuyen on the banks of the Mekong River. This is a medium-sized city with a population of approximately 300,000. The city was selected as an example of a flood-prone settlement with concentrated pockets of low-income households. Long Xuyen is built

on flat, deltaic land and is crossed by a system of waterways. Flooding of parts of the city is an annual occurrence between July and October, broadly coinciding with the local rainy season, while in the dry season, the river water levels and rainfall both steadily fall to minimum levels, and some of the waterways become dry. The rainfall and river level data for Long Xuyen demonstrate this strongly seasonal pattern (Fig. 1).

Within the city, the study focused upon four peri-urban communities. These were Binh Duc ward, My Thanh ward, the riverine island of My Hoa Hung, and a small islet called My Thanh. The geographical spread of the sampling was designed to minimize the bias that might result from any site-specific characteristics (e.g., location of a major pollution source).

These four communities were identified as low-income zones containing clusters of households with per capita incomes below the official poverty line. For poorer households, environmental health concerns and the consequences of seasonal changes are potentially acute because many households rely on river water for domestic uses, including the provision of drinking water. Additionally, sanitation conditions are basic, with many households using simple latrines located over watercourses and fish ponds. Few people in these areas have access to solid waste collection services, and many of their occupations (e.g., fishing, farming and boat transport) bring them into direct contact with river water. The four sites were identified through local contacts as being especially flood-prone and therefore subject to extreme seasonal variation of environmental conditions. Many of the houses stand on stilts to remain above floodwaters during the flooding season.

Given the large seasonality of the river levels and rainfall in this area, disease risk might be expected to show seasonal trends (Lin et al., 2000). However, existing surveillance data and previous research in the study area (Tran & Few, 2006) were inconclusive. For studies such as this, routine surveillance data for disease are often of limited use due to the very low number of community cases reported to the health officials (Wheeler et al., 1999). Additionally, surveillance data in this case were only available at the ward level, and it was not possible to focus upon disease dynamics in the pockets of low-income households. An earlier research project focusing on local health practitioners' perceptions of floods found that many of these health practitioners perceived the risk of diarrheal and other waterborne diseases to be heightened during the annual floods (Tran & Few, 2006). However, contrasting views were also expressed in that study, including the view that the risk of contracting diarrheal disease from water sources might be heightened during the dry season. Indeed, in a search for statements from public health bodies within southern Vietnam on seasonal risks to public health, we mostly found sources referring to the higher risk of diarrheal disease in the dry season, although one statement focusing on rotavirus described peaks of incidence (i.e., new cases) occurring in both seasons (www.tuotire.com.vn; <http://giaoduc.edu.vn>; www.medinet.hochiminhcity.gov.vn/data/news/2008/3/5377/Rotavirus.htm; [all accessed January–March 2010]).

Methods

The research design combined quantitative and qualitative analyses to develop an understanding of: seasonal changes in the levels of environmental contamination (hazard), variations in diarrheal disease incidence (outcome), and seasonal variations in health behavior and other factors (pathways) that may affect the relationship between hazard and outcome.

Of key interest to this study was seasonal dynamics. Therefore, the field data collection took place in four phases over a 12-month period. Two data collection phases occurred during the peak of the

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