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Climatic hazards, health and poverty: exploring the connections in Vietnam

Roger Few and Pham Gia Tran

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Abstract

Vietnam is highly prone to climatic hazards, including extreme weather events and marked seasonal changes. Climatic hazards have wide-ranging implications for human health, but in most hazard-prone countries there has been little household level research on health risks. Drawing on the results of qualitative research in the Central Provinces and the Mekong Delta, this paper is one of the first empirical studies to examine how the social dimensions of vulnerability come into play in the generation of health outcomes associated with hazards. It explores particularly how aspects of economic livelihood, physical location, education and protective behaviour contribute to social differentiation in exposure and susceptibility, as well as shape people's capability to avoid adverse health impacts. These aspects were closely linked with, but not solely determined by, income-poverty. Understanding of risks to health in low-income settings requires careful analysis of this complex shaping of vulnerability. It also requires recognition that health protection for the poor may be articulated more in terms of protection of wider livelihood assets than preventive health actions *per se*.

Introduction

Vietnam faces annual risks from floods and tropical cyclones (Imamura and Dang Van To 1997; UNDP 2004). Climatic hazards such as these affect most regions of the globe and in many their impacts are likely to be exacerbated by the effects of climate change (IPCC 2007). The prospect of changes in the frequency, magnitude and distribution of such hazards compounds an already severe problem in many regions, especially in developing countries where the state's capacity to provide widespread protection measures is often low and where poverty and vulnerability to hazards may have a cyclical relationship (White et al. 2004; Wisner et al. 2004).

One of the most complex and widespread impacts of hazards is on health. Climatic hazards bring both short and long term, direct and indirect health risks, including accident and injury, changes in exposure to vectors and pathogens, psychosocial effects, impacts on food supply and impacts on health care services (Ahern et al. 2005; Shultz et al. 2005). Yet health aspects of hazards tend to be under-researched and, in particular, there is at present very little work that analyses the constraints and opportunities that shape poorer households' capacity to adapt to the health challenges (Few 2007; Woodward and Hales 2003).

The paper reports on two small-scale, exploratory case studies on this theme in Vietnam: in the Central Provinces and the Mekong Delta regions. It demonstrates how interlinked

elements of vulnerability can come into play in the generation of health outcomes relating to hazards. It explores particularly how aspects of income-poverty, physical location, health education and the relation between knowledge and practice can influence people's exposure and susceptibility to adverse health impacts as well as their capability to avoid such outcomes. The following sections set out the conceptual and methodological basis of the research, and provide descriptive accounts of hazards, health risks and potential responses from each of the two case studies. Drawing on this background material, the final section then elaborates on key factors that served to shape the vulnerability of households to health impacts across both the case studies.

Poverty, health and hazards: conceptual strands

Three interlinked sets of literatures helped to shape the research approach. First, from development studies, a broad span of people-centred approaches including work on entitlements, capabilities and sustainable livelihoods has emphasized the multi-dimensional nature of poverty and the complexity of social processes that serve to shape individual wellbeing (see e.g. Carney 1998; Devereux 2001; Leach et al. 1999; Moser 1998; Sen 1981, 1984). One linking message in these approaches is that understanding of poverty and wellbeing must go beyond a simple focus on the distribution of material and financial resources. It must consider how opportunities and threats to wellbeing operate via non-economic as well as economic assets, including human, social and environmental resources, and it must recognize how the ability to use resources to achieve wellbeing is structured by wider economic, social, cultural and political relations. Second, from health studies, a rich vein of social science research has emphasized in parallel fashion how health outcomes are generated by a complex raft of social and environmental factors (e.g. Curtis and Taket 1996; Gatrell 2002; McElroy and Townsend 1996). Together with exposure to disease agents – the focus of traditional biomedical research – approaches such as population health emphasize the broad social determinants that contribute directly or indirectly to health and wellbeing, shaping the nature of health outcomes (Raphael 2008; Young 2005). They include factors such as education, literacy, income, employment, working conditions, food security, housing conditions, social support networks, gender relations and cultural norms. Third, from disaster studies, there are equally well-established approaches, including work broadly on the political ecology of hazards, that highlight the social dimensions of risk (see e.g. Bankoff et al. 2004; Wisner et al. 2004). Risk in this conceptualization must be seen as a function not only of the nature of the hazard, but, perhaps more importantly, of the characteristics of people and human systems that face its impacts – their vulnerability. Vulnerability is defined in subtly different ways by different authors but essentially it is

comprised of the likelihood of physical exposure to the hazard, people's underlying susceptibility or sensitivity to its impacts, and their ability to cope with or adapt to risk (Adger 2006; Cutter 2006). In turn, once again, multiple resources and complex capabilities shape all these aspects of vulnerability.

Work linking these ideas of risk with themes of public health is still relatively thin on the ground, although they have begun to influence the fields of disaster medicine (e.g. Arnold 2002; Sundnes and Birnbaum 2003) and health and climate change (Confalonieri et al. 2007; McMichael et al. 2003; Menne and Ebi 2006). Lindsay (2003) has also drawn insightful parallels between population health approaches and studies of disaster vulnerability and coping capacity. Drawing on all these influences, we can depict individual human vulnerability to the health impacts of hazards in terms of closely interlinked elements of the 'external' physical and social environment, 'personal' attributes including perceptions, capabilities and actions, and 'internal' health status. These elements, and, crucially, the interaction between them, together define differential vulnerability to health impacts (Few 2007). They can come into play with differing intensity at each step along the pathway from hazard to health outcome, and they can operate through a range of social dimensions. This paper examines how some of these dimensions of vulnerability take effect for people living at the sharp end of health risk from hazards: in communities characterized by poverty, in an individual and collective sense, in a developing country.

Methodology

Two sets of field studies were undertaken in Vietnam in 2006, in urban sites in the Mekong Delta and in rural sites in the Central Provinces. The focus in these studies was on how people who are exposed to climatic hazards perceive and cope with the health threats, and the factors that shape how effectively they can respond. For the sites in the Central Provinces the principal climatic hazards were episodic tropical cyclones and floods, some of which had resulted in humanitarian disasters especially in rural areas (Beckman et al. 2002: Phong Tran and Shaw 2007). For the Mekong Delta sites seasonal flooding and occasional extreme floods were the principal hazards, posing potentially severe problems in the urban areas because of chronic environmental health issues (Nguyen Huu Ninh 2007; Pham Gia Tran and Few 2006).

In each study interviews were conducted with 24 low-income households situated within sites of repeated or seasonal exposure to hazard events. Selection of households was based on a 4-stage process. In consultation with local key informants, the

researchers selected spatial zones considered most prone to hazards. A list was then compiled of all households in the selected zones classified as 'poor' under the ward-level HEPA (Hunger Eradication and Poverty Alleviation) program. A target number of households was then allocated for each zone, proportionate to its number of registered 'poor' households. Within this sampling frame, a random selection was then made. (Because this was a household-level study we did not attempt to sample for individual characteristics of respondents such as gender and age; however, we recognize that it is somewhat artificial to place a distinction between individual and household levels of analysis).

Interviews were conducted with one adult representative of each household. All interviews were semi-structured, guided by a flexible question schedule, designed to elicit qualitative information on interviewees' perceptions of hazard/disaster events and attendant health risks and information about the forms of coping response at both household and communal level. Additional local key informant interviews took place at city/district and ward/commune level, with heads or senior representatives of local authorities, health facilities and local branches of the Viet Nam Red Cross. Interviews were conducted in Vietnamese and translated by field researchers. Interview quotes provided in the text are as faithful as possible to the original statements of the interviewees, but inevitably there is an interpretative element in the translation process.

For each case study area in turn, the next two sections provide background information on hazard events, local perceptions of their health implications, and forms of response to potentially available to households. Some of the factors that may underlie how vulnerability to health risks is socially differentiated are then explored in the following sections.

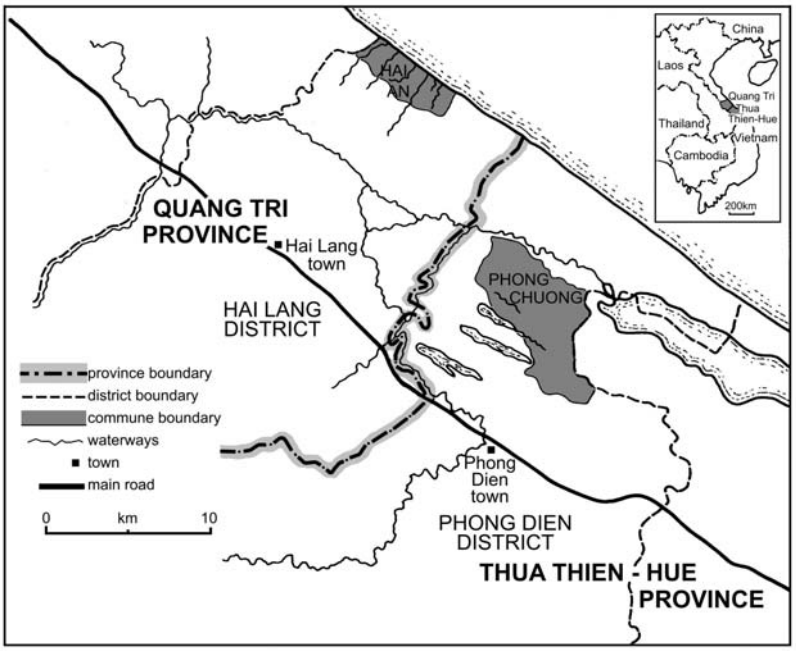
Central Provinces study: hazards, health risks and response options

The provinces of Thua Thien - Hue and Quang Tri are located adjacent to one another in the narrow central region of Vietnam. High, steep-sided mountain ranges inland and low-lying plains along the coast heighten the risk from natural hazards such as tropical cyclones (including typhoons), flash floods and landslides (SRV 2004; Wickramanayake 1994). Annually, the Central Provinces are threatened by an average of four to six tropical cyclones between August and December, bringing high winds, storm surges and the threat of coastal flooding (including breaches to sea dykes). Heavy rain, often associated with storm events, causes riverine flood risk between September and December. The most catastrophic event in recent memory was a flood disaster in 1999,

which killed 600 people across seven provinces of central Vietnam. Typhoon, tropical storm or flood disasters had also affected the study areas in 2003 and 2005. For many people in the region, these hazard events compounded ongoing economic difficulties. At the time of the study, monthly average income per capita in the North Central Coast region was around two-thirds of the national average (GSO 2006), and many rural families fell well below the official poverty line of 200 000VND (approximately US$12.5) per capita per month.

Figure 1 indicates the locations of the two study sites within these provinces: both are low-lying areas prone to typhoon and flood hazards. *Phong Chuong* is one of sixteen communes in the district of Phong Dien, in the north of Thua Thien - Hue province. Phong Chuong commune occupies an area with flat, sandy terrain, located close to the coast and the lagoon. At the time of the research the commune population was approximately 7,550. Most people interviewed in the study relied on farming and animal husbandry for income generation. *Hai An* is one of twenty communes in the district of Hai Lang, in the south of Quang Tri province. It is a coastal commune, lying 15km to the north of the district centre. It had a population of around 4,750, and small-scale fishing was the main economic activity, providing more than half the average household income.

Figure 1 Location of the study sites in Central Vietnam



The two communes had the same organizational structure to manage disaster risk: a Committee for Flood and Storm Control (CFSC), organized by the local authority (the commune people's committee), and with close involvement of the local Red Cross branch and of sectoral agencies. All of these bodies were in turn overseen and supported by equivalent district, provincial and national structures. Primary health care in each commune was provided by a commune health station, under administrative control by the district health authority. Higher levels of medical care were available in the main urban centres of the district and province. Key informants stated that most households in the communes had some access to water supplies from deep-drilled wells, although use of river water for drinking and cooking remained common. Most people used simple, open latrines, which were seen as a common source of environmental contamination.

Hazards and health risks

Phong Chuong and Hai An faced a similar mix of hazards associated with extreme weather: principally typhoons and lesser storms, and flash floods generated from high rainfall inland. Hai An, with its line of villages all fronting the coast, had been the more susceptible to storm surges and coastal flooding associated with typhoons, while river floods appeared to have had a more widespread effect in Phong Chuong. Interviewees were able to name key risks to people's lives and livelihoods from severe hazards: including injury, illness, food and income shortages, damage and losses to housing, crops, livestock and infrastructure and disruption of the local environment. At the same time they also tended to recognize that smaller magnitude hazards such as tropical storms and minor annual floods could also pose serious risks.

Discussion of health risks associated with these hazards included not only the more obvious threats of death and injury from the physical force of wind and water, collapse of houses and trees and drowning incidents, but also the wider implications of hazards for levels of morbidity. The perspectives of health sector staff largely echoed those of the household interviewees. Overall, diarrhoeal disease was the principal disease concern. Increased risk of diarrhoeal disease after typhoons and floods was listed by all twenty-four householders from the two communes. Children were seen as particularly susceptible, both to contracting the disease and to its symptoms. Reasons suggested for the increased risk included the existence of contaminated floodwater (polluted by debris, animal carcasses and waste from latrines), together with shortages of safe water.

The same environmental conditions were also seen to pose elevated risk of skin diseases and conjunctivitis, especially among children who might play in the polluted water. Other diseases linked with hazards by interviewees included respiratory illnesses, such

as common cold and influenza, and the mosquito-borne disease dengue, which, in its haemorrhagic form, can be life-threatening. However, even among health staff, there was no clear consensus on the existence or mechanism of these hazard-disease linkages. It was suggested by one informant that dengue might be heightened in floods when the water recedes and leaves behind many small pools suitable for *Aedes* mosquitoes to breed.

Malnutrition was also discussed by the health sector staff and by some households. There were several references to food shortages and hunger potentially resulting from crop losses and income losses following destructive floods and typhoons. One householder explicitly made a link between malnutrition and increased susceptibility to diseases, especially for children. The risk of severe malnutrition is likely to be especially high for children that are chronically malnourished. About 24 percent of children in Hai An commune were malnourished in an average year, according to health staff, which is relatively high for the district and province.

Response mechanisms

As well as identifying threats to health, households and key informants in the study areas described the responses they could make to combat health risks before and after hazard events strike.

All households were able to list some kinds of actions they take in advance of hazards, including: securing the house roof and walls against winds and floods; clearance of waterways and ponds to prevent blockages and/or reduce contamination; reserving stores of food and drinking water; and preparing a boat for evacuation. Mostly, these were preparedness measures taken at the start of the disaster season or when hazards are imminent, but there were also a few longer-term mitigation actions. In the aftermath of typhoons and flash floods, and during long-term floods, people described how they take steps to try to avoid disease risk, such as: evacuation to safe sites and shelters during emergencies; taking extra steps to ensure safe drinking water after hazards; and providing extra advice to children on hygiene and risk from polluted water.

Key informants and householders also described response activities that may be undertaken by local and external institutions. In relation to health risk the list of potential support actions included: provision of information to the public (including early warnings and risk reduction advice); evacuation and shelter organization; distribution of relief materials (food, clothing, blankets, roofing); provision of medicine kits and water purification tablets to households; emergency mobile health teams;

mosquito spraying; and organization of brigades for environmental cleansing. These again entailed measures to prevent health risk effects, but also some key public health measures to break the link to health outcomes and/or promote recovery. As with activities undertaken directly by households, however, not all these actions were automatically put into practice during or after hazard events; moreover, when they were implemented, they were not necessarily accessible to all households. It is the reasons for these differences that are the key interest of this paper, and which are explored later in the paper.

Mekong Delta study: hazards, health risks and response options

The cities of *Cao Lanh* (150,000 people in 2006, capital of Dong Thap province) and *Long Xuyen* (350,000 people in 2006, capital of An Giang province) lie in the heart of the Mekong Delta. Each is located on one of the two main branches of the Mekong river (see Figure 2). Annual seasonal flooding affects most of the Delta region, usually between July and October (broadly coinciding with the rainy season). The flood levels vary from year to year, and the region recorded abnormally high floods in each of the years 2000, 2001 and 2002, creating disaster conditions in some areas (Nguyen Huu Ninh 2007; SRV, 2004).

Though the Mekong Delta region and its cities in particular are relatively prosperous by national standards, environmental health remains a challenge in many areas, particularly for the poorer and more marginalized segments of the urban population. In both the study cities around 60 percent of inhabitants did not have ready access to piped water at the time of the study, according to key informants, and even fewer had household connections to sanitation systems. Alternative sources of domestic water included river water, rainwater and bottled water. River water was commonly used for drinking (with or without treatment). In central urban areas, options also included communal taps in public buildings and piped water purchased from neighbours. Sanitation options included open defecation, pit latrines, fishpond latrines and latrines with septic tanks. Though dyke systems for flood control were gradually expanding in both cities at the time of the study, many peripheral and some central urban areas had incomplete structural defences as well as deficient drainage systems. Figures 3 and 4 indicate the location of the specific study sites within the two cities: sites chosen for their high exposure to flooding.

Figure 2 Location of Long Xuyen and Cao Lanh in the Mekong Delta

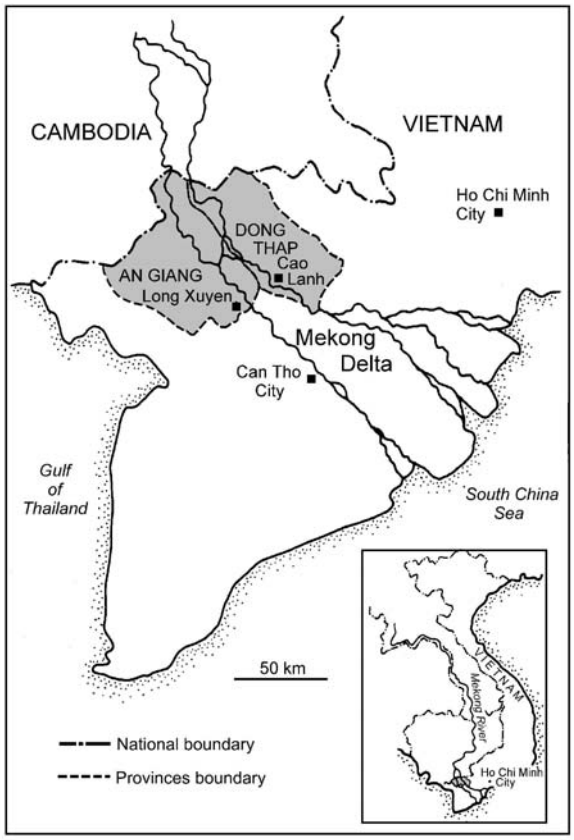


Figure 3 Long Xuyen study sites

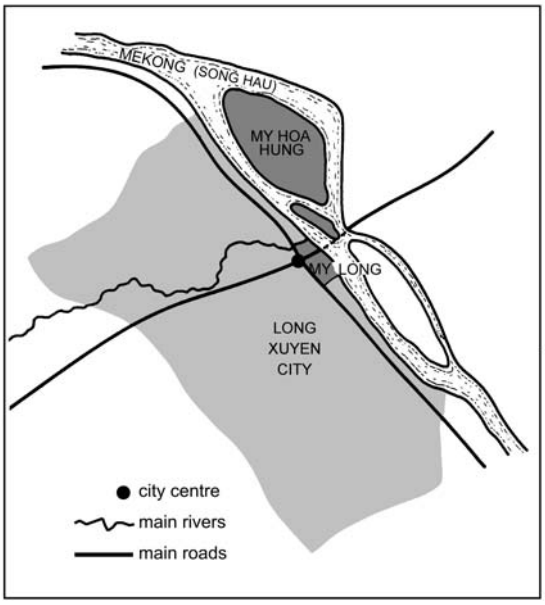
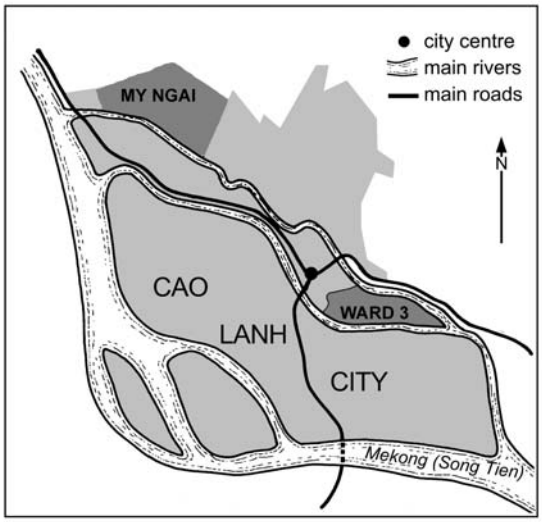


Figure 4 Cao Lanh study sites



In both cities, one central and one peripheral site were selected. In Cao Lanh these were *Ward 3* and *My Ngai* commune. Ward 3 is located close to the city centre of Cao Lanh. According to local key informants the majority of the workforce was engaged in low-income occupations such as work for hire, selling lottery tickets, collecting waste and fishing for crabs and fish from canals. My Ngai commune lies on the north-east outskirts of Cao Lanh, close to the Song Tien branch of the Mekong river. It is peri-urban in character, with mostly agricultural land-use and an economy dominated by farming.

In Long Xuyen the sites were *My Long* ward and *My Hoa Hung* commune. My Long ward is located between the city centre and the Song Hau (Mekong) river. Many of the poorer and most flood-prone households live in small stilt houses on the river margin, with income sources including casual labour and small businesses such as motorcycle/cycle transport, selling of food items or lottery tickets, and sewing services. My Hoa Hung commune occupies islands within the Song Hau, opposite the city centre and accessible by ferry and smaller boats. Occupations in the commune include rice farming, fishing, work for hire in these sectors and other trades such as boat transport and waste collection. My Thanh is a separate islet accessible by small boat either from the commune centre or from the city. The islet is narrow and actively eroding on its western shore, where most homes were located.

The two communes and two wards that made up the study sites each had a CFSC to manage disaster risk and a local health station. In both Cao Lanh and Long Xuyen the study populations had additional access to health services from a city-level preventive health centre and from city and provincial-level hospitals.

Hazards and health risks

Though flooding is a part of the normal seasonal cycle in the Mekong Delta, and, indeed, is integral to the agricultural productivity of the region, every year brings hardships for households directly exposed to the rising water. During the peak months of September and October, residents in low-lying or poorly-protected houses in both cities (often lower-income households) may experience flooding not only of surrounding land but also entry of water into their houses with peaks heights at each high tide. In some houses depths of 40-50cm above the floor could be experienced at the peak periods. In extreme years such as 2000, flood levels could be much higher – as much as 100cm depth in some houses. Interviewees referred commonly to disruption of livelihoods, disruption of transport (particularly accessibility of minor roads), damage to houses and possessions, contamination of homes, and potential disease impacts.

Increased risk of diarrhoeal disease was raised consistently as a priority issue, by both local key informants and householders. Two thirds of the household interviewees (eight from each city) associated flooding with diarrhoeal disease risk. Most expressed understanding of a connection between contamination of waters by waste and faecal matter and risk of infection, citing bodily contact with polluted water (including bathing), unsafe use of river water sources (failure to boil or treat water) and poor food hygiene as mechanisms of transmission.

Skin disease was also commonly listed as a flood season hazard, occasionally producing severe symptoms in sufferers. As well as faecal and other waste, agrochemicals (fertilizers, pesticides) flushed from fields during floods was seen as a pollution source that might cause skin disease – by householders and local key informants alike. As in the Central Vietnam study, respiratory diseases and dengue were raised as flood-related diseases by some interviewees but the linkages were inconclusive and not recognised by all health sector staff.

As well as infectious disease risk, concerns over risk of drowning and injury during floods were widespread. Child drownings accounted for the great majority of deaths directly attributed to the 2000, 2001 and 2002 floods, and though they are very rare events in most years, one in two households expressed fear for children's safety during the flood months when water levels are high and currents may be strong. Injuries were generally seen as commonplace during flood seasons, with accidental falls and collisions with submerged objects resulting from the daily movement of people through standing water.

Two further possible health consequences of flooding raised in the Mekong Delta sites include stress-related illness and risk of malnutrition related to loss of income. Stress factors were apparent at the household level, with more than one in two interviewees referring to increased anxiety, fears and/or intra-household tension as a result of the dangers and damage associated with flooding and its livelihood impacts. Malnutrition risk was raised by some of the key informants. Though households can to some extent turn to fishing for subsistence during flood conditions, many spoke of economic difficulties during floods, which, for the poorest at least, is likely to be a risk factor for malnutrition.

Response mechanisms

As in the Central Vietnam study, interviewees at household and institutional levels in the Mekong Delta study described various health-related responses to flood hazards. Almost all households (twenty-one out of twenty-four) were able to identify some kinds

of preparedness or mitigative actions they take in advance of hazards, most commonly simple steps to strengthen the house structure and efforts to clear waste matter from the environs of the home. When floods are established, households may employ a variety of coping mechanisms to minimize health-related impacts, including: erecting raised planks and hammocks within the home to avoid water contact; regularly clearing flood waste from home; taking extra steps to ensure safe drinking water; and extra vigilance over the safety of children.

Key informants and householders also described response activities that may be undertaken by local and external institutions during typical and extreme floods. In relation to health risk the list of potential support actions included: provision of information to the public (including announcements on flood levels and flood-related disease prevention); provision of 'flood kindergarten' sites for care of children during working hours; making free medicine kits available at health facilities; increased health monitoring; emergency mobile health teams, medical boats and 24-hour staffing of health facilities during extreme floods; mosquito spraying in high-risk sites; and organization of environmental cleansing via mobilization of mass organizations. Again, not all these actions were automatically put into practice during the flood season, and, if they were implemented, they were not necessarily accessible to all households or neighbourhoods. We now turn to explore these dimensions of differential vulnerability in more detail.

Discussion: what shaped vulnerability?

The preceding sections have set out in descriptive terms the forms of health risk faced by low-income populations in the Vietnam study sites, and the range of responses at household and institutional level that could act as interventions to limit progression of the health impact pathway for climatic hazards. The core purpose of this exploratory research was not to assess the severity of the risks nor the reach and effectiveness of the response mechanisms, but to demonstrate the means by which social determinants influence how exposure, susceptibility and ability to cope with health risks are differentiated within hazard-prone communities (Lindsay 2003). In other words, the purpose was to explore what shaped vulnerability.

At an individual, intra-household level, vulnerability to health impacts obviously can be expected to vary according to attributes such as age, gender and disability. Such *intra*-household variations in vulnerability are amply demonstrated by work in Vietnam (e.g. Oxfam 2008; Pham Thi Lan 2000; Save the Children 2003) as well as wider contexts

(Enarson and Hearn-Morrow 1998; Hemingway and Priestley 2006; Jabry 2002). One example arising in both case studies was a commonplace perception that children tended to have heightened vulnerability to disease resulting from hazards, related in part to physiological factors such as disease resistance and in part to factors such as hygiene behaviour, contact with sources of contamination during play activities, and daytime sleeping (*Aedes* mosquitoes bite by day).

However, the methodology for this project examined households as a unit, and the following discussion focuses primarily on vulnerability at a household level and on *inter*-household variations. From the interview data, there was strong recognition by many households that health-related vulnerability is differentiated by characteristics such as housing type, water supplies, quality of latrines, household hygiene and the nature of the local environment. The conceptual approaches noted earlier in the paper emphasize that characteristics such as these arise through a complex web of economic, social, cultural and political factors. Though it was difficult to do justice to this complexity in the confines of a small-scale study, there were a series of themes that emerged particularly strongly in the interviews and which can serve as illustration of the interweaving dimensions that helped to shape vulnerability at household level.

Income-poverty and economic livelihoods

> 'I don't know what I could do – if I have money everything is easy'
> (*interviewee CL7, My Ngai*).

The economic dimensions of vulnerability are deeply rooted within the hazards and development literature. Understanding linkages with income-poverty, livelihoods and political economy has been a driving force behind key advances in the social science of vulnerability in landmark work such as Sen (1981) and Wisner et al. (2004). In research on livelihoods in northern Vietnam, Adger (1999) particularly underlined how household incomes combined with differential entitlements to resources shaped patterns of vulnerability to climate extremes.

Across all the study sites reported in this paper, economic factors were as central as might be expected in shaping risk of health impacts from floods and typhoons. All the households sampled for interview were of lower-income status, and shortage of money and material resources made it difficult in general for people to take steps to prevent health risk effects and/or limit deleterious outcomes. In the Mekong Delta study, though twelve people reported taking emergency steps to strengthen and secure the house against floods, bank erosion and winds, in most cases these were temporary measures not involving investment in the permanent structure. A total of fifteen interviewees in

the Mekong Delta stated that they wanted to be able to do more to strengthen and raise the floor of their homes. One specifically stated that raising the floor is a priority need because 'it will limit contact with water and prevents disease' (*interviewee LX11, My Hoa Hung*). Similarly, eleven people in the Central Vietnam study emphasized the need for a stronger, typhoon-resistant house as a priority health protection measure.

Boat ownership was another limiting factor associated with income-poverty, affecting people's ability to reach shelters during floods and in some cases to access health care. Staff at My Ngai Health Station said the facility itself was never inundated, but that access to it had to be by boat during deeper floods and many poor people without boats could not easily reach the health station. People in Hai An also spoke of the aspiration to own a larger boat, with three of the householders in this fishing community explicitly stating that this would enable them to raise and stabilize income and hence provide better health protection for the family. This livelihood-strengthening role of boat ownership was neatly expressed by one interviewee: 'In the flood season, if you have no boat you are like one who has no feet' (*interviewee CL11, My Ngai*).

Ability to provide safe water for the family, to avoid disease, remained a major concern for some households, but options for doing so were limited by economic capacities. In both studies, use of river water for cooking and drinking was commonplace. Water was typically taken from local watercourses and stored in large jars outside the home, in some cases with alum added to help clean the water, and in fewer cases fuel was used to boil the water. Interviewees spoke of the need for extra care with water treatment following hazard events and for taking steps to secure non-contaminated supplies, yet suggested this was difficult for many families living in poverty because of the cost of buying bottled water, accessing piped water supplies elsewhere or, for the poorest, installing suitable roofing material for rainwater harvesting. Installing hygienic latrines usable in wet and dry seasons was even further beyond the means of most families: 'cost of construction of a toilet is millions [hundreds of dollars], so how can the poor have access to it?' (*interviewee LX5, My Long*). Key informants at district level in Hai Lang also saw building of hygienic latrines as a key measure, but argued that this undertaking required external assistance.

Economic poverty can not only constrain the ability to prepare for hazards, but also force people to prioritize earning an income over health protection and seeking health care. Two interviewees in the Mekong Delta study explicitly stated that looking after health had to come second to securing income. Several interviewees spoke of not always having money for medicine or being too poor to afford health care treatment. An interviewee in Long Xuyen acknowledged that ill-health itself impacts on earning power, but stressed that inevitably they had to prioritize economic activities. He added:

'no job means no money and having no food; if you have no food to eat how can you be in good health?' (*interviewee LX12, My Hoa Hung*).

The poor may also be more exposed to health hazards because of the occupations available to them, especially within the Mekong Delta. According to interviewees those engaged in net fishing and shellfish collection who spent much time wading through floodwaters were regarded as especially at risk of injury from submerged objects . Similar risks applied to people harvesting rice and wild vegetables in flood conditions. One interviewee also spoke of risk of snakebite when moving through water in fields and canals. Another householder suggested that income-poverty made the poor more susceptible to disease risks because they could not stay at home during floods but had to go out into the fields to maintain income.

Nevertheless, the influences on household-level vulnerability and coping capacity emerging from this research were by no means solely economic. For example, even the less-poor households faced health risks and had serious concerns they could not necessarily manage during a normal seasonal flood in the Mekong Delta sites. One family in My Long that had the benefits of piped water, septic tank, and a pre-stocked medicine cabinet, still had problems with flood incursions into the home, incoming waste, abundant mosquitoes and emotional stress during the flood period. Other factors played their part too, often in combination with, but not necessarily reducible to, income-poverty.

Locational dimensions

One critical influence is the physical location of a household in relation to the distribution of hazard effects: a factor that is often closely linked with, but not necessarily controlled by, poverty. In Hai An, for example, households located alongside water channels were considered by far the more vulnerable to flooding, as well as to bank erosion, and may have experienced inundation when houses nearby were clear of water. One resident described his physical vulnerability to the 1999 flood, which 'swept away my house because I lived near the waterway; I lost all my properties and was forced to live in my parents' home,' (*interviewee HA9, Thuan Dau Village*).

A focus on how risk from hazards is spatially differentiated and how locations can become sites of heightened vulnerability has featured in the work of geographers such as Cutter (1996) who has developed a 'hazards of place' approach. A similar approach has been used by Smoyer (1998) in the context of health and extreme events, showing how risk from heatwaves can vary significantly from locality to locality within a single city. Within Long Xuyen many of the households most vulnerable to flood conditions

were those located at the water's edge on My Thanh islet in My Hoa Hung commune, where they were exposed to physical danger from rapid currents on the main river channel, wave action and erosion of the banks on which the houses stand. In the words of one interviewee: 'The landslides are powerful and cause broken houses. From 2000 to now, my house was moved three times after floods. We had to borrow to buy land,' (*interviewee LX10, My Hoa Hung*). Though linkages between exposure to hazards and income-poverty were certainly clear - many households occupying marginal locations were indeed low-income - the association between the two was only ever partial.

Mitigative measures against hazards also create a spatially differentiated dimension of vulnerability. Some houses in the Central Vietnam sites benefited from stands of trees screening them from high winds and sand movement. The location of flood control structures – dykes and embankments – similarly could strongly shape the local geography of hazards. In both Cao Lanh and Long Xuyen such mitigative measures were being progressively extended on a block-by-block basis, and there was strong interest and support among householders in the study sites for construction of upgraded roads and dyke systems to reduce flood impacts and protect livelihoods in 'unprotected' localities. My Hoa Hung was one site where raised platforms known as 'residential clusters' had been built for the resettlement of households from particularly hazardous locations: in this case especially for some former residents of the eroding banks of My Thanh islet.

Specific health risks associated with hazards can also vary spatially in relation to environmental health and sanitation, especially in urban settlements. In the Mekong Delta study, there were conflicting perceptions among householders on whether river water sources are cleaner in the flood or the dry seasons: in part this may have been dependent on very localized conditions such as proximity to sources of pollution that may be spread by floodwaters including fish-pond latrine sites and waste dumps. Residents of My Hoa Hung commonly complained of contamination of water by 'waste from nearby fish boat houses' (*interviewee LX12, My Hoa Hung*): catfish aquaculture was a growing sector in that stretch of the Mekong river. Health staff in Cao Lanh pointed to potentially ironic problems of high floodwaters becoming trapped and stagnating in some neighbourhoods where dyke systems have been created for flood protection.

Household location can affect capacity to prepare for imminent hazard events. In both studies, warnings and risk information were conveyed by various channels, including loudspeaker announcements and public meetings at neighbourhood centres. Households located at the fringes of urban blocks and rural villages may have been outside audible range of loudspeakers or unaware of public meetings. One householder stated:

> People are lacking information on how serious the disaster is. My family does not have a TV set, and the loudspeaker in the village is not in my reach because we are too far away from it (*interviewee PC5, Chinh An village*).

In the Central Vietnam communes, households in some areas also complained of lack of suitable shelters they could reach. Two interviewees stressed a need for more access to boats for rescue and evacuation and two others wanted an increase in (multi-purpose) public shelter sites. Location vis-à-vis public facilities further affects capacity to cope with hazards. In the Mekong Delta, a system of 'flood kindergartens' was established after 2000 for emergency childcare during flood conditions, but at least one resident in the study claimed that their locality was not served by this measure. Access to health care had also been a problem during floods in Hai An because the health station was sited in a flood-prone plot next to a waterway.

Awareness, education and health protection practices

The linkage between people's understanding of health risks from hazards and health protection practices is central to health promotion. Defined in simple terms as the process of empowering people to control their health more effectively (see WHO 1986, for a more expansive definition), health promotion entails building and supporting people's awareness and knowledge of risks and how to reduce them, together with efforts to ensure they can put that knowledge into practice. Though we are conscious of important debates in the hazards literature surrounding knowledge construction and reproduction (explored by Bankoff et al. 2004), this section reflects the explicit focus of most interviewees in the studies on the role of health and hygiene education in fostering health promotion. Research that exists on health awareness and education in relation to environmental hazards indicates that this aspect of health promotion is by no means straight-forward. Individuals tend to display variation in receptivity to information, for example, because of differing sensitivity to health risk as well as differing abilities to understand information and implement knowledge (Few and Matthies 2006). In a study in Pakistan, Halvorson (2004) found that existing awareness of environmental disease-causing agents tended to be high, but there were strong doubts over the actual impact of new knowledge gained through health education. Hence, Wisner and Adams (2002) emphasize that active participation of communities in preparedness and response to hazards tends to be crucial to the success of this process.

Awareness of health risks and health protection practices emerged as a key aspect of coping capacity in the Vietnam studies. Some interviewees related this closely to level of general schooling and literacy, pointing to the existence of major

information/communication barriers for those they regarded as poorly educated: 'people with low education…. are not enthusiastic in accessing information on health and disease' (*interviewee LX6, My Long*). But others related it to variations in the quality of health education and outreach provision.

In the Mekong Delta, for example, flood-related health education included disease prevention advice on water use, food safety, environmental sanitation and mosquito breeding sites, delivered via leaflets, posters, loudspeaker announcements, community meetings and visits by local health workers. In both cities, however, there were calls for more clearly understandable and more regular health education activities on flood risks, especially for poor households and the more vulnerable individuals. Several household interviewees expressed concerns over levels of knowledge regarding health and hazards. A gap in knowledge was perceived by some people, with one saying: 'I am unlearned, and I don't know the causes of diseases. [But] I observe that more diseases are occurring in the flood season' (*interviewee CL7, My Ngai*). One interviewee felt that leaflets did not necessarily match the reading skills and awareness of people with low levels of education. In Central Vietnam, nine interviewees wanted to see more information on preparedness and coping. When asked about the most important way to improve protection against health threats, one interviewee said: 'to educate children to avoid dirty water, to keep their body fit by eating well-cooked food, and to use safe drinking water during the disaster season' (*interviewee PC6, Luong Mai village*).

However, though incomplete, awareness of health risks and the means to reduce those risks was indicated by most of the household interviewees. A gap appeared to remain between understanding and acting on dangers to health, especially in the critical areas of water treatment, food safety and sanitary hygiene. It is important to recognize that health behaviour is constrained not just by limits to understanding, but also by limits on people's ability and willingness to act on the knowledge they have. It was claimed by one respondent in Phong Chuong, for example, that many people had no option but to use floodwater for drinking and cooking after hazards struck, often without access to methods of water treatment. It was also pointed out by one national-level interviewee, that poor people evacuated from their homes to higher ground during floods often do not have the means to store food safely – they may then have little choice but to face what they know is a disease risk.

Inter-linked elements of vulnerability to health impacts

Earlier, the paper introduced the idea of interlinked 'elements' of vulnerability to health impacts (Few 2007), and it is useful briefly to illustrate some of these linkages. Most of the interview material related to *external* and *personal* elements of vulnerability: that is,

to aspects of physical and social environment (external) and human cognition and action (personal), and to the interconnections between them. In essence, this refers to the interaction of structure and agency in determining vulnerability to health-related impacts of climatic hazards. Sadly, in this exploratory, household-level study it was difficult to do justice to *internal* elements of vulnerability, which refer largely to underlying health, mental health and nutritional status of individuals and how these condition the likelihood of a threat to their health translating into a serious health outcome. (However, we have seen reference to pre-existent malnutrition as a major factor that could exacerbate sensitivity to disease threats associated with hazard events, especially among children. Malnutrition is an internal element of vulnerability that, in most cases, is profoundly shaped by the interaction of personal and external elements through the delimitation of entitlements to food security.)

The interplay of personal and external elements of vulnerability refers both to how physical and social context impinges on people's resources and practices in relation to health, and to how individual beliefs and actions can serve to modify context, again with implications for health. We have seen, for example, how certain households in Long Xuyen that used local watercourses as a source of drinking water believed they were more exposed to health threats during floods because of the proximity of catfish producers. The growth of the aquaculture sector in and around the city may have been exacerbating this problem. External aspects of the physical environment and regional economy were therefore interacting with personal water supply practices to influence household vulnerability. We have also seen the potential connection between sanitation issues and flood-related health problems in the Mekong Delta. On the one hand, this is an example of the personal reshaping the external: sanitation practices at a household level exacerbating contamination of the local environment for neighbouring households. On the other hand, many poorer households were unable to build safer latrines because of high construction costs associated in part with the physical environment of a floodplain terrain and a high water table. Moreover, for low-income households, personal ownership of a more hygienic latrine was likely to depend on the existence of external social assistance.

Some of the most critical linkages between external and personal elements lie in the mechanisms by which structure in a social sense can influence agency through shaping capabilities to respond to risk. Clearly, economic development and collective poverty in Vietnam at a structural, external level have a major role in shaping personal capabilities, but they are reflected too in the relationship between institutional practices and household vulnerability to health impacts. Adger (1999) has emphasized the importance of institutional and policy dimensions of vulnerability in Vietnam. Management of hazards and disaster risk in the country has been strengthened considerably in recent

years, with growing interventions in disaster preparedness and response by both government agencies and non-governmental organizations (Viner and Bouwer 2006). We have seen that policy initiatives in the Mekong Delta, for example, included creation of residential clusters and flood kindergartens - although the planning and provision of these had not benefited all communities and households equally. However, in part at least because of chronic shortage of funding, key informants at national and local level in government and other supporting agencies recognised that they were limited in their ability to improve structural protection for communities, to guarantee sufficient resources to aid evacuation, shelter, relief and recovery, and to provide adequate health care and outreach in emergencies. The preceding section particularly highlighted shortcomings in the provision of health education on hazards.

Though we do not focus on them in this paper, largely because of the limitations of the scope of the studies, it must be noted that other social, political and cultural dimensions play a vital part too in the interaction between external and personal elements in defining vulnerability. The role of cultural norms and social capital, for example, in facilitating or restricting response to risk has been explored in general texts on hazards such as Oliver-Smith and Hoffman (1999) and Pelling (2003), and specifically for health aspects of extreme events by Rashid and Michaud (2000) and Wolf et al (2009). It was stressed by some key informants, for instance, that certain potentially risk-raising behaviours such as use of river water and fishpond latrines are part of the cultural fabric of traditional rural life in Vietnam. In the Mekong Delta cities some key informants associated this adherence to tradition with in-migration of rural populations – although it may clearly also have been linked with ability to afford higher-cost alternatives. In a more positive sense, reports from both Thua Thien-Hue (Shaw 2006) and Quang Tri (Oxfam 2008) have emphasized the importance of levels of social cohesion and local organization in determining how well communities recovered from the 1999 flood disaster. Vietnam is characterized by high levels of membership of mass organizations that can be mobilized during and after emergencies (Pham Gia Tran and Few 2006). The country has also seen recent policy initiatives that may potentially expand opportunities for community-level activism (Mattner 2004), although concerns remain over the depth and reach of participatory processes in practice – as noted in comments from Hai An on disaster preparedness planning and also by Phong Tran and Shaw (2007). Here culture and politics weave closely together, both in terms of the governance of risk management, and also in a micro-scale sense in the politics of interaction and negotiation for those affected by hazards and how that shapes their capabilities to respond.

Conclusion

Empirical studies of the interaction between health, hazards and vulnerability remain few in number, especially in the context of low-income countries prone to climatic hazards. This paper presents a scoping of some of the factors at work in shaping vulnerability at the household level, using examples from a series of exploratory studies in Vietnam. It is intended to illustrate the complexity of how health impacts come to be suffered or avoided by people, and also to stimulate further targeted research in this field that places analysis of risk to health in its social context.

Reflecting the core issues raised by interviewees in the studies, this paper has focussed particularly on dimensions related to economic livelihood, household location and health awareness/education, and on the interactions between them. As with most aspects of hazard impact in developing countries, economic factors were seen to have a fundamental role in health-related vulnerability. Income-poverty tended to constrain people's ability to prevent impacts, to seek treatment and to withstand disease. But income-poverty also operated in sometimes subtle, sometimes stark inter-linkage with other dimensions. The location of households most exposed to flood hazards, for example, was commonly alongside watercourses: in many cases these housed the poorest families occupying marginal sites, sometimes illegally, and living in simple houses of fragile construction without raised foundations. Similarly, the studies began to reveal how protective health behaviour could be constrained in practice: in part this appeared to reflect gaps in awareness and education on how to avoid or reduce risks, but it was at least as evident that ability to take action was linked to opportunity and resources. A crucial requirement for researchers is to understand how economic poverty interacts with these, and other, wider aspects of vulnerability, in an approach that has close parallels both with work on multi-dimensional poverty and on the social determinants of health.

Finally, it is important to note that health protection was often viewed as intrinsic to protection of wider livelihood assets. This finding alone underlines the social complexity that surrounds vulnerability, and exposes the limitations of viewing health risk and response from a narrowly sectoral perspective. Instead of targeted preventive health measures, several householders argued that broader poverty reduction would be the key to protecting their family's health during hazard events. When asked about the most important way to gain better protection from health risks of hazards, one interviewee replied with the following:

> '…to own a strong house to stay in during typhoons and floods; to receive support in terms of loans to stop hunger and poverty; to send children to school to have better knowledge and understanding' (*interviewee PC2, Phu Loc village*).

People made a logical connection between initiatives such as loans for fishing boats and improvements to road infrastructure with the ability to provide a safe home, adequate food, water and medicines, and ready access to a television or radio for receiving warning messages. All would contribute to protection of health against climatic hazards, now and in future.

References

Adger, W.N. (1999) Social vulnerability to climate change and extremes in coastal Vietnam. World Development 27(2): 249-269.

Adger, W.N. (2006) Vulnerability. Global Environmental Change 16: 268-281.

Ahern, M., Kovats, R.S., Wilkinson, P., Few, R., Matthies, F. (2005) Global health impacts of floods: epidemiologic evidence. Epidemiologic Reviews 27: 36-46.

Arnold, J.L. (2002) Disaster medicine in the 21st Century: future hazards, vulnerabilities, and risk. Prehospital and Disaster Medicine 17: 3-11.

Bankoff, G., Frerks, G., Hilhorst, D. (eds) (2004) Mapping vulnerability: disasters, development and people. London, Earthscan.

Beckman, M., Le Van An, Le Quang Bao (2002) Living with the floods: coping and adaptation strategies of households and local institutions in Central Vietnam. SEI/REPSI Report Series No 5, Stockholm Environment Institute.

Carney, D. (ed.) (1998) Sustainable rural livelihoods: what contribution can we make? London, Department for International Development.

Confalonieri, U., Menne, B., Akhtar, R., Ebi, K.L., Hauengue, M., Kovats, R.S., Revich, B., Woodward, A. (2007) Human health. In Parry, M.L., Canziani, O.F., Palutikof, J.P., van der Linden, P.J., Hanson, C.E. (eds), Climate Change 2007: Impacts, Adaptation and Vulnerability. Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. Cambridge, Cambridge University Press: 391-431.

Curtis, S., Taket, A. (1996) Health and societies: changing perspectives. London, Arnold.

Cutter, S.L. (1996) Vulnerability to environmental hazards. Progress in Human Geography 20: 529–539.

Cutter, S.L. (2006) Hazards, vulnerability and environmental justice. London, Earthscan.

Devereux, S. (2001) Sen's entitlements approach: critiques and counter-critiques. Oxford Development Studies 29: 245-263.

Enarson, E., Hearn-Morrow, B. (eds) (1998) The gendered terrain of disaster: through women's eyes. London, Praeger.

Few, R. (2007) Health and climatic hazards: framing social research on vulnerability, response and adaptation. Global Environmental Change 17: 281-295.

Few, R., Matthies, F. (eds) (2006) Flood hazards and health: responding to present and future risks. London, Earthscan.

Gatrell, A.C. (2002) Geographies of health: an introduction. Oxford, Blackwell.

GSO (2006) National Statistics Yearbook 2005. Socialist Republic of Vietnam, General Statistics Office, Statistical Publishing House, Hanoi.

Halvorson, S.J. (2004) Women's management of the household health environment: responding to childhood diarrhea in the Northern Areas, Pakistan. Health & Place 10: 43-58.

Hemingway, L., Priestley, M. (2006) Natural hazards, human vulnerability and disabling societies: a disaster for disabled people? The Review of Disability Studies 2 (3): 57-68.

IPCC (2007) Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change. [Core Writing Team, R.K Pachauri, A. Reisinger (eds)]. Geneva, IPCC.

Imamura, F., Dang Van To (1997) Flood and typhoon disasters in Viet Nam in the half century since 1950. Natural Hazards 15: 71-87.

Jabry, A (ed) (2002) Children in disasters: after the cameras have gone. London, Plan UK.

Leach, M., Mearns, R., Scoones, I. (1999) Environmental entitlements: dynamics and institutions in community-based natural resource management. World Development 27(2): 225-247.

Lindsay, J. (2003) The determinants of disaster vulnerability: achieving sustainable mitigation through population health. Natural Hazards 28: 291–304.

Mattner, M. (2004) Power to the people? Local governance and politics in Vietnam. Environment & Urbanization 16: 121-127.

McElroy, A., Townsend, P.K. (1996) Medical anthropology in ecological perspective. Boulder, Westview Press.

McMichael, A., Campbell-Lendrum, D., Corvalan, C., Ebi, K., Githeko, A., Scheraga, J., Woodward, A. (eds) (2003) Climate change and human health: risks and response. Geneva, World Health Organization.

Menne, B., Ebi, K. (eds) (2006) Climate change and adaptation strategies for human health. World Health Organization Regional Office for Europe/ Steinkopff Verlag, Darmstadt.

Moser, C. (1998) The asset vulnerability framework: reassessing urban poverty reduction strategies. World Development 26: 1-19.

Nguyen Huu Ninh (2007) Flooding in Mekong River Delta, Viet Nam. UNDP Human Development Report Office Occasional Paper 2007/53.

Oliver-Smith, A., Hoffman, S. M. (eds) (1999) The angry Earth: disaster in anthropological perspective. New York, Routledge.

Oxfam (2008) Viet Nam: climate change, adaptation and poor people. Oxfam in Viet Nam, Hanoi.

Pelling, M. (2003) The vulnerability of cities: natural disasters and social resilience. London, Earthscan.

Pham Gia Tran, Few, R. (2006) Local responses to floods in the Mekong Delta, Viet Nam. In Few, R., Matthies, F. (eds) Flood hazards and health: responding to present and future risks. London, Earthscan:128-144.

Pham Thi Lan (2000) Need assessment in response to flood disaster in Mekong River Delta. Save the Children, Hanoi.

Phong Tran, Shaw, R. (2007) Towards an integrated approach of disaster and environment management: a case study of Thua Thien Hue province, central Viet Nam. Environmental Hazards 7: 271-282.

Raphael, D. (ed) (2008) Social determinants of health: Canadian perspectives. Toronto, Canadian Scholars' Press Incorporated.

Rashid, S., Michaud, S. (2000) Female adolescents and their sexuality: notions of honour, shame, purity and pollution during the floods. Disasters 24: 54–70.

Save the Children (2003) Child drowning in the Mekong Delta: current situation and solutions. Save the Children in Vietnam, Hanoi.

Sen, A. (1981) Poverty and famines: an essay on entitlement and deprivation. Oxford, Clarendon.

Sen, A. (1984) Rights and capabilities. In Sen, A., Resources, values and development. Oxford, Basil Blackwell, 307-324.

Shaw, R. (2006) Critical issues of community based flood mitigation: examples from Bangladesh and Vietnam. Science and Culture 72 (1-2): 62-71.

Shultz, M., Russell, J., Espinel, Z. (2005) Epidemiology of tropical cyclones: the dynamics of disaster, disease, and development. Epidemiologic Reviews 27: 21-35.

Smoyer, K. E. (1998) Putting risk in its place: methodological considerations for investigating extreme event health risk. Social Science and Medicine 47(11): 1809-1824.

SRV (2004) National report on disaster reduction in Vietnam. Socialist Republic of Vietnam.

Sundnes, K.O., Birnbaum, M.L. (eds) (2003) Health disaster management: guidelines for evaluation and research in the Utstein style. Volume I conceptual framework of disasters. Prehospital and Disaster Medicine 17, Supplement 3.

UNDP (2004) Reducing disaster risk: a challenge for development. New York, United Nations Development Programme.

Viner, D., Bouwer, L.M. (2006) Linking climate change adaptation and disaster risk management for sustainable poverty reduction: Vietnam country study. MWH report to the European Commission in support of the Vulnerability and Adaptation Resource Group work program.

White, P., Pelling, M., Sen, K., Seddon, D., Russell, S., Few, R. (2004). Disaster risk reduction: a development concern. London, Department for International Development.

WHO (1986) The Ottawa Charter on Health Promotion. World Health Organization, Geneva. http://www.who.int/hpr/NPH/docs/ottawa_charter_hp.pdf (accessed 24 March 2009).

Wickramanayake, E. (1994) Flood mitigation problems in Vietnam. Disasters 18: 81-86.

Wisner, B. and Adams, J. (eds) (2002) Environmental health in emergencies and disasters. Geneva, World Health Organization.

Wisner, B., Blaikie, P., Cannon, T., Davis, I. (2004) At risk: natural hazards, people's vulnerability and disasters. London, Routledge.

Wolf, J., Lorenzoni, I., Few, R., Abrahamson, V., Raine, R. (2009) Conceptual and practical barriers to adaptation: vulnerability and response to heat waves in the UK. In Adger, W.N., Lorenzoni, I., O'Brien, K. (eds) Adapting to climate change: thresholds, values, governance. Cambridge, Cambridge University Press.

Woodward, A., Hales, S. (2003) Weather, climate, climate change and human health. Applied Environmental Science and Public Health 1(1): 3-7.

Young, T.K. (2005) Population health: concepts and methods. New York, Oxford University Press.

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