CHAPTER 3. HUMAN HEALTH: THE MOST BASIC VULNERABILITY[24]

Countries of all income levels are vulnerable to natural forces, as was amply demonstrated by Hurricane Katrina in the U.S. in 2005 and by the 2003 European heat wave. When extreme weather destabilizes the balance between natural and human systems, protective structures and institutions quickly break down, particularly those that are already weak or stressed, eventually threatening human lives and well-being.

In Europe and Central Asia, the most urgent health issues arising from climate change relate to already vulnerable populations: the elderly, the ill, the very young, the displaced, and the marginalized. When extreme weather combines with political instability and civil strife, the numbers of people facing serious health emergencies can multiply, as experienced in post-independence Georgia in the 1990s. Persons living in substandard, decrepit housing, such as the Roma, will be hardest hit by floods and heat waves.

Long-term threats to human health under a changed climate may be less easy to measure or attribute than those resulting from extreme weather events such as floods or droughts—but they are also important. A more stressed agriculture sector will translate into higher rates of malnutrition and increased susceptibility to disease. Families that depend on rain-fed agriculture will be affected by shifts in precipitation and may migrate to seek improved livelihoods, thereby increasing the numbers of people underserved by local health systems. Water degradation from a variety of sources will expose more people to dengue fever and diarrheal diseases.

What follows is an examination of two categories of health risk: first, immediate and direct threats occasioned by warmer, wetter weather, with more climatic extremes; second, setbacks brought on by the consequences of and adjustments to climate changes, including interrupted livelihoods, migration and temporary displacement, and inadequate nutrition.

Warmer and more extreme weather brings new threats and exacerbates others

Extreme weather events, such as floods and droughts, are the most immediate and obvious health risks—and projections indicate these events will become more intense and frequent. In addition, the threats arising from extreme events are sometimes aggravated by parallel crises, including civil strife, breakdown in health systems, and institutional collapse.

Floods

Floods, which account for half the world's natural-disaster fatalities, constitute a multi-pronged assault on human systems. From 2000 to 2007, ECA's ten most severe floods—in Russia, Turkey, Romania, Poland, and Tajikistan—accounted for nearly 500 casualties (table 3.1). Deaths from drowning or collapsing structures were compounded by landslides, which frequently accompany floods. Evacuations, particularly those involving hospital patients and other vulnerable groups, are enormously stressful and increase the risk of heart-attack.

[24] This chapter is based on "The Health Dimension of Climate Change" by Tamer Rabie, Safinaz el Tahir, and Tereen Alireza, a background paper commissioned for this report.

TABLE 3.1 A RISING TIDE OF FLOODING EPISODES

Year	Country	Location	Casualties
2002	Russia	Novorossiisk	167
2002	Russia	Stavropol, Krasnodar, Karachaevo-Cherkesia, Ingushetia, Adygea, Chechnya, Kabardono-Balkaria, North Osetia-Alania, Dagestan	91
2006	Turkey	Cinar, Bismil	47
2002	Turkey	Rize, Corum,Yozgat, Kars and Mus provinces	34
2005	Romania	Harghita, Mures, Dolj, Bacau, Vrancea, Galati, Braila, Bistrita, Gorj, Suceava	33
2006	Romania	Arbore, Bistrita, Maramures, Arad	30
2001	Poland	Malopolskie, Swietokrzyskie, Donoslaskie, Oploskie, Slaskie, Warminsko-Mazurkie, Podlaskie, Gdansk, Slupsk regions	27
2005	Romania	Alba, Tulcea, Giurgiu, Vrancea, Bacau, Braila, Galati, Vrancea, Ialomita	24
2002	Tajikistan	Dasht, Langar	24
2007	Tajikistan	Asht district	21

Source: EM-DAT, accessed January 2008. *Notes:* Table includes the ten most lethal, in numbers killed, of the flood events in ECA recorded in EM-DAT for 2000–2007.

But some of the health impacts are less immediate and less obvious. Post-traumatic stress, increased poverty, compromised nutrition, and interrupted livelihoods all affect human health without appearing immediately as illnesses or injuries caused by extreme weather. Long-term displacement of people and permanent migration from flood-damaged residences goes hand-in-hand with lower living standards and increased vulnerability.

Over the last thirty years, Georgia's experiences have shown the extent of a small, unstable country's vulnerability to flooding. They also demonstrate the ways that extreme weather combines with institutional weakness and civil strife to further lower the quality of life for thousands of citizens.

Between 1987 and 1989, earthquakes, floods, and landslides caused the displacement of 20,000 people in the Svanetia and Ajara regions. At the same time, because of the disruptions during the unraveling of the Soviet Union, Georgia suffered a severe shortage of medical supplies and required international assistance. Civil strife added refugees from violence to those uprooted by natural disaster, leading to a number of crowded, unhealthy, and highly insecure temporary settlements. In 1993, thousands of people were driven out of makeshift homes, and again in 1998, by which time the population of internally displaced reached 40,000. Extreme weather events—in a context of political instability, institutional weakness and poverty—became a major contributor to poverty, insecurity, and vulnerability.

While Georgia emerges as the most vulnerable for the period 1980–2000, measured by the mortality rate among those exposed to floods, it wasn't alone. The Czech Republic was the second most vulnerable for the same period, followed by Slovakia and Moldova (UNDP DRI).

Following the immediate damage and trauma of a flood, but well before the long-term effects of displacement and loss of income run their course, there may be a wave of health risks stemming from water-borne illnesses as sewage, industrial wastes, and agricultural runoff flow into human settlements and degrade the water supply (box 3.1).

BOX 3.1 WITH EVERY FLOOD A RISK OF DISEASE

Flooding, apart from causing drowning and injury from collapsing structures, introduces a host of illnesses as water supplies are contaminated with sewage and wastewater from farms and factories. Poorly maintained water systems and inherited environmental degradation add to the risks.

The following flood-related illnesses are already present in the ECA region, and are projected to become more frequent threats:

Dysentery, an infectious disease caused by the bacterium *Shigella dysenteriae*, is a common threat in floods. In Tajikistan in 1992, flooding combined with displacement from civil unrest to put hundreds of people at risk, resulting in higher childhood mortality in two villages.

Typhoid fever, an infectious disease carried by feces and urine, is caused by the bacterium *Salmonella typhi.* In May 1996, following heavy rains and flooding in Tajikistan, a poorly maintained sewage system came under additional stress and contaminated the water supplies. In the ensuing typhoid fever outbreak, 7,516 cases were reported in a month's time, a third of them in children under the age of 14. As in Georgia, simultaneous stresses on institutions and infrastructure, from the flooding and prior weaknesses, combined to worsen the health crisis. About 50 health clinics and schools were damaged by the floods. The toilet system of a major hospital was inundated, further spreading the dangerous bacterial contaminant. Prior conditions added to the population's vulnerability once the flood came. Amid civil violence, public funding of health facilities had tapered off, leaving the system short of diagnostic supplies and drugs for treatment of infectious diseases. In 1995, soap had become largely unavailable and chlorination of the water supply had been halted due to a lack of materials. In some parts of the country, people had begun using open canals for their water supply, but hundreds of these were ruined in the floods.

West Nile Virus, which is highly dangerous for the elderly, is spread primarily by mosquitoes, whose larvae thrive in the pools of standing water normally left by flooding. An outbreak of the disease followed 1999 floods in the Czech Republic, when *Aedes* mosquitoes proliferated in affected areas. Europe's largest recorded outbreak occurred in Bucharest, Romania in 1996 and showed that urban areas also were vulnerable, with larvae multiplying in flooded basements of buildings.

Tahyna, a virus that breeds in flooded areas, was detected in the Czech Republic following three separate episodes of flooding.

Leptospirosis, a once rare infectious disease carried by rodents and other animals, spreads through contact with moist soil, mud, vegetation, or contaminated water. Russia, Ukraine, and the Czech Republic have experienced outbreaks following floods.

Other water-borne diseases, including cholera, hepatitis A and salmonella, have surfaced in the region following flooding episodes.

Source: Rabie et al. 2008.

The massive upheaval caused by a flood and the resulting loss of homes, possessions, and livelihoods leaves people strained and exhausted, often suffering from post-traumatic stress disorder and depression.

The fallout can be even more serious following floods that displace and destroy on a wide scale. For example, when Poland's Oder River flooded in 1997, it affected 86 cities and towns, 875 villages, and 450,000 farms, with an overall economic cost of an estimated $3.5 billion. The Federation of Red Cross and Red Crescent Societies reported 50 suicides linked to the disaster in a two-month period. High levels of physical and emotional stress impact a host of bodily systems, complicating pregnancies and raising the risk of heart disease.

Heat waves

Heat waves have an immediate impact on public health, often aggravating a variety of health conditions or bringing about unhealthy changes in water or air quality. Researchers have found that during an extended period of intense heat, the number of deaths rises above established seasonal norms. These are considered "excess deaths," and are attributed to the effects of intense heat.

Cities intensify heat waves because traffic, buildings, and sparse vegetation all increase temperatures further. In 2001 in Moscow, 276 deaths above a multi-year average were attributed to a nine-day heat wave. That same summer, heat waves may have caused hundreds of deaths in Croatia, Slovenia, and the Czech Republic. The latest estimates for the pan-European heat wave of 2003 point to 70,000 deaths. The 2003 heat wave was the most dramatic in recent history, but there have been a number of fatal heat waves in Central and Southeastern Europe over the last ten years (table 3.2).

TABLE 3.2 HEAT WAVES ADD TO ILLNESSES

Year	Heat wave temp. record ºC	Country (location)	Number of heat wave related morbidities*
2005	36	Romania (Bucharest)	500
2000[a]	46	Turkey	300
2000	35	Croatia (Zagreb, Split, Osijek, Rijeka)	200
2006	36	Romania	200
1996	40	Romania	200
2000	43	Romania (Bucharest, Bechet)	100
2007	40.3	Slovakia	89
2000	42	Serbia and Montenegro	70
2007[b]	45.5	Bulgaria	50

Source: EM-DAT. Based on information obtained in January 2008.* Reported in EM-DAT as number of injured, the people suffering from physical injuries, trauma or an illness requiring medical treatment as a direct result of a disaster. (a) Heat wave associated with drought event. (b) Heat wave associated with wild fires and drought event.

The following categories show the ways that periods of intense heat generate new health threats or undermine the body's capacity to manage existing conditions:

Heatstroke is a severe condition in which, under excessive exertion, the body ceases sweating. This causes body temperature to rise to dangerous levels, and can result in fainting, organ failure, and death.

Heat cramps and heat exhaustion occur when the body sweats so much that the concentration of salt in the body becomes dangerously low. The condition can increase the heart rate and lead to heatstroke if left untreated. Infants and small children are at risk because their fluid reserves are smaller than those of adults. The elderly, who may eat and drink little because of weak appetite and take medications that leave them more prone to dehydration, are also at risk.

Exacerbation of existing conditions is a major risk, since a number of cardiovascular, cerebrovascular, renal, respiratory, and psychological conditions are sensitive to heat. For example, during 17 heat waves in the Czech Republic over an 18-year period, there was a 13.6 percent increase in cardiovascular mortality (Kyselý and Huth 2004). Studies in Croatia and Uzbekistan have found weakened performance of heart patients during times of extreme heat.

Stressed infrastructure can *compromise utility service delivery* and thereby worsen health conditions, and as chapter 6 will explain, ECA's inherited stock of Soviet-era infrastructure and poorly-ventilated housing is vulnerable to atypical heat. Heavy use of air-conditioning alleviates risks for people who can access or afford it, but strains power supplies and may lead to outages. Such an electricity outage would limit water access for many people, setting off a cascade of other impacts.

Extreme heat can also lead people to engage in *riskier behaviors*, such as swimming in open canals, rivers, or lakes, leading to deaths that wouldn't occur in less extreme summer weather.

Pollution, smog and fires—which often intensify during a heat wave—lead to higher than normal cardiovascular problems and deaths. Under extreme heat and a lack of rainfall in 2007, wildfires proliferated in Southeastern Europe, causing dozens of hospital visits as well as a number of deaths.

Droughts

Droughts, depending on their severity and duration, present the human organism with a variety of health risks. A severe drought in 2000 and 2001 in Tajikistan and Uzbekistan cut the availability of drinking and irrigation water and led to slow, chronic forms of malnutrition as households eliminated meat and dairy products from their diet.

The severe drought that hit Moldova in the summer of 2007 offers a well-documented case of the impact on health. A survey by the World Food Program and the Food and Agriculture Organization of the U.N. estimated that the crisis impacted 84 percent of the country's arable land, leading to estimated economic losses of $407 million from crop failures and livestock deaths.

Strains on ordinary citizens were evident. A household survey showed that 72 percent of the households interviewed were worried about having enough food. Of households with three or more children, 59 percent reported that they ate differently, with some foods they formerly counted on now unavailable. Nearly 40 percent of the households surveyed said their water source was dried up or at least damaged by the drought conditions.

Changing averages: malaria, allergies and algal blooms

A number of diseases associated with warmer weather will probably become more prevalent in ECA, and some have already surfaced. A major concern is malaria.

Largely eradicated from Europe, malaria has returned to the Caucasus and Central Asia, with weather-related events raising disease levels. For example, mudslides in 1997 elevated the prevalence of malaria in Azerbaijan, increasing the number of breeding sites considerably. Malaria is also endemic in Turkey and Tajikistan, where the Roll Back Malaria program was introduced in 1998.

Warmer average temperatures will also increase pollen-related allergies, particularly in Central Europe where the ragweed Ambrosia is more highly concentrated than most other regions of the world. Pollen concentration increases with higher temperatures and higher ambient concentrations of CO_2.

Changing averages are affecting health in other ways. Warmer, wetter weather is changing conditions in the Baltic Sea, with ramifications for human health. One process underway is eutrophication, involving an increase in nutrients, usually nitrogen and phosphorous, in the sea. The process triggers algal blooms that lead to a hypoxic or anoxic conditions and a degradation of environmental quality.

One category of algal blooms, cyanobacteria, has been present in the Baltic for decades, but has recently increased in duration, frequency, and biomass. Resulting toxins trigger gastrointestinal illnesses and liver damage in cases of persistent exposure, and ingesting contaminated water has killed cattle and pets.

The toxins are a risk to human health as well, and may be linked to carcinomas in China. Climate change models project two types of impacts in the Baltic Sea—increased freshwater runoff into the Baltic from increased precipitation and flooding, plus warmer sea temperatures—both of which can contribute to increased cyanobacteria.

The climate change–health outcome matrix

The following matrix distills the findings and projections of an extensive literature on the relationship of current climate and climate change with human health.

TABLE 3.3 HEALTH CONSEQUENCES OF A CHANGING CLIMATE: DIRECT AND INDIRECT

Exposure / Outcome	Direct Impacts				Indirect Impacts	
	Extreme weather events			Changing averages	Migration	Coastal degradation
	Heat wave	*Flood*	*Drought*			
Mortality (cause-specific)						
Drowning		x				
Physical trauma		x				
Heat exhaustion	x	x				
Fire	x		x			
Suicide		x				
Respiratory Diseases						
Asthma				x		
Acute lower respiratory tract infections			x			
Mental Diseases						
Depression		x	x		x	
Post-traumatic stress disorder		x	x		x	
Reproductive Diseases						
Perinatal complications*		x				
Amenorrhea		x				
Rodent/Vector Borne Diseases						
Leptospirosis		x				
West Nile fever		x				
Tahyna		x				
Malaria		x		x	x	
Dengue				x		
Tick-borne encephalitis				x		
Lyme borreliosis				x		
Water/Food Borne Diseases						
Cholera		x	x	x	x	
Dysentery		x			x	
Hepatitis A		x			x	
Salmonella		x		x		
Acute toxicity						x
Other						
Malnutrition			x		x	
HIV/AIDS					x	
Allergies				x		
Dehydration			x			
Dermatitis						x
Gastroduodenal ulcer disease		x				

Source: Rabie et al. (2008). *Notes:* "x" denotes evidence for link between defined exposures and health outcomes; blank cells denote no evidence of association. *Includes pregnancy loss and disorder (premature delivery, missed abortion, birth asphyxia, premature rupture of membranes, intrauterine growth retardation).

Vulnerability from climate-driven migration: the health perspective

In rural areas, livelihoods depend directly on climate-sensitive resources, particularly water, and settlements are highly exposed to weather extremes. Households earning income from farming and livestock activities have historically resorted to seasonal or indefinite migration when conditions become too harsh or too precarious. For families reliant on subsistence farming, climate-driven migration tends to be permanent, as in situations where drought has decreased the land area that can be cultivated.

As elsewhere, impacts of climate change in ECA countries come on top of existing conditions and patterns of vulnerability. Migration linked to climate change will add to already high levels of migration; and recipient countries may find their resources are overstretched, particularly in the delivery of health services.

ECA accounts for one-third of the world's total migration (excluding movement of people between industrialized countries), partly because of the high level of migration since the break-up of the Soviet Union. Migration in ECA forms two main streams: first, from Eastern Europe and the former Soviet Union to Western Europe; second, within the states of the former Soviet Union. Russia is the main destination for migrants in the second stream, while the main sending countries in ECA are Albania, Kazakhstan, and Georgia.

People in the region move to pursue economic opportunities, and a challenging or changing climate already does and will continue to influence the economic decision to migrate. A chronic lack of rain pushes families and whole communities to relocate, usually in a depleted and highly vulnerable state. Recurrent drought in Moldova between 1990 and 2007—including a 45-day heat wave in 2007—hit the country's agricultural sector hard as water resources became increasingly scarce. The resulting outflow led to concentrations of Moldovans in large cities, such as Rome and Moscow (IOM 2007).

In Kazakhstan, flooding has caused widespread displacement. Unusually warm days and heavy rains in February 2008 resulted in the inundation of 48 settlements in southern Kazakhstan, forcing 13,000 people from their homes. Most moved into camps or relatives' homes. But in some cases, the floods did long-term damage to farmland and irrigation canals, making restoration of earlier living patterns unlikely. Looking ahead, some anticipate more flooding in the area, possibly displacing as many as 250,000 people.

Migration prompts illness and premature death in three ways (see figure 3.1). *First*, dislocated people are stressed and exhausted, without access to safe water and sanitation. This makes the migrants more vulnerable to infectious and psychological illnesses, as well as worsening chronic conditions.

Adding to this vulnerability, uprooted people have limited access to medical services. Migrants often have little choice but to work as unskilled labor in high-risk, unhealthy jobs. The psychological stresses of culture shock, language barriers, possible discrimination, and overarching insecurity tends to worsen other health conditions.

Second, health systems may be unprepared to deal with the infectious diseases and other illnesses brought by the migrants—either from their home countries or from somewhere along

their journey. Infectious diseases are a special challenge for health systems, which must treat individual patients *and* trace and contain the vectors of disease in order to protect the public.

Migrant populations are vulnerable to type 2 diabetes, cardiovascular diseases, and tuberculosis. According to the European Society for Clinical Microbiology and Infectious Diseases, several large European cities have already experienced tuberculosis epidemics related to increased migration from Asia, Africa, and Latin America. A survey taken in Athens in 2004 and 2005 found positive tuberculin skin tests for 96 out of 1,460 immigrants from Albania, Bulgaria, Romania, the former Soviet Union, Africa, and Southeast Asia (Antypa et al. 2007).

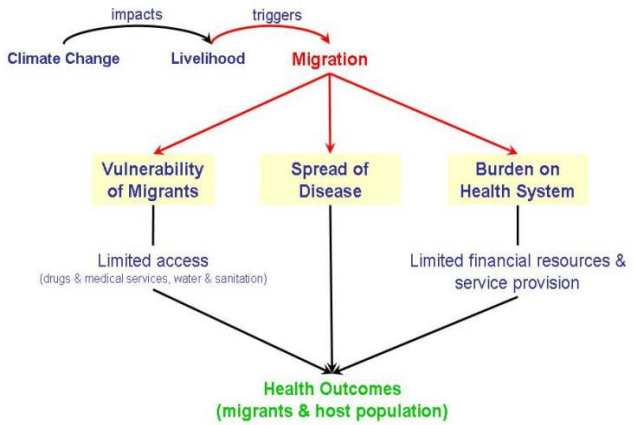
Migrants have higher rates of hepatitis B and C, HIV/AIDS, and malaria than the native populations (Gushulak and MacPherson 2006). A 2005 study within the European Union found that 46 percent of the HIV/AIDS diagnoses were among immigrants, with most of the infections originating outside the EU (Hamers et al. 2006).

Meanwhile, in Spain a study showed that all of the 24 children admitted to hospitals with malaria between 1997 and 2005 were children of immigrants (Martinez-Baylach et al. 2007). Between 1992 and 2001, Albania reported 114 cases of malaria, all immigrants who contracted the disease before arriving in Albania (WHO 2002). If the health systems of the destination countries aren't prepared to deal with a heavier disease burden, immigrants will not receive proper care, and the uninfected population, both immigrant and native, will be at risk.

Third, immigrants are often underserved by health systems in their destination countries, either because of poor communication, restricted access, or discrimination. Lacking access to primary and preventive care, as well as information about available services, immigrants postpone treatment, resorting finally to costly visits to the emergency room. According to evidence from Germany, the greater prevalence of unsafe working conditions and high fertility rates among immigrants also lead to a high number of health complications.

Adaptation options for dealing with migration, discussed more in the next section, might include expanding laboratory facilities to screen for previously unfamiliar diseases as well as familiar ones, such as tuberculosis. In addition, countries will need to design communication and education campaigns that help immigrants surmount barriers to health care.

FIGURE 3.1 HOW MIGRATION AFFECTS HEALTH AND HEALTH SYSTEMS



Source: Rabie et al. 2008.

Assessing vulnerability and prioritizing protections

Countries can take stock of their exposure to climate change and its impact on concurrent health problems. But first, governments will need data that answers some basic questions: What share of the population lives near the coast? What is the history of flash floods? How much of the population is over the age of 75? How many people are living with diabetes?

In addition, an assessment of exposure and sensitivity must be accompanied by an analysis of adaptive capacity in the health sector. Determinants of adaptive capacity include:

- *Economic resources*: public expenditure on health as a percentage of GDP;
- *Technology*: adequacy of technological assets in place for responding to health risks;
- *Human capital*: the quantity and skills of health professionals, including research specialists;
- *Access to risk-spreading mechanisms*: insurance products that enable a society to spread the financial losses associated with the health outcomes occasioned by climate change;
- *Access to and ability to manage information*: the availability of critical indicators basic to understanding health risks, including public health surveillance tools, emergency communications, as well as a system for monitoring changing averages;
- *Institutionalized practices*: clinical guidelines, performance assessment protocols, and systems for emergency preparedness;
- *Attention to equity*: a measure of how evenly access to and use of health services are distributed throughout the population, and how evenly health deficits are shared.

Adapting health systems to the realities of climate change will depend on a reliable flow of information and a paradigm of working across organizations. Public health is affected by the actions taken in many other sectors. For example, if a country's energy sector increases surge capacity to support cooling during heat waves, heat-related distress and death will decline. Recognizing the probability of flooding and threats to the water system, governments can lower health risks by strengthening the physical integrity of water facilities (see chapter 6).

Adaptation policy can be grouped into two categories: responsive, which reduces vulnerabilities arising from climate changes that have already occurred; and anticipatory, which addresses health outcomes associated with projected future climate change. Box 3.2 provides a number of adaption actions, both responsive and anticipatory, for government health professionals and the general public to respond to two of the most likely and damaging climate extremes.

In addition to the extreme phenomena of floods and heat waves, climate change involves long-term shifts in average temperatures and precipitation levels, which carry long-term health implications. Governments should strengthen monitoring and surveillance activities in order to detect any new epidemics that might surface. Hygiene should be improved across the board (e.g., food preparation), along with vaccination programs and health education. A map of high-risk areas should be developed, along with plans for vector-control programs.

Anticipating an increase in migration as a result of climate change, governments should establish screening for tuberculosis and other services for uncommon diseases that might arrive with new residents. Health facilities must inform immigrants of the available health services, and perhaps hire more professionals from sending countries. The governments of destination and departure countries could work together to coordinate these actions.

BOX 3.2 ADAPTATION STRATEGIES FOR FLOODS AND HEAT WAVES

Anticipatory strategies for floods

Governments:

- Establish systems to communicate with the public, health professionals, and emergency responders
- Design education campaigns for populations at risk, including evacuation plans
- Set up multi-lingual information systems that can function during and after floods and power outages
- Divide regions into risk zones based on historical and projected trends for setting investment priorities and informing the public of risks
- Limit settlement in flood plains with updating and enforcement of zoning laws

Health institutions and professionals:

- Increase laboratory diagnostic capacity and strengthen disease-related data bases
- Increase awareness about vector-borne diseases
- Waterproof facilities and create safe storage for key equipment
- Train staff for emergency conditions, including hospital evacuations
- Back up patient files on computers
- Create flood-resistant communications systems
- Create a back-up supply of safe water for hospitals, and invest in purification equipment

General public:

- Understand safety procedures and priorities in event of a flood
- Participate in insurance schemes and other mechanisms for spreading the financial risk
- Demand a variety of flood-control policies from government

Responsive strategies for floods

Governments:

- Deliver necessary public awareness materials and work with media to get key information about the emergency into circulation
- Ensure public hygiene is maintained
- Increase levels of human and animal vaccination in year of floods
- Survey contaminants and environmental threats
- Ensure access to food, water, and shelter for the most vulnerable

Health institutions and professionals:

- Employ sound surveillance methods to detect and contain epidemics
- Communicate with government and the public about outbreaks of disease
- Organize post-flood epidemiological monitoring
- Include psychological testing to pick up on stress-related factors
- Provide social support to vulnerable groups

General public:

- Drink from only safe water supplies, and boil or chlorinate tap water
- Discard suspect food; remove any dead animals and disinfect contaminated areas; always wear protective gear
- Treat furniture and rooms for vector-borne diseases that might come from rodents or insects
- Clean flooded basements promptly to avoid mosquitoes and molds
- Use insect repellent

continued

Anticipatory strategies for heat waves

Governments:

- Make sure there is enough surge capacity in the power system
- Plan future housing to maximize natural ventilation
- Include space for trees in urban designs
- Plan back-up water supplies
- Coordinate forecasting and early warning systems across local authorities
- Create cool spots and havens using natural and designed systems

Health institutions and professionals:

- Inform patients of their particular vulnerabilities to heat stress
- Connect health professionals with forecasting/warning systems
- Coordinate with government on public awareness plan, with special outreach to vulnerable groups
- Ensure adequate staffing for emergency periods
- Create heat wave hotline and web-based services for public inquiries
- Create a media effort around limiting the effects of smoke and smog

General public:

- Stay attuned to summer weather forecasts, and know the health risks, including one's own personal medical vulnerabilities associated with extreme heat
- Agree in advance on possible leave policies from work
- Advocate for policy makers to adopt heat wave plans

Responsive strategies for heat waves

Governments:

- Provide continuous electricity during heat waves, with priority for healthcare facilities
- Guarantee a flow of public information about government activities, forest fires, emergency programs

Health institutions and professionals:

- Monitor health of patients, including out-patients, particularly the elderly and chronically ill
- Ensure patients understand the seriousness of heat-induced conditions
- Use media to expand awareness of ways to stay healthy during extreme heat

General public:

- Avoid strenuous activities, and stay indoors during hours of maximum heat
- Drink a lot of fluids, but avoid alcohol and caffeine
- Refuel cars at night to lessen gas vapors; reduce car use
- Guard against forest fires and be ready to evacuate if needed
- Reach out to the elderly and vulnerable

Source: Rabie et al. 2008.