MANAGING THE PUBLIC HEALTH RISK OF EXTREME WEATHER DISASTERS
In 2012, the United States accounted for a higher proportion of losses due to a series of severe weather-related catastrophes. In 2013, natural catastrophes caused $160 billion in overall losses and $65 billion in insured losses worldwide. Some 67 percent of overall losses and 90 percent of insured losses worldwide were attributable to the United States. Over the past century, extreme weather (hydrometeorological) disasters have increased much more rapidly than disasters caused by geological or biological disasters (Center for Research on the Epidemiology of Disasters 2009). As a result, disaster reduction has emerged as a core element of sustainable development.

In light of the ever-increasing extreme weather, public health must now include ways to reduce human vulnerability to disaster. This places public health uniquely at the community level to build human resilience to climate-related disasters (Clack et al. 2002). By focusing on a community’s vulnerability and recovery capabilities, the at-risk-individuals become a priority and responsible authorities must enhance social equity and promote community cohesiveness. and the responsible authorities are tasked with enhancing social equity and promoting community cohesiveness (Werry 2006).

“Primary prevention seeks to prevent the disaster hazard exposure from ever occurring (Keim 2008).”

Reducing the Risk of Disaster-Related Adverse Health Effects

Extreme weather events raise the risk of health-related disasters when these four factors converge: (Intergovernmental Panel on Climate Change 2011):

- The presence of a health hazard associated with an extreme weather and climate events, commonly considered as a function of frequency and impact
- The degree of exposure to the hazard sustained by the person or population
- The degree of vulnerability of the person or population to that particular health hazard
- The degree of resilience of the person or population in order to avoid or moderate harm.

To differentiate these key factors, it is helpful to consider them as intrinsic or extrinsic to the individual at risk:

**Vulnerability** is considered *intrinsic* to the individual person at risk and includes the major domains of demographics, education, race, language and ethnicity, and health status.

**Resilience** is largely an *extrinsic* response that includes economic capacity, availability of human and material resources (e.g., food, water, shelter, sanitation, transportation, personal protective equipment, access to health care), and social capital.

**Hazard Avoidance**

A *disaster hazard* is defined as “a dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage” (UN International Strategy for Disaster Reduction 2009).
Hazard analyses commonly begin with a comprehensive identification of all hazards that may occur within a given area or jurisdiction. Once they have been identified, they must then be assessed as to their potential severity of loss and to the probability of occurrence. In public health practice, the process can be very difficult.

Primary prevention seeks to prevent the disaster hazard exposure from ever occurring (Keim 2008). This function is consistent with the category of risk treatment known as risk avoidance, e.g., zoning and regulations that prevent settlement in disaster-prone areas like floodplains. The risk of adverse health effects as related to specific extreme weather events varies not only according to the type, likelihood of occurrence, and impact of the hazard but also is dependent on the degree of exposure to the hazard.

Risk reduction involves methods that reduce the severity of the loss or the likelihood of the loss from occurring. Secondary prevention aims to detect the disaster hazard event early to control its advance and reduce the resulting health burden (Keim 2008). For example:

**Secondary prevention** for disasters involves accurate detection of a flash flood and early warning of the population that will allow for protective actions like evacuation.

**Risk-reduction activities** seek to mitigate the health consequences of disasters that cannot be prevented.

The risk of a public health disaster occurs when affected populations are both exposed and vulnerable to environmental hazards (Keim 2008). Exposure and vulnerability are dynamic, varying across temporal and spatial scales, and depend on economic, social, geographic, demographic, cultural, institutional, governance, and environmental factors (Intergovernmental Panel on Climate Change 2011).

## Exposure Reduction

Exposure is defined as subjection to the influence or effects of a disaster-related health hazard. The toxicity or lethality of an environmental health hazard is often characterized by a dose-response relationship. Typically, as the degree of exposure to a health hazard increases, the human emotion of concern—itself an adverse health effect—appears in more of the population. In the case of extreme weather events, the degree of exposure of a given population to the hydrometeorological hazard (e.g., extremes of wind, temperature, and precipitation) has a direct relationship to the incidence and severity of adverse health outcomes.

In the short term, human exposures to climate-related health hazards may be accomplished by reducing the population proximity to the hazard. This typically involves creation of a hazard map that accurately models zones where the population is at risk. In the case of landslides, tropical cyclones, floods, heat waves, and wildfires, exposure reduction is commonly achieved by temporary evacuation of the population at risk and sheltering in safe-shelter conditions. In the case of drought, reducing the impacts of exposure may also involve evacuation or migration (mainly in low-resource countries) and (in high-resource countries) also commonly involves sheltering in place with additional support being delivered to the population at risk in the way of water, food, sanitation, and health care.

Long-term exposure reduction for all of these hazards most frequently involves disaster-related mitigation (UN Disaster Relief Office 1991). Mitigation may occur as both structural measures (such as wind- or flood-resistant construction, flood-plain management, and planting) and nonstructural measures (such as land use regulation, water conservation, agricultural and forestry practices, and building codes) (Malilay 1997; UN Disaster Relief Office 1991).
### Hazard Reduction Strategies

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### Vulnerability Reduction

**“The heaviest burden of every disaster most often falls disproportionately on women, children, the frail, the elderly, and those with disabilities.”**

Within the context of disaster risk reduction, vulnerability is defined as the likelihood of suffering an adverse health effect when exposed to a given health hazard. These are characteristics and circumstances that are inherent to the specific person or population. People are not equally susceptible to the same health hazard. Differences among persons are due to such factors as demographics, socioeconomic status, social capital, and health status. The heaviest burden of every disaster most often falls disproportionately on women, children, the frail, the elderly, and those with disabilities.

**Human vulnerability to disasters is a complex phenomenon that includes social, economic, health, and cultural factors. Vulnerability links people with their environment and with the social forces, institutions, and cultural values that sustain them. Given that extreme weather hazards are likely to occur, the risk of adverse health impacts is lessened by lowering human vulnerability to the hazard.**

Healthy people are less vulnerable to the adverse effects of many disaster hazards. Health promotion programs, medical care, social support services, and social integration that result in a reduction of the existing burden of disease and injuries create greater functionality and sustained mobility in a healthier population that is less susceptible to any given extreme weather hazard.
Building Resilience

The UN International Strategy for Disaster Reduction (2009) defines **resilience** as “the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions [emphasis added].” More recently, the term resilience has been broadly used to describe actions spanning the entire disaster cycle from disaster prevention to recovery. To clarify this distinction, it is helpful to conceive of resilience as the ability to resilience from or spring back from a stressor or shock (UN International Strategy for Disaster Reduction 2009). By definition, resilience then occurs in the postimpact phase of a disaster and is the ability to manage change in the face of shocks and stresses (UK Department for International Development 2012).

According to “Health Disaster Management Guidelines” (2003), for resilience to a disaster hazard, an individual or society must be able to absorb the damage, adapt to the damage, and react in such a way so as to mitigate.

Community Resilience

Community resilience, or the sustained ability of a community to withstand and recover from adversity (e.g., economic stress, influenza pandemic, man-made, or natural disasters), has become a key policy issue in the United States, especially in recent years. While there is general consensus that **community resilience** is defined as the ability of communities to withstand and mitigate the stress of a disaster, there is less clarity on the precise resilience-building process (Chandra et al. 2011). The literature related to defining key measures and applications of building community resilience has been rather broad and lacking in the specificity required for implementation. According to one technical report published by Rand Corporation, community resilience represents a unique intersection of preparedness and emergency management, traditional public health, and community development, with its emphasis on preventive care, health promotion, and community capacity building (Chandra et al. 2011).

Health Resilience

There are also key assumptions that distinguish between community resilience and human health resilience, especially the level of the individual person at risk for disaster-related mortality.

“The resilience of a social system is determined by the degree to which the system has the necessary resources and is capable of organizing itself to develop its capacities to treat risks (e.g., implement disaster risk-reduction programs) and institute means to transfer (e.g., insurance) or manage residual risks (e.g., response and recovery).”
CLINICAL CORRELATES: BUILDING COMMUNITY RESILIENCE

Community health workers have historically been integral players in disaster management (Perez and Martinez 2008). Their roles are various: providing first aid, dispensing drugs, delivering babies, giving child care advice and nutrition education, monitoring immunizations, promoting sanitation and hygiene, making health care referrals, performing school activities, making home visits, and maintaining community records. They are the sentinels and guardians of a community knowing who is sick and where to find resources. Health workers are trusted counselors because they are of the communities in which they work and may share a similar set of values (Perez and Martinez 2008). During natural disasters, they are vital players in mitigation because they understand the resources, health, and social complexities of the area affected. Research has shown that community health workers improve pregnancy and birth outcomes, health, and screening-related behaviors, as well as management of chronic disease and are vital actors in disaster situations (Richter et al. 1974).

In disaster management planning, providing education and resources to community health workers can serve twofold to mitigate negative effects of the disaster and provide feedback to higher-level systems of management.

Socioeconomic Resilience

Poverty is an important determinant of disaster risk and an important constant of resilience (Nelson 1990). Poverty is both a condition and determinant of resilience, and as such, poverty reduction is an essential component of reducing human health risk to extreme weather hazards and climate change (Thomalla 2006). Populations with limited access to safe water, food security, safe housing, and public services have less absorptive capacity to the adverse effects of disaster hazards. Worldwide, loss of life from climate-related disasters is far higher among the low-resource countries. Yet within each nation, including high-resource countries, the poor are most affected (Intergovernmental Panel on Climate Change 2007, 2011; National Science and Technology Council 1996; Brouwer et al. 2007; Nelson 1990).

Building Human Resilience

Those with less resilience to the disaster hazard have a higher risk for injury and illness and less likelihood for a speedy and full recovery as compared to those who are more resilient. For example, poor people living in substandard housing within temperate climate zones are more susceptible to heat-wave-related illness than are affluent, well-connected persons are equipped to ensure their own readiness for such an event. In this sense, equitable and sustainable access to education, health care, economic development, and public services is essential in building human resilience to extreme weather events.

“Preparedness is defined as activities and measures taken in advance to ensure effective response to the impact of hazards (UN International Strategy for Disaster Reduction 2009).” Preparedness, response, and recovery activities all increase resilience during the postimpact phase of extreme weather events. Preparedness also implies a certain level of resource availability and a behavioral approach focused on actions taken in advance of a disaster in order to reduce its impact, helping to build resilience from the adverse health effects of disaster hazards.
Human health will continue to be affected by the environment and extreme weather events, but health care practitioners working at the community level can help build human resilience and enhance recovery in the wake of climate-related disasters.

REFERENCES


