HAPI

Health
And
Places
Initiative

September 2014

Disasters, Health, and Place

A RESEARCH BRIEF
VERSION 1.0

Photo by Ann Forsyth

The HEALTH AND PLACE INITIATIVE (HAPI) investigates how to create healthier cities in the future, with a specific emphasis on China. Bringing together experts from the Harvard Graduate School of Design (HGSD) and the Harvard School of Public Health (HSPH), it creates a forum for understanding the multiple issues that face cities in light of rapid urbanization and an aging population worldwide.

Health and Places Initiative
http://research.gsd.harvard.edu/hapi/
Harvard Graduate School of Design

The Research Briefs series summarizes recent research on links between human health and places at the neighborhood or district scale and provides background for a number of other forthcoming products—a set of health assessment tools, planning and urban design guidelines, urban design prototypes, and neighborhood cases. While the Research Briefs draw out implications for practice, it is these other tools that really provide specific, real-world guidance for how to create healthy places.

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Thanks to Heidi Cho, Lydia Gaby, Andreas Georgoulias, Emily Salomon, and Dingliang Yang for assistance and to Elizabeth Hamin for helpful comments.

Suggested Citation:
Health and Places Initiative. 2014. Disasters, Health, and Place. A Research Brief. Version 1.0. http://research.gsd.harvard.edu/hapi/

Big Ideas

- Disasters are a result of both a hazardous event and vulnerability to that event. Their timing is frequently uncertain and of low probability. While some hazards are inevitable, steps can be taken to reduce vulnerability.
- Categories of disasters include geophysical ("natural"), biological, technological, economic, or due to terrorism.
- Health issues related to disasters can be direct (death, injury, illness, mental health) or indirect (destruction of health infrastructure, unhealthy living conditions, population displacement).
- Using data primarily from the OFDA/CRED International Disaster Database, Coppola (2011,18) describes several recent disaster trends, "In sum, recent trends indicate that the number of people affected by disasters is rising. Overall, disasters are becoming less deadly. Overall, disasters are becoming more costly. Poor countries are disproportionately affected by disaster consequences. The number of disasters is increasing each year."
- Urban areas have characteristics that affect the vulnerability to disasters (e.g. density of both people and infrastructure, urban poor, economic / communication activity).
- Climate change is closely related to disasters, as changes in the natural variability of different geophysical events (e.g. extreme weather events, rainfall rates, etc.) generally increases the frequency of hazardous events and vulnerabilities to those events. A separate HAPI Research Brief deals with this important issue.
- Urban poor and those in low-income countries are more susceptible to health effects from disasters because they have fewer resources. Women, children, minorities, the elderly, the chronically ill, and the geographically disadvantaged (populations living on the flood plains, coastal regions, or seismically active zones) may be more at-risk during disasters.
- Disaster prevention is the most important and cost-effective part of disaster planning. This is also the place where effective planning can have the biggest impact, more for geophysical disasters than other types.
- Disaster prevention or mitigation involves assessing vulnerabilities to hazards and then taking measures to reduce those vulnerabilities. For example, locating public facilities at hazard free sites, building codes and standards, barriers/levees, and protective resource preservation. Disaster mitigation is closely related to climate change adaptation.
- Other disaster planning measures include disaster preparedness steps and effective disaster response and recovery.

What The Research Says

What are disasters?

The World Health Organization (WHO) collaborating Centre for Research on the Epidemiology of Disasters (or OFDA/CRED) defines disaster as, "a situation or event which overwhelms local capacity, necessitating a request to a national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering" (Guha-Sapir et al. 2013, 7).

The United Nations International Strategy for Disaster Reduction (ISDR) defines disasters as, "A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources" (UNISDR 2009, 9).

Disaster Types

Types of disasters include geophysical or "natural" (e.g. earthquakes, volcanoes, storms, floods, extreme temperature, droughts, wildfires), biological (e.g. epidemics, insects, animal stampedes), technological (e.g. nuclear power plant accident, mass communications crash), economic (e.g. financial system collapse), or terrorism (expanded from Guha-Sapir et al. 2013, 7).

Armed conflicts and wars are sometimes included in disasters definitions, but they are different from other disasters in that they often don't have a sudden onset, and can continue for a long time. Conflicts can be caused and exacerbated by other disasters, due to resource scarcity, so disaster resilience and conflict prevention are closely related (Harris et al. 2013). However, planners can do little to prevent large-scale conflicts, so this area is outside the scope of this synthesis.

Geophysical disasters are the most common form of disasters, affecting millions of people every year.

Example: Sawada et al. (2011) compared the aggregate impacts of geophysical or "natural" disasters and "human-induced" (e.g. wars, economic, industrial) disasters across 189 countries between 1968 and 2001 for the Research Institute of Economy, Trade and Industry (using several well-known economic, crisis and disaster databases). They conclude, "According to our estimation results, in the short term, natural disasters generate the largest negative welfare impacts which are followed by wars and economic disasters" (Sawada et al. 2011, 1).

Example: Trends in geophysical disaster occurrence reported by OFDA/CRED (2012) show an increase in number of reported disasters: for example, reported geophysical disasters were 224 in 1992, which increased to 428 in 2002. However, most recently this trend has leveled off or even decreased, with only 357 reported disasters in 2012. However, 2012 is likely an anomaly, as trending rates of those killed and affected are typically much higher. In 2012 geophysical disasters killed 9,655 people (however, the annual average is typically much higher — 2002–2011: 107,000) and 124.5 million people became victims worldwide (annual average 2002-2011: 268 million) (Guha-Sapir et al. 2013, 1, 3).

Floods, droughts, and storms are the types of geophysical disasters that impact the most people.

According to OFDA/CRED data on geophysical disasters (2013, 2), "In 2012, 53% of victims were from floods, 27% from droughts and 16% from storms."

Climate change and the risk of extreme events and geophysical disasters are closely related.

Example: According to a recent joint report by the Intergovernmental Panel on Climate Change (IPCC 2012), "A changing climate leads to changes in the frequency, intensity, spatial extent, duration, and timing of extreme weather and climate events, and can result in unprecedented extreme weather and climate events" (IPCC 2012, 5). Also, "There is evidence that some extremes have changed as a result of anthropogenic influences, including increases in atmospheric concentrations of greenhouse gases" (IPCC 2012, 7). For example, they cite warming of extreme daily minimum and maximum temperatures globally, intensification of extreme participation, and extreme coastal high water (IPCC 2012, 7).

For more information on health and place issues related to climate change, please see the Climate Change HAPI Research Brief.

However, terrorism affects thousands of people every year, and incidents are increasing.

Example: According to the University of Maryland's (UMD) National Consortium for the Study of Terrorism and Responses to Terrorism (START) global terrorism database, there were 8,441 incidents of global terrorism in 2012, killing approximately 15,401 people and injuring approximately 25,436 people.

In general, geophysical disasters are more deadly than terrorism. However, it is interesting to note that for 2012, the numbers of deaths from terrorist attacks were actually *higher* than geophysical disasters (15,301 deaths from terrorist attacks, 9,655 deaths from geophysical disasters) (Guha-Sapir et al. 2013, 1; UMD-START data 2012).

Limited research suggests industrial disasters (e.g. collapse, explosion, fire, gas leak, chemical spill, poisoning, radiation, other) are the least deadly type of disaster, affecting thousands per year – as opposed to millions affected yearly by geophysical disasters. While the frequency of industrial disasters is increasing, reported deaths are decreasing.

Types of disasters include **geophysical** or 'natural', **biological**, **technological**, **economic**, or **terrorism**

- Guha-Sapir et al. 2013, 7

Example: Coleman (2006) used two disaster databases (CRED and Emergency Management Australia) to quantify the frequency of human-induced disasters in higher-income countries during the 20th century. He found, "The analysis shows an exponential growth in disaster frequency, largely due to an increase in traditional hazards such as fires and explosions, rather than from new technologies. Although the number of incidents has grown, this has been offset by a decline in fatalities per incident" (Coleman 2006, 3). Reported injuries trends have stayed about the same — in range of hundreds per decade. For example, there were 174.9 reported injuries in the 1990s due to industrial accidents (Coleman 2006, 9). No reasons were given why reported deaths are decreasing.

Furthermore, Coleman (2006) reports, "In the first 73 years of the century there had been just 57 recorded [industrial] disasters, equal to an average of 7.8 per decade. But there were 45 disasters in the 1970s, 54 in the 1980s and 105 in the 1990s" (Coleman 2006, 6). Finally, "[Industrial] disasters have consistently killed around 1,000 people in OECD [Organisation for Economic Co-operation and Development] countries during most decades of the past century" (Coleman 2006, 9).

Health Issues

All disasters affect the health of communities, in proportion to the intensity of the disaster and the exposure and vulnerability of the community. The tables below describe both direct (often more immediate, short-term) effects of disasters, and more indirect (often mid- to long-term) effects. While all disasters have the potential for all these effects, the tables describe particular disasters more likely to cause certain effects, where data is available.

Photo by Ann Forsyth

High-poverty areas are extremely vulnerable to disasters.

Table 1. Direct health effects of disasters[1]

Effect	Disaster type
Deaths (e.g. acute trauma, drowning)	All, but most deadly incidents tend to be geophysical disasters: large earthquakes, floods, tsunamis, and storms. However, mortality from terrorism has been increasing. Deaths via long-term or indirect effects hard to quantify. Similarly, deaths from war or armed conflicts are outside the scope of this research synthesis
Injury	All, geophysical disasters biggest impact
Illness (communicable, water-borne, vector-borne, tuberculosis)	Geophysical disasters (mainly floods and storms), armed conflict. Displaced populations are especially vulnerable
Acute respiratory infections	Geophysical disasters, armed conflict, forced displacement, nutritional emergencies, and dust from terrorist attack explosion. Displaced populations are especially vulnerable
Toxic exposure	Floods, dust/chemicals from terrorist attack explosion, radiation from nuclear disaster
Mental health impacts (e.g. Post-Traumatic Stress Disorder, stress, anxiety, depression, etc.)	All, but especially mass violence (terrorism) versus natural or technological disasters

1. Alderman et al. (2012, 38–44); Bellos et al. (2010, 1); Chan et al. (2009); Coleman (2006); Doocy et al. (2013a, 21); Doocy et al. (2013b); Guha-Sapir et al. (2013); Harvill et al. (2010); Kimbrough et al. (2012); Maslow et al. (2012, 1186); McLaughlin et al. (2012, 1222); Norris (2002); Stanke et al. (2012); UMD-START data (2012); UNSCEAR (2008, 15, 17); Uscher-Pines (2009, 5).

Table 2. Indirect health effects of disasters[2]

Effect	Disaster type
Destruction of health infrastructure	Geophysical disasters, armed conflict
Healthcare professionals unwilling to work	Radiological, nuclear, biological, or chemical disasters
Unhealthy living conditions (e.g. inadequate shelter, overcrowding)	Displaced populations due to geophysical disasters, armed conflict
Population displacement	Heavy flooding, tsunamis, hurricanes, earthquakes, explosions
Birth outcomes, child development	Floods, droughts, and economic disasters
Malnutrition, food insecurity	Floods, droughts, and economic disasters
Non-communicable diseases (cardiovascular disease, cancer, chronic lung diseases)	Floods, earthquakes, nuclear disaster, armed conflict (long-term effects)

2. Alderman et al. (2012, 44-45); Bellos et al. (2010, 1); Bhutta et al. (2009, 45); Chaffee (2009, 50); Chan et al. (2009, 57); Doocy et al. (2013a, 21); Harville et al. (2010, 68, 84); McLaughlin et al. (2012); Uscher-Pines (2009, 2); UNSCEAR (2008, 17).

Place Issues

Urban environment may be uniquely vulnerable to disasters.

Disaster research increasingly indicates that urban areas may be especially vulnerable to disasters (see Gasparini et al. 2014, 67; Pelling 2003; Kidokoro et al. eds. 2008, 3-27). Table 3 below describes some physical and social aspects of urban areas, which make them vulnerable to disasters: urban locations, density, and effects of poverty and spatial inequality. Additionally, inhabited areas can indirectly create new hazards through high emissions, contributing to climate change and its associated hazards and health effects (Wamsler 2014, 91, 112).

Example: According to the IPCC (2012), "High exposure and vulnerability are generally the outcome of skewed development processes such as those associated with environmental degradation, rapid and unplanned urbanization in hazardous areas, failures of governance, and the scarcity of livelihood options for the poor. Increasing global interconnectivity and the mutual interdependence of economic and ecological systems can have sometimes contrasting effects, reducing or amplifying vulnerability and disaster risk" (IPCC 2012, 8).

Table 3. Aspects of urban environments that increase vulnerability to disasters[3]

Characteristic	How it increases vulnerability
Location or unsafe development (formal or informal)	Proximity to coastlines, waterways, or geological hazards (e.g. landslides, unstable soil) increases environmental vulnerability
Density	Increasing numbers of people living in cities and megacities and dense populations and infrastructure mean there are more people and infrastructure affected by harzards
Economic and political activity	Economic/commercial activity can degrade the environment; political activity (and density of infrastructure and people) can make urban areas a target for terrorism or lead to ineffective disaster management
Poverty and inequality	Spatial segregation of the urban poor means poorer housing quality, overcrowding, and an increased likelihood of residences to be in a vulnerable areas (e.g. floodplain, unstable soils or slopes); poorly constructed residences

3. Adger et al. (2005, 1036); Douglas et al. (2008); Galea (2006); Gaspirini (2014, 2-3, 68-69); Joffe et al. eds., (2013, 2); Kidokoro et al. (2008, 4, 18, 100-101, 107); Pelling (2003); Wamsler (2014, 21-23, 82, 86).

Asia and Africa together accounted for 94.9% of the global geophysical disaster victims in 2012.

According to OFDA/CRED data (2012, 2), "Asia accounted in 2012 for 64.5% of global [natural] disaster victims, followed by Africa (30.4%). Compared to their 2002–2011 annual averages, the number of victims in 2012 increased in Africa and Oceania, but decreased in the Americas, Asia and Europe (Guha-Sapir et al. 2013, 2)."

Terrorism affects the Middle East and North Africa, South Asia, and Sub-Saharan Africa the most.

The vast majority of these terrorist attacks were in the Middle East and North Africa, South Asia, or Sub-Saharan Africa. This has increased from 5,067 incidents in 2011 (8,155 deaths, 14,493 injuries) and 4,823 incidents in 2010 (7,666 deaths, 15,688 injuries) (UMD-START data 2012).

Vulnerable Groups

The UN/ISDR reports that, "Urbanization, environmental degradation, population growth and poverty are some of the interlinked factors that increase their [community] vulnerability" (UN/ISDR 2008, iii). Besides these trends, certain demographic groups are more sensitive to the effects of disasters or less able to cope with their aftermath (see Table 4).

Table 4. Demographic groups vulnerable to disasters[4]

Demographic	Reason for Vulnerability
Low-income (people and countries)	Low-income people face barriers to health care, more vulnerability to post disaster mental health problems
Females	Increased drowning risk in tsunamis and floods (in low-income countries only) and increased risk of death from earthquake (somewhat mixed findings – reasons unclear, possibly because women are more likely to work inside the home, which is more likely to be a structurally unsound building if in a low-income country); worse disaster health outcomes generally, reduced fetal growth, more distress, mental health issues among pregnant and postpartum women
Children	Increased drowning risk in tsunamis and floods due to age, increased risk of death from earthquake, worse disaster health outcomes generally, development affected post disaster
Older adults	Increased drowning risk in tsunamis and floods due to mobility difficulties or lack of desire to evacuate, increased risk of death from earthquake
Ethnic minorities/ communities of color	Increased likelihood of adverse health outcomes and more distress, due to increased risk of a more severe exposure to disaster, and intergroup tensions due to historical (or ongoing) marginalization
Those with chronic diseases	Exacerbation or complications of underlying chronic diseases post earthquake
Medically underserved communities (e.g. poor, rural)	Rural and low-income areas have less access to healthcare

4. Alderman et al. (2012, 38, 45); Chan et al. (2009, 55, 57), Davis et al. (2010, 1, 2,7), Doocy et al. (2013a); Doocy et al. (2013b), Harvill (2010, 1); Norris et al. (2002, 236).

China

China experiences a large number of geophysical or "natural" disasters, representing a third of the victims worldwide in recent years. Floods and storms affect the most people, but the country is also prone to earthquakes.

According to OFDA/CRED data, "In 2012, China experienced its fourth highest number of natural disasters in the last decade. The country was affected by a variety of disaster types, including 13 floods and landslides, 8 storms, 7 earthquakes and one period of extreme temperature… contributing to a total of 44.6 million victims, a figure representing 34.7% of global reported disaster victims" (Guha-Sapir et al. 2013, 1).

According to the UN/ISDR (2008) report, "China is a country prone to all kinds of natural hazards, including floods, droughts, landslides, earthquakes, and cyclones. There is increasing vulnerability of communities to natural hazards, due to both the growing impact of climate change, and the impact of the country's rapid industrialization and urbanization. Since the early 1990s, China has entered a period of frequent disasters, characterized by weather and climate extremes and a sharp increase in damage losses" (UN/ISDR 2008, 1).

1. The number of people affected by disasters is rising.
2. Overall, disasters are becoming less deadly.
3. Overall, disasters are becoming more costly.
4. Poor countries are disproportionately affected by disaster consequences.
5. The number of disasters is increasing each year.

- Coppola (2011, 18)

Photo by Ann Forsyth

Roadside drainage systems and other infrastructure investments can prevent the impact from flooding and storms.

Things for Certain (or semi-Certain)

As noted at the start of this Research Brief, using data primarily from the OFDA/CRED International Disaster Database, Coppola (2011, 18) describes several recent disaster trends, "In sum, recent trends indicate that
1. The number of people affected by disasters is rising.
2. Overall, disasters are becoming less deadly.
3. Overall, disasters are becoming more costly.
4. Poor countries are disproportionately affected by disaster consequences.
5. The number of disasters is increasing each year."

If we can reduce vulnerability of communities, we can reduce disasters.

Disasters are defined as an event that "overwhelms local capacity" or an event that "exceeds the ability of the affected community or society to cope using its own resources" (OCED and UN/ISDR). Therefore, hazardous events can occur anywhere, but a disaster can only occur where there are people. As Keith Smith describes this process in his book *Environmental Hazards: Assessing Risk and Reducing Disaster* (2013, 12), "If a community is threatened by an extreme event, the risk may be contained or minimized in some way, but, if people or infrastructure cannot be protected, a disaster is the likely outcome." See also Wamsler 2014, 20; Wisner et al. 2004, 49; and UNISDR 2009, 25 for further description of this disaster concept.

Coppola (2011, 21) summarizes some examples of how disaster management (especially mitigation) can impact overall disaster deaths in their book *Introduction to Disaster Management*,

"There are several explanations for the falling fatality rates of disasters. These include:

1. More organized and comprehensive preparedness campaigns are helping individuals and communities to decrease their vulnerability and to react more appropriately in the face of disaster.
2. Early warning systems are giving potential victims more time to leave the dangerous situations associated with impending disasters.
3. Special disaster-specific protection structures, such as tornado safe rooms, are mitigating the impact that disasters have on human life.
4. Building code creation and enforcement are helping to increase the resilience of the various structures and systems upon which humans depend.
5. Secondary, post-disaster consequences, such as famine and disease, are more effectively managed by modern public-health response mechanisms.
6. Proper zoning procedures and enforcement are helping to prevent people from moving into the path of disasters and helping to remove those who are already there.
7. Sustainable development processes are helping to reduce population movement into areas of highest risk."

Low-income countries are more vulnerable to mortality from geophysical disasters.

Example: The United Nations' International Strategy for Disaster Reduction (UN/ISDR 2008) report, "Towards National Resilience: Good practices of national platforms for disaster risk reduction" describes how, "Disasters are especially ruinous for developing countries: the smaller the economy and the weaker the infrastructure, the greater the human cost and damage to development prospects" (UN/ISDR 2008, iii).

Things up in the Air

Data on industrial disasters is much more limited than geophysical disasters.

Example: Coleman (2006) used two disaster databases (CRED and Emergency Management Australia) to quantify the frequency of industrial disasters in higher-income countries during the 20th century. He states, "The literature on human-caused disasters is far more limited, and is largely confined to consideration of specific types of hazards which are analyzed in terms of historical frequency, causes and nature, and future probability" (Coleman 2006, 4).

Some disaster impacts, especially long-term impacts, are unknown.

The varying metrics used in the literature and the breadths of medical problems that can arise from geophysical disasters create challenges in creating sound policies based on data. For example, dust caused from earthquakes may cause respiratory problems that are not attended to until weeks after the event. This health effect is not necessarily documented as disaster-related health effect in datasets and may guide policy makers to mis- or under-allocate resources and aid services to certain regions.

Example: Alderman et al.'s (2012, 46) systematic review of flood health effects identified the following knowledge gaps: "Is there epidemiological evidence for the role of floods in indoor mold growth and toxic contamination? If so what are the long-term health impacts of these exposures? What is the long-term impact of floods on non-communicable diseases, including chronic disease and mental illness?"

Implications

In these HAPI Research Briefs we aimed to find implications for planning and design at roughly the neighborhood level. These could include quantifiable standards, more qualitative but yet evidence-supported insights, and other good practices. Not every topic has a full complement of these implications.

Disasters will be an ongoing, if not increasing, concern for urban planning and design. Increasing prevalence and severity of geophysical disasters necessitates more immediate policy and planning interventions. Disaster management is commonly described as four phases: prevention (or mitigation), preparedness, response, and recovery (Coppola 2011, 9-10). Disaster mitigation is closely related to climate change adaptation (see Wamsler 2014, 48-49 for similarities and differences). These phases, and associated interventions, are described in more detail below.

Standards and Insights

Prevent Disasters

Of all the disaster management phases, urban planners and policy-makers can most effect disaster prevention. Disaster prevention and hazard mitigation are a critical component of sustainable development recommended by the United Nations International Strategy for Disaster Reduction (UNISDR). Disaster response and recovery alone are not useful ways of managing disasters without mitigation interventions (Coppola 2011, 12). Hazards are inevitable: careful planning can greatly reduce a place's vulnerability to hazards, and thereby protect health and welfare.

The list below describes examples of disaster mitigation strategies, which have been used to decrease vulnerability to environmental hazards (both natural and human-induced). They tend to fall into five general categories: public information, infrastructure protection, natural resource protection, hazard avoidance, and policies or plans.

Strategies for disaster mitigation

Public information[5]

- Mapping of existing and predicted hazards (e.g. GIS and modeling)
- Education and outreach initiatives (e.g. public announcements, plan reviews)

Infrastructure Protection[6]

- Building and infrastructure hardening (e.g. floods, earthquakes)
- Building codes and standards (e.g. for floods, earthquakes, energy efficiency, storms, etc.)
- Disaster resistant construction and siting
- Building and land use permitting and inspections
- Barriers (e.g. levees, seawalls, embankments, barrages, dams, dikes, floodgates on building entrances, elevated subway entrances)
- Flood prone properties, floating houses, floodable first floors
- Retention systems (e.g. basins, open water channels, floodable zones/water squares)
- Improved drainage systems (e.g. capacity and sewage, separation of storm water from sewage)

Natural Resource Protection[7]

- Beach, dune, and wetlands preservation, breakwaters, mangrove forests
- Riparian buffers
- Protective resource preservation
- Combine hazard reduction with natural resource management and environmental preservation
- Green areas for flood retention, natural ecosystem buffers
- Increased vegetation to decrease extreme heat events and reduce run-off water
- Measures to increase recharge of ground water (small dams, bunds, underground dams)
- Drought resistant planting
- Planning forestry areas upwind of town to mitigate wind-and snow-storms
- Firebreaks in urban design, such as buffer zones between heathlands and urban areas

5. Berke and Smith 2009; Godschalk 2003, 140; Kidokoro et al. eds. 2008, 114, 239; Schwab 2011, 49; Wamsler 2014, 135-136, 138
6. Berke and Smith 2009; Chan et al. 2009, 55; Coppola 2011, 175; Doocy et al. 2013b, 21; Kidokoro et al. eds. 2008, 19, 20, 70, 239; Wamsler 2014, 130-132, 134; Wisner et al. 2004, 239;
7. Adger 2005, 1038; Berke and Smith 2009; Coppola 2011, 26, 175; Godschalk 2003; Wamsler 2014, 130-133

Hazard Avoidance[8]

- Limiting future development in hazard zones
- Relocating existing development from hazard zones
- Locate public facilities, critical infrastructure, utilities away from hazards
- Water conservation measures (drought), water backup systems

Policies or plans[9]

- Development regulations, remove legal and regulatory barriers
- Taxation and fiscal policies (e.g. additional resources to make poor neighborhoods safer from hazards, loans for business disaster recovery, incentives to move to low-risk areas)
- Vulnerability assessment and disaster mitigation plans, consideration of disaster risk in national development and sector plans
- Complementary goals and objectives in the local hazard mitigation plan and comprehensive plan
- Promote mainstream risk reduction and adaptation into urban planning

Other regulatory, policies or plans[10]

- Insurance (requirements), both public and private
- Creation and maintenance of disaster rescue units
- Development of coordinated disaster management, sustaining leadership

Disaster Preparedness

Disaster preparedness entails creating emergency operations plans and processes, emergency personnel, and stocking supplies to facilitate disaster response and recovery. Urban planning and policy may have some influence over this area, mainly through regionalization of resources and (some) emergency operations plans.

Disaster preparedness measures[11]

- Regionalization of resources (e.g. diversified supply chains)
- Training (e.g. emergency drills)
- Statutory authority
- Public education (e.g. what to expect when disasters strike, behavior changes to reduce risks)
- Emergency operations plans
- Advanced warning systems
- Stockpiling supplies, food, water
- Resource inventory
- Monitoring conditions of potential disasters and preparedness

Disaster Response and Recovery

Disaster response and recovery is largely a matter for emergency services, during and immediately after the hazardous event. However, planners have a role to play in the reconstruction of the community.

Measures for useful disaster response and recovery[12]

- Warning
- Evacuation
- Positioning of supplies and resources
- Search and rescue
- First aid and medical treatment
- Health and sanitation
- Provision of food, water and shelter
- Restoration of facilities and services
- Reconstruction of community (housing, economy, infrastructure) to be more resilient to disasters

Other Good Practices

Get the community involved in the disaster management process.

Example: As described in Joffe et al. eds. (2013, 96), *Cities at Risk: Living with Perils in the 21st Century,* "In order to increase community resilience it is vital to facilitate mitigation and preparedness behaviours and collaboration of local communities with disaster risk management agencies. Increasing awareness and facilitating adjustment behaviours of individual community members does not automatically lead to the formation of community groups that will join efforts to prepare particular districts for disasters. Thus, it is important to design programs which encourage individuals to form community groups or join civil initiatives and work for the mitigation/preparedness of their whole communities."

8. Berke and Smith 2009; Coppola 2011, 175; Godschalk 2003; Kidokoro 2008, 27; Wamsler 2014, 130-131, 133, 135; Wisner et al. 2004, 240
9. Berke and Smith 2009; Gasparini et al. eds. 2014, 78-79; Godschalk 2003, 141; IPCC 2012, 8; Kidokoro et al. eds. 2008, 19; Schwab 2011, 49; Wamsler 2014, 38-40, 55-63, 130-131
10. Kidokoro et al. eds. 2008, 20, Schwab 2011, 49
11. Coppola 2011; Joffe et al. eds. 2013, 171; Kidokoro et al. eds. 2008, 20; Wamsler 2014, 135; Wisner et al. 2004, 241
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