



# EXTREME WEATHER EVENTS

2016

## OVERVIEW

Although extreme weather events are rare in Massachusetts they have been occurring more frequently over the last 15 years. Between 1985 and 2015, FEMA recorded 14 weather-related disasters in Massachusetts. Climate models predict the increased intensity and frequency of extreme weather events will compromise community infrastructure, and threaten populations that are currently highly vulnerable to climate hazards and other stresses.

## HOW ARE PEOPLE EXPOSED?

Exposure to extreme weather events may result in exposure to flood water and storm debris. Disruption of infrastructure (e.g., septic/sewage/wastewater treatment facilities, electric grid, transportation, and communication systems) may result in exposure to extreme cold or heat, unsafe food and drinking water, mold in homes and buildings, and loss of access to medical services. Individuals may also be exposed to waterborne pathogens (e.g., bacteria) and/or toxic chemicals that contaminate food and drinking water sources, by wading through contaminated flood water, improper use of power generators or non-vented outdoor appliances (e.g., camp stoves) or malfunctioning fireplaces.

## WHAT ARE THE HEALTH EFFECTS?

The most serious health effects related to extreme weather are injury and death caused by storm damage and debris. People also die from carbon monoxide poisoning from improper use of generators or unvented outdoor appliances during storm-related power failures. Property damage and displacement of homes and businesses can lead to loss of livelihood and long-term mental stress for those facing relocation. Individuals may develop post-traumatic stress, anxiety and depression following extreme weather. Health effects also include increases in food- and water-borne illnesses, exacerbation of pre-existing diseases, and increases in respiratory illnesses from exposure to mold.

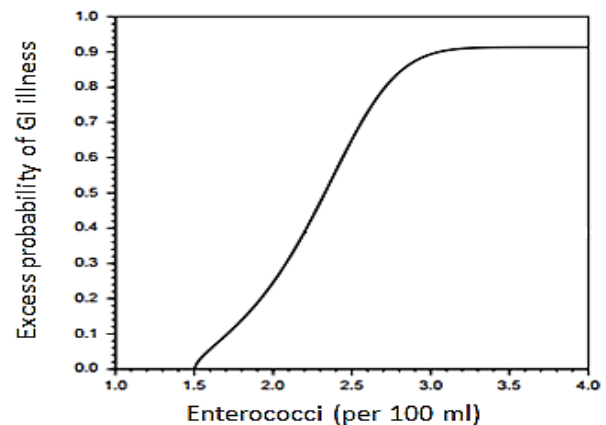
## HOW WILL CLIMATE CHANGE MAKE THINGS WORSE?

From 1958 to 2010, there was a 70% increase in the amount of precipitation that fell on the heaviest precipitation days and these events are projected to increase. In addition, tropical storm intensity is likely to increase, resulting in an increase in the frequency of major hurricanes (Category 3 and greater), and winter storm intensity is likely to increase as well.

## WHAT ARE THE EXPOSURE AND RELATED HEALTH RISKS FROM EXTREME WEATHER EVENTS?

Below is a conceptual approach to assess climate-related health risk based on exposure to the climate hazard. First, the relationship between the levels or exposure to the hazard that elicits a health response is derived from scientific literature. For example, below illustrates the relationship or exposure-response function between bacterial (Enterococci) concentrations that are often elevated in flood waters [exposure] and risk of gastrointestinal (GI) illness [response].

Figure 1: Relationship Between Bacterial (Enterococci) Concentrations and Risk of Gastrointestinal (GI) Illness\*



Second, potential health risks can be estimated by applying the exposure-response function derived from Figure 1 to varying levels of exposure across the community. For example, the table below illustrates that as the magnitude of exposure to contaminated drinking water increases from low to high, the risk of GI illness increases from low to critical.

Exposure to Contaminated Water	Moderate	Severe	Critical
	Low	Moderate	Severe
	Low	Low	Moderate
Pathogen Concentration Low → High			

## WHAT ARE THE FACTORS THAT INFLUENCE HEALTH RISKS FROM EXTREME WEATHER EVENTS?

Below are examples of factors that may increase vulnerability to health risks from extreme weather events. These factors need to be considered in adaptation planning to reduce vulnerability to the health impacts of climate change.



### SOCIODEMOGRAPHIC

- Individuals over 65
- Individuals over 65 and living alone
- Children under 5
- People of Color
- People living in poverty
- The homeless
- People with limited English proficiency
- Renters



### PRE-EXISTING HEALTH CONDITIONS

- Adults with respiratory disease (e.g., asthma, COPD) and cardiovascular disease
- Children with respiratory disease (e.g., asthma)
- Individuals using electricity dependent medical equipment and/or medications that need refrigeration.
- Individuals with disabilities or mobility problems
- Individuals with mental health challenges



### ENVIRONMENT

- Degraded water quality
- Coastal and stream bank erosion
- Ecosystem damage
- Damage to aquatic and agricultural resources
- Damage to parks and recreational land



### INFRASTRUCTURE

- Interruption of utilities (e.g., electricity, phone service, cable)
- Failure of wastewater treatment systems
- Loss of safe drinking water
- Disruption of transportation and communication systems
- Loss of access to medical services
- Food and supply shortages

## What Intervention Strategies Can Increase Adaptive Capacity for Extreme Weather Events?

DPH's Bureau of Environmental Health (BEH) is providing support to local health departments to increase their capacity to address the additional health burden associated with climate change at the local level. We also coordinate with other DPH programs and state agencies engaged in responding to the aftermath of extreme weather events. As part of this effort, we are also promoting local adaptation strategies to reduce harm from extreme weather events identified in the Massachusetts Climate Change Adaptation Report <http://www.mass.gov/eea/waste-mgmt-recycling/air-quality/climate-change-adaptation/climate-change-adaptation-report.html> including:

### Short-term

- Identify critical facilities and infrastructure at risk from flooding, such as water and sewer facilities susceptible to intrusion and implement modifications that decrease potential flood damage, and/or removing of critical infrastructure from vulnerable areas
- Assess capability to deploy power generators and water pumps to medical facilities
- Encourage preparedness in the home, in schools, in the work place, and at healthcare facilities
- Develop communication and outreach plans to raise public awareness of evacuation routes, flood zones, and response plans
- Support implementation of DPH's Mass in Motion and other Wellness programs to increase community resilience <http://www.mass.gov/eohhs/gov/departments/dph/programs/community-health/mass-in-motion/>
- Implement actions to prepare for storms from BEH's Community Sanitation Program <http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/comm-sanitation> and the Office of Preparedness and Emergency Management (OPEM) emergency preparedness programs <http://www.mass.gov/eohhs/gov/departments/dph/programs/emergency-prep/>
- Implement actions to address mold from the aftermath of a storm <http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/iaq/pollution/mold/>

### Long-term

- Incorporate information on extreme weather and storm probabilities into coastal planning, transportation, and public works projects
- Promote workforce development to train public health staff to respond to climate change-related health threats

\*Reference for Figure 1: Kay, David, et al. "Derivation of numerical values for the World Health Organization guidelines for recreational waters." Water Research 38.5 (2004): 1296-1304.

**For more information about the health impacts of climate change contact the DPH Climate and Health Staff**

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