Swampscott, Massachusetts in October 2015
Photo Credit: Jim Olivetti

Massachusetts Department of Public Health

CLIMATE HAZARD ASSESSMENT PROFILE FOR

SEA LEVEL RISE

2016

OVERVIEW

Coastal areas of Massachusetts are highly vulnerable to damage from accelerating sea level rise and storm surge during coastal storms. Sea levels rose about nine inches during the 20th century. Currently, over half (53%) of Massachusetts residents live in coastal communities. Based on population and sea level rise projections over the next century, it is estimated that potentially a half million people living along Massachusetts coast may be at-risk from rising sea levels.

HOW ARE PEOPLE EXPOSED?

Rising sea levels may erode shorelines, threaten coastal drinking water supplies with salt-water intrusion, and displace coastal communities. Sea level rise also contributes to higher storm surges and flooding during coastal storms. Individuals may be exposed to physical hazards, contaminated flood water and drinking water, and displacement with possible permanent relocation.

WHAT ARE THE HEALTH EFFECTS?

Storms and sudden inundation from rising seas pose a physical danger to those caught in its path. Property damage and displacement of homes and businesses can lead to loss of livelihood and long-term mental stress for those facing relocation or living in a deteriorating community. Health effects include increases in food- and water-borne illnesses and increases in respiratory diseases due to mold from flooding. The burden of the long term impacts of rising sea level can also affect mental health. Individuals may develop post-traumatic stress, anxiety and depression following an extreme weather event or relocation.

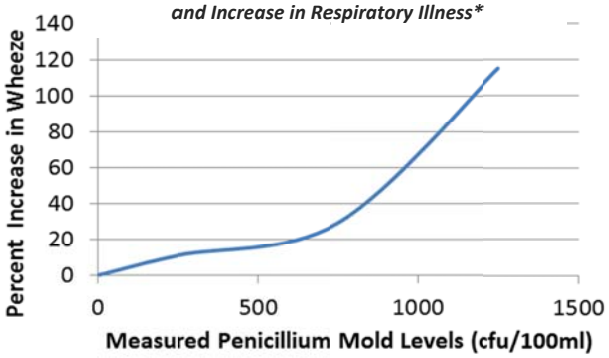
HOW WILL CLIMATE CHANGE MAKE THINGS WORSE?

The pace of sea level rise resulting from the melting of arctic ice appears to be accelerating. By 2030, plausible projections of sea level rise predict a rise in sea level of 8 inches compared to 2000. By 2050, the sea level will likely be 1.5 feet higher (and as much as 2.1 feet higher) than it was in 2000, and as much as 3.1 to 4.3 feet higher by 2070.

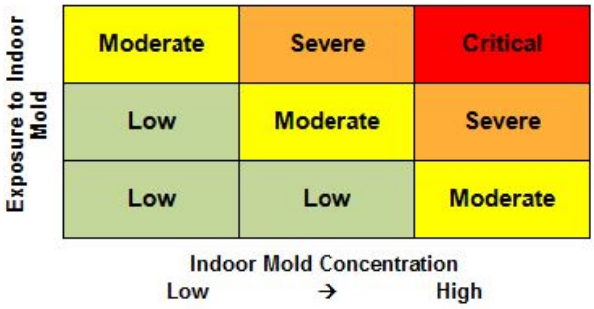
WHAT ARE THE EXPOSURES AND RELATED HEALTH RISKS FROM SEA LEVEL RISE?

Below is a conceptual approach to assess climate-related health risks based on exposure to the climate hazard. First, the relationship between the levels of the hazard that elicit a health outcome of concern is derived from scientific literature. For example, Figure 1 below illustrates the relationship between exposure to mold [exposure concentration] and increase in wheezing [response].

*Figure 1: Relationship between Exposure to Mold and Increase in Respiratory 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 indoor mold contamination increases from low to high, the potential risk of respiratory illness increases from low to critical.



WHAT ARE THE FACTORS THAT INFLUENCE HEALTH RISKS FROM SEA LEVEL RISE?

Below are examples of factors that may increase vulnerability to health risks from sea level rise. 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

ENVIRONMENT

- Degraded water quality
- Coastal erosion
- Ecosystem damage
- Damage to aquatic and agricultural resources
- Loss of shoreline and recreational land

PRE-EXISTNG 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

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

What Intervention Strategies Can Increase Adaptive Capacity for Sea Level Rise?

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 preparing for sea level rise. As part of this effort, we are also promoting local adaptation strategies to reduce harm from inland flooding identified in the Massachusetts Climate Change Adaptation Report http://www.mass.gov/eea/waste-mgnt-recycling/air-quality/climate-change-adaptation/climate-change-adaptation-report.html including:

Short-term

- Increase the use of climate and weather information in managing storm water/flood risk and individual events
- 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 community 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/
- 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)http://www.mass.gov/eohhs/gov/departments/dph/programs/emergency-prep/
- Actions to address mold from the aftermath of a storm

Long-term

- Incorporate information on sea level rise 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: Gent, Janneane F., et al. "Levels of household mold associated with respiratory symptoms in the first year of life in a cohort at risk for asthma." Environmental Health Perspectives 110.12 (2002): A781.

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Funding for this work was made possible (in part) by the Centers for Disease Control and Prevention (CDC) "Building Resilience Against Climate Effects (BRACE) " Cooperative Agreement Number 5UE1EH001123. The written content are solely the views of the authors and do not necessarily reflect the official views of the MA Department of Public Health, CDC, or the US Department of Health and Human Services.