Charles River
Photo Credit: Boston University

Massachusetts Department of Public Health

CLIMATE HAZARD ASSESSMENT PROFILE FOR

HEAT AND AIR QUALITY

2016

OVERVIEW

Extreme heat events have claimed more lives on average over the past ten years than any other severe weather event. In the Northeast US, hot weather conditions can also contribute to unhealthy air quality. Climate models project that increases in greenhouse gas (GHG) emissions will lead to an increase in extreme heat events and associated air pollution episodes in Massachusetts.

HOW ARE PEOPLE EXPOSED?

During a heat event, sweating and increased blood circulation close to the skin's surface helps maintain an ideal core body temperature. A loss of internal temperature control results in a rise in the core body temperature and potential increase in heat-related health impacts. If pollution levels are also high during a heat event, people may be exposed to air pollutants both indoors and outdoors, including ozone and particulate matter. Aeroallergens are also expected to increase from longer pollen season and release of airborne allergens.

WHAT ARE THE HEALTH EFFECTS?

The health effects from excessive heat include heat stroke (hyperthermia), heat exhaustion, cramps, edema, and, premature mortality. Extreme temperatures can also worsen chronic conditions such as respiratory, cardiovascular and kidney diseases, and diabetes-related conditions. Poor air quality can also negatively affect respiratory and cardiovascular systems including triggering asthma attacks and heart attacks. Studies have found that the mortality during heat waves is higher on high air pollution days. The increases in pollen counts also can worsen allergies.

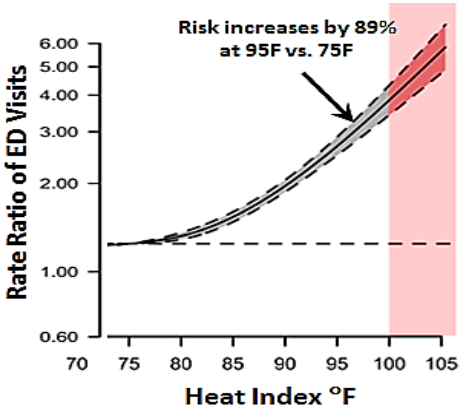
HOW WILL CLIMATE CHANGE MAKE THINGS WORSE?

Climate change models predict that warming temperature trends will continue, and that Massachusetts is projected to experience an increase in the number of hot days each summer. For example, in 2010, Massachusetts counties observed up to 7 days where temperatures exceeded 90ºF. By 2080, counties throughout Massachusetts are projected to experience 17 to 52 days when temperatures would exceed 90ºF (based on the high emissions scenario) and an increase of up to 7 ppb in daily 8-hour maximum ozone by 2050 if there are no substantial reductions in GHG over the next decade.

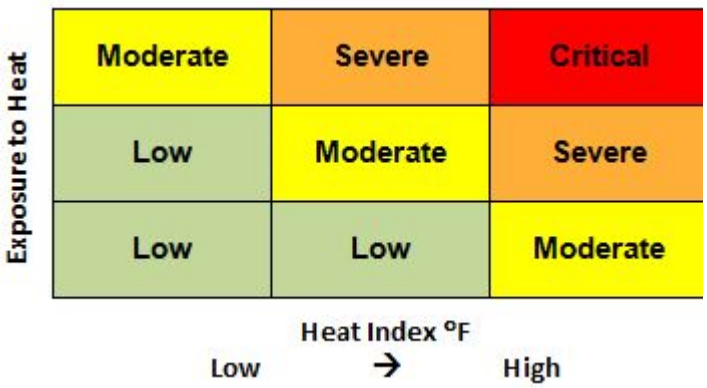
WHAT ARE THE EXPOSURES AND RELATED HEALTH RISKS FROM HEAT AND AIR POLLUTION?

Below is a conceptual approach to assess climate-related health risks 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 heat index [exposure] and risk of heat related Emergency Department (ED) Visits [response].

Figure 1: Relationship between Heat Index and Risk of Emergency Department *(ED) Visits



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 the heat index increases from low to high, the potential risk of ED visits increases from low to critical.



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

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

SOCIODEMOGRAPHIC

- Individuals over the age of 65
- Individuals over 65 living alone
- Children under 5
- People of Color
- People living in poverty
- People who work or recreate outdoors
- The homeless
- People with limited English proficiency
- People living in an urban area with limited green space
- People living near high-traffic roadways
- People lacking access to air conditioning

ENVIRONMENTAL

- Poor air quality
- Increased pollen production and season length
- Changes in animal and plant species distribution and abundance

PRE-EXISTING HEALTH CONDITIONS

- Individuals with pre-existing conditions such as cardiovascular disease, respiratory disease, renal disease and diabetes
- Children with respiratory disease(e.g. asthma)
- Individuals taking medications that impair heat adaption response, or increase susceptibility to respiratory distress
- Individuals using electricity dependent medical equipment or medications requiring refrigeration

INFRASTRUCTURE

- Interruption of electrical service (e.g. brown outs and blackouts)
- Food spoilage due to refrigeration failure
- Lack of access to air conditioning
- Loss of air conditioning due to power failure or mechanical failure

What Intervention Strategies Can Increase Adaptive Capacity for Heat and Air Pollution?

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 extreme heat events and air pollution episodes. 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-mgnt-recycling/air-quality/climate-change-adaptation/climate-change-adaptation-report.html including:

Short-term

- Work with local health departments to develop and implement a heat response plan in your community including:
- Identify and map vulnerable populations and areas in your community using DPH's Vulnerability Mapping Tool https://matracking.ehs.state.ma.us/Climate-Change/index.html
- Determine if cooling centers can operate during loss of electricity
- Advertise cooling centers and provide transportation to centers
- Improve public access to air conditioning units and other cooling strategies to reduce exposure to heat
- Raise awareness of pollution-related health risks among care providers and local residents and include monitoring of local air quality conditions using MassDEP's MassAIR Online http://public.dep.state.ma.us/MassAir/Pages/MapCurrent.aspx?&ht=1&hi=101 and USEPA's AirNow https://www.airnow.gov/
- 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/

Long-term

- Work with municipal planners to identify and reduce "heat island" impacts in areas with vulnerable populations
- Initiate efforts to educate health care providers regarding health risks related to heat and air pollution exposure

* Reference for Figure 1: Presentation by the BRACE Northeast Heat Collaborative on May 24, 2016 at the New England Climate Adaptation, Preparedness, and Resilience Seminar, Durham, NH

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