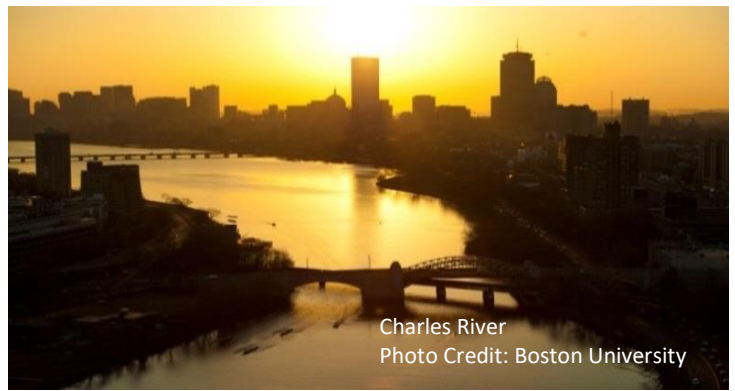


EXTREME HEAT AND POOR AIR QUALITY



Charles River
Photo Credit: Boston University

CLIMATE HAZARD OVERVIEW

Extreme heat events have claimed more lives in the United States over the past 10 years than any other weather-related event. In the Northeastern U.S., hot weather conditions contribute to unhealthy air quality. Climate models predict that climate change will lead to an increase in extreme heat events and associated air pollution episodes in Massachusetts.

HOW WILL CLIMATE CHANGE MAKE THINGS WORSE?

Climate change models predict that Massachusetts will continue to experience an increase in the number of days over 90°F during the summer season. For example, between 1971 and 2000, Massachusetts averaged 5 days per year where temperatures exceeded 90°F. By 2080, communities throughout Massachusetts are projected to experience 17 to 52 days each year when temperatures exceed 90°F. Higher temperatures also contribute to poor air quality, including increases in aeroallergens and the number of days with air quality alerts.

WHO IS EXPOSED TO EXTREME HEAT AND POOR AIR QUALITY?

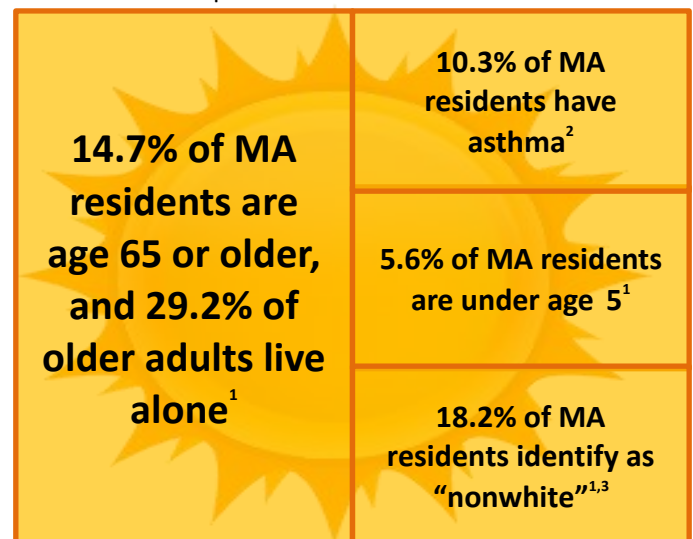
During prolonged periods of extreme heat, people spending time inside buildings that lack cooling systems (e.g., schools, workplaces, and homes), working outdoors, engaging in outdoor recreational activities, or experiencing homelessness, may all be at risk for excessive heat exposure. During a heat event, people may also be exposed to increased levels of harmful air pollutants such as ozone and particulate matter, and aeroallergens such as pollen.

WHAT ARE THE HEALTH EFFECTS?

In response to heat, the human body increases sweating and blood circulation close to the skin's surface to help maintain an ideal core body temperature. However, extreme heat can overwhelm temperature control mechanisms and cause core body temperature to rise. The health effects of excessive heat range from discomfort and fatigue to heat stroke (hyperthermia), heat exhaustion, cramps, edema, and premature mortality. Extreme temperatures can also worsen chronic conditions including respiratory, cardiovascular and kidney diseases, and diabetes-related conditions. Poor air quality during extreme heat events can also negatively affect respiratory and cardiovascular systems which may trigger asthma attacks and heart attacks. Studies have shown that mortality during heat waves is higher on high air pollution days. Potential increases in pollen levels may also worsen allergies and other respiratory illnesses.

WHO IS VULNERABLE TO EXTREME HEAT EVENTS AND HEAT-RELATED AIR QUALITY HAZARDS?

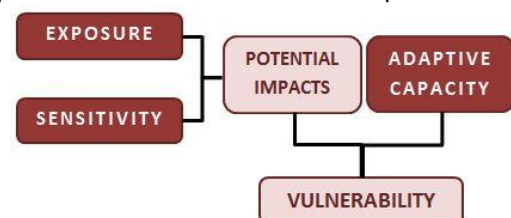
Identifying populations most vulnerable to the health burdens of climate change is an important step in developing state and local adaptation plans. Publicly available data can be used to assess the health-related vulnerability for extreme heat and poor air quality events. Some examples of vulnerability data for Massachusetts are provided below.



HOW CAN WE ASSESS VULNERABILITY TO CLIMATE HAZARDS?

Climate vulnerability is a function of:

- **Potential impacts** from *exposure* (contact with the climate hazard) and *sensitivity* (e.g., age, pre-existing health conditions, social disparities) that may increase or decrease health impacts
- **Adaptive capacity** – factors that influence the ability to respond and recover from climate impacts



The next page provides information to assess exposure, sensitivity, and adaptive capacity to reduce climate change impacts. This information should be considered when planning actions to reduce health risks from extreme heat and poor air quality in Massachusetts communities.

WHAT ARE THE FACTORS THAT INFLUENCE VULNERABILITY TO EXTREME HEAT AND POOR AIR QUALITY?

Assessment of community-specific vulnerabilities will inform adaptation planning efforts. By considering these factors, communities can increase health equity and resilience to climate change impacts. The MA Environmental Public Health Tracking Portal provides helpful tools and community-specific vulnerability data: <https://matracking.ehs.state.ma.us/>.



SOCIODEMOGRAPHIC

- People over age 65
- People over age 65 and living alone
- Children under age 5
- People of Color
- People who are living below the poverty line
- People experiencing homelessness
- People with limited knowledge of English
- People lacking access to air conditioning



PRE-EXISTING HEALTH CONDITIONS

- People with pre-existing conditions such as cardiovascular disease, respiratory disease, renal disease, and diabetes
- Children with respiratory disease, such as asthma
- People taking medications that impair heat adaptation response, or increase susceptibility to respiratory distress
- People using medical equipment that requires electrical power or medications that require refrigeration
- People with physical disabilities or special needs
- People with mental health challenges



ENVIRONMENT

- People living near high-traffic roadways
- People living in areas with poor air quality
- People living in urban areas with limited greenspace
- People working or exercising outdoors
- People living in areas with increased pollen



INFRASTRUCTURE

- Interruption of utilities (e.g., electricity, phone service, internet)
- Refrigeration failure resulting in food spoilage
- Lack of access to cooling systems (AC, ventilation, shelters)
- Loss of air conditioning due to power or mechanical failure

Intervention Strategies for Reducing the Health Impacts of Extreme Heat and Poor Air Quality Events

- Develop and implement a heat response plan in your community
- Identify vulnerable populations and health issues in your community using the DPH Community Profiles, and other tools available on the EPHT website: https://matracking.ehs.state.ma.us/planning_and_tools/index.html
- Identify and map vulnerable locations and populations using DPH's Climate Change Vulnerability Mapping Tool <https://mass.gov/dph/climate-vulnerability-map/>
- Determine if cooling centers can operate during loss of electricity
- Advertise availability of cooling centers
- Provide transportation to cooling centers for vulnerable residents
- Improve public access to air conditioning units and develop other cooling strategies to reduce exposure to heat
- Raise awareness of heat and air pollution-related health risks among medical care providers and residents by monitoring local air quality conditions using MassDEP's MassAIR Online <http://eeaonline.eea.state.ma.us/dep/massair/web/#/pollution/map/max> 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/>
- Work with municipal planners to identify and reduce "heat islands", particularly in areas with vulnerable populations
- Incorporate information on extreme heat into planning, transportation, and public works projects
- View the Massachusetts State Hazard Mitigation and Climate Adaptation Plan for information on climate adaptation strategies <https://www.mass.gov/service-details/massachusetts-integrated-state-hazard-mitigation-and-climate-adaptation-plan>
- View the Massachusetts Climate Change Adaptation Report, Chapter 6: "Human Health and Welfare" for health adaptation strategies <https://www.mass.gov/service-details/2011-massachusetts-climate-change-adaptation-report>

1. 5-Year US Census American Cities Survey, 2018. Data available via <https://mass.gov/dph/climate-vulnerability-map>
2. MA DPH Statistics About Asthma, 2015, available via <https://www.mass.gov/service-details/statistics-about-asthma>
3. Hattis D, Ogneva-Himmelberger Y, Ratick S. The spatial variability of heat-related mortality in Massachusetts. Applied Geography 33 (2012) 45-52.

For more information about the public health impacts of climate change in Massachusetts contact:

Massachusetts DPH | Bureau of Environmental Health | Environmental Toxicology Program

250 Washington Street, Boston, MA 02108

Phone: 617-624-5757 | Fax: 617-624-5183 | TTY: 617-624-5286

Websites: <https://www.mass.gov/climate-and-health>; <https://matracking.ehs.state.ma.us/Climate-Change/index.html>



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