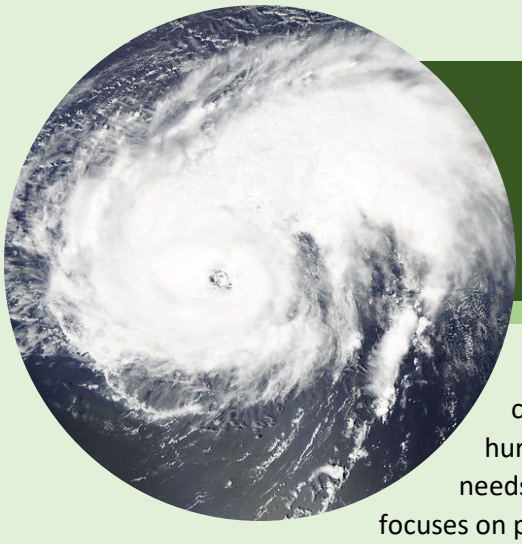


Health and Population Impacts Associated with Hurricanes

Bedford, Massachusetts Profile

Hurricanes can seriously affect people's health – especially if communities do not plan ahead. To protect residents during and after hurricanes, communities should customize their strategies to meet local needs. The MA Region 4AB Public Health Emergency Preparedness Coalition focuses on planning for the entire community and ensures health equity is considered in emergency preparedness and planning.

A person's risk of health impacts from a hurricane can vary based on many factors such as background, pre-existing health conditions, and where they live or work. Therefore, communities should develop plans that take these factors into account and address the needs of those who are most at risk. Each community is unique in its demographics, socioeconomic conditions, and geography. As a result, hurricane impacts – and the most effective solutions – may vary across the region.

Health Impacts of Hurricanes & Associated Events

Over the past few decades, hurricanes have become more frequent and severe. Experts predict this trend will continue.[1] Since 2000, Massachusetts has experienced six hurricanes that caused significant health impacts and infrastructure damage. Four of those hurricanes occurred since 2020.[2] In 2023, the Atlantic Basin (the section of the Atlantic Ocean along the Eastern Seaboard) saw 20 storms, including seven hurricanes. Of those, three were "major" hurricanes (Category 3 or higher on the Saffir-Simpson scale).[3]

These extreme storms often hit hardest for people with health conditions or those facing social and economic challenges. People and communities may face both immediate challenges after a hurricane and ongoing issues throughout the recovery process.

Physical Health Risks

Flooding, debris, strong winds, and building damage can harm people who do not – or cannot – evacuate. This is especially true in coastal and flood-prone areas. Hurricanes often cause power outages, which put people who rely on electronic medical devices at risk. Additionally, after a storm, damage to roads, buildings, and utilities can pose risks to emergency responders and make it more difficult for people to get medicine or medical care.

Environmental Health Hazards

Hurricanes can make the air quality worse by breaking dust, pollen, and other particles into very fine material. This is especially dangerous for people with breathing problems.[4] Mold can also grow in damp areas, such as flooded homes. This increases health risks for residents and recovery workers, especially those with existing respiratory conditions.[5,6] After hurricanes, water and sanitation problems can lead to more illnesses from contaminated food and water.[7,8]

Behavioral Health Impacts

Hurricanes and their aftermath can also harm people's mental and emotional well-being. Displacement, losing a home, and losing possessions may lead to anxiety, depression, or Post-Traumatic Stress Disorder (PTSD). Youth, people with existing health conditions, and those experiencing homelessness can be especially affected.[9,10,11] Chronic stress can last long after the storm, especially for those who already have health issues.[12]

People without social support or access to services—such as individuals who are undocumented, socially isolated, or speak limited English—often have a harder time recovering financially, emotionally, and physically after a hurricane.[13]

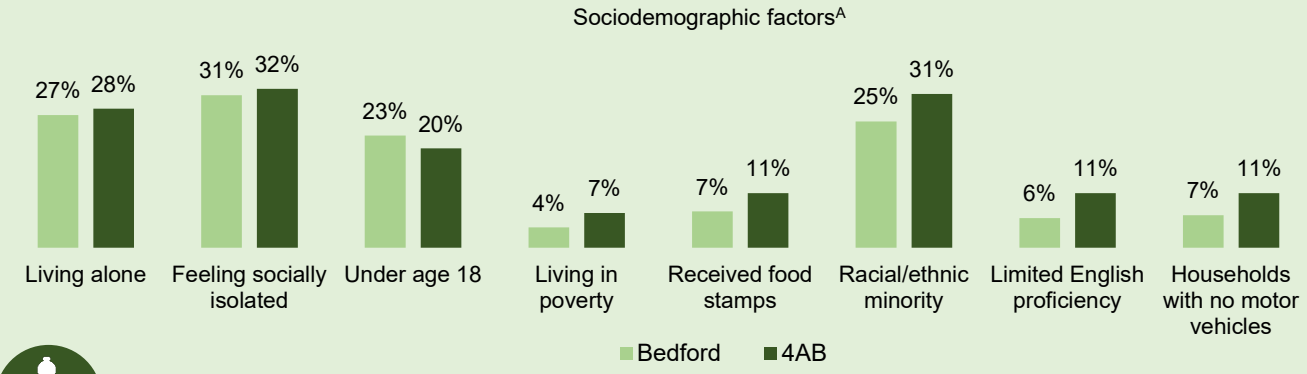
Populations At Risk of Hurricane Health Effects

Understanding which groups are more likely to experience negative health impacts after a hurricane can lead to more effective and equitable plans. Often, people have multiple traits that increase their vulnerability. For example, individuals with limited financial resources are more likely to live in flood-prone areas or in homes that can be easily damaged by strong winds. People with disabilities are also more likely to have limited financial means. Planners should consider these overlapping risk factors when designing mitigation and response strategies.

Bedford is characterized by its woody wetlands. It spans 14 square miles with 14,273 residents representing 1% of the region's population. Compared to Region 4AB, it has more older adults living alone and more Asian residents. Rates of hypertension and asthma-related emergency department visits are higher.[A] Sociodemographic factors, health status, and the places people live, work, and play all affect how they experience and cope with hurricane risks.

Sociodemographic Factors

A person's age, income, language, household composition, housing situation, and other factors can affect their ability to prepare for, respond to, and recover from hurricanes.



People living alone or who are socially isolated may not receive critical evacuation notices. They can be harder for emergency responders to reach and may have less support from friends or family.[14,15] They are also more likely to have chronic diseases, disabilities, mental health challenges, or substance use issues – all of which increase their risks of negative health impacts.

Children who experience hurricanes are more likely to suffer physical and mental health effects later – especially if they lose vital support systems, such as family members, their home, or their school community.[9]

People living in poverty may live in housing that is easily damaged by strong winds or flooding.[16] They often cannot afford emergency supplies, flood insurance, or the cost of evacuation.[17,18] A recent survey found people who evacuated during Hurricane Harvey spent $1,200–$2,300.[17,16] Low-income households may also face extra barriers – like limited access to communication, transportation, food, or medical care – both during and after a storm.

Communities of color are more likely to live in areas with less reliable infrastructure, which puts them at higher risk. Past hurricane responses show that recovery help is often not distributed equally. For example, following Hurricane Harvey in Texas, Black residents were twice as likely as White residents to report not getting enough help recovering.[17] Inequitable conditions lead to differences in income, health, housing, and neighborhood conditions. In Bedford, 16.4% of residents are Asian, 4.1% are Hispanic, 2.1% are Black, and 7.0% are other racial/ethnic minorities.[A] Poverty rates are more than 12.3 times higher for residents of "some other race" (50.9%) compared to White residents (4.14%) and 34.1 times higher compared to Black

residents (1.5%).[A] 100.0% of residents who are American Indian or Alaska Native live in poverty.[A]

Non-English speakers or people with limited English can face extra challenges in finding evacuation information or applying for post-storm assistance.[17] Undocumented individuals may avoid seeking medical care or other services due to immigration concerns.

Households without vehicles can have trouble reaching emergency shelters or evacuating safely.

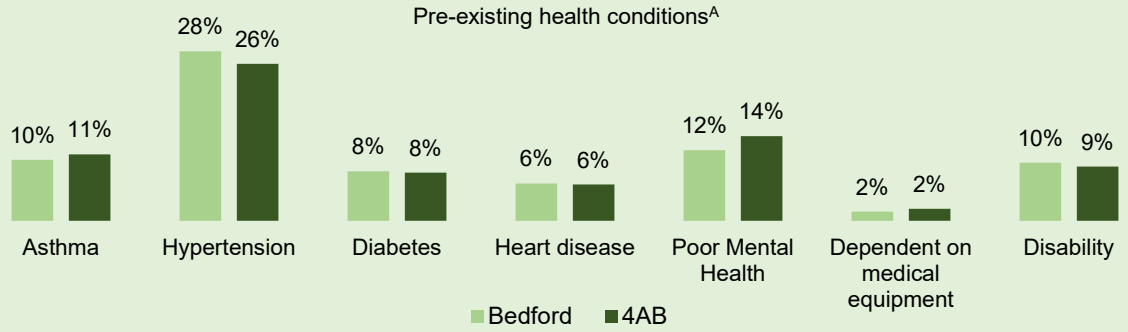
People experiencing homelessness may not have a safe place to stay during a hurricane. They often face barriers to using shelters, may not get evacuation notices, and typically lack transportation.[19] In Massachusetts, there are 19,141 people experiencing homelessness.[A]

People with pets may hesitate or refuse to evacuate if they cannot bring their pets.[20] About 32% percent of US households have cats, and 46% have dogs.[21]

People with limited access to health care may delay or skip treatment for hurricane-related injuries or illnesses, including mental health care. In Massachusetts, 9% of people do not have a personal doctor or health care provider.[22]

Pre-Existing Health & Medical Conditions

People with pre-existing health conditions are at increased risk of negative health impacts as the result of a hurricane.



People with pre-existing health conditions are at higher risk of harm from hurricanes. This includes those with asthma, COPD, other breathing problems, and heart disease. Losing access to healthcare can have serious health impacts, especially for those who need dialysis or cancer treatment.[23,24] Research shows hurricane-related deaths can continue for up to 15 years after a storm, totaling tens of thousands of fatalities.[25] Most of these occur among people whose existing health conditions make them more vulnerable. Hurricanes can also worsen mental

health conditions and substance use disorders in the days, months, and even years after a storm.

People who require medication may not be able to get their medications during an emergency. They may forget to bring them when evacuating or be unable to refill prescriptions if pharmacies lose power or close.[26] In the United States, about half of all people use at least one prescription medication each month.[27] Power outages also threaten those who use a medication that needs to be refrigerated.[10]

People with power-dependent medical devices are at greater risk during storms. Power outages can leave these devices unusable.[28] In Region 4AB, all 60 communities have an emergency notification system, and 21 of those communities (35%) keep a registry of people with access and functional needs. These registries help ensure that residents who need extra assistance receive transportation, medical supplies, and other services during emergencies.

People with disabilities often have fewer resources, face more barriers when evacuating, and are more likely to be negatively impacted by service disruptions.[29] Around the world, people with disabilities are up to four times more likely to die in a natural disaster than those without disabilities.[29]

Environment

Where people live, work, and spend leisure time affects how a hurricane impacts them. Some areas face more risks than others due to factors like power outages, proximity to water, or older housing.

Communities that frequently lose power are more vulnerable to hurricanes. In Region 4AB, smaller towns typically have more frequent and longer outages. Contributing factors may include tree cover, distance from critical infrastructure, and utility practices that fix outages first where more customers are affected. Between 2021 and 2023, Region 4AB averaged 4.70 hours of power loss per 1,000 people. In Bedford, that number was 6.0 hours.[30]

People living near the coast or in flood zones face higher hurricane risks. MassMapper can show which streets and neighborhoods are likely to flood. This tool can also add other layers of information to help communities plan for storms.[31]

Living in housing that is not built or updated to withstand strong winds or flooding can pose serious health risks. In Region 4AB, 1,847 people live in mobile homes, boats, and recreational vehicles, which can be more easily damaged. However, there were no recorded homes in this category in this community. 93% of homes in Massachusetts were built prior to 2008, when wind load requirements were first added to the state building code.[32] People living in basement apartments are more likely to experience flooding.[33] Flood insurance can offer limited coverage, especially when flooding is due to heavy rainfall overwhelming drainage systems.[34] After

hurricanes, heat waves can occur because of the lingering warm, humid air. About 11% of Massachusetts residents do not have air conditioning or cannot afford to use it, which raises health risks during extreme heat.[35]

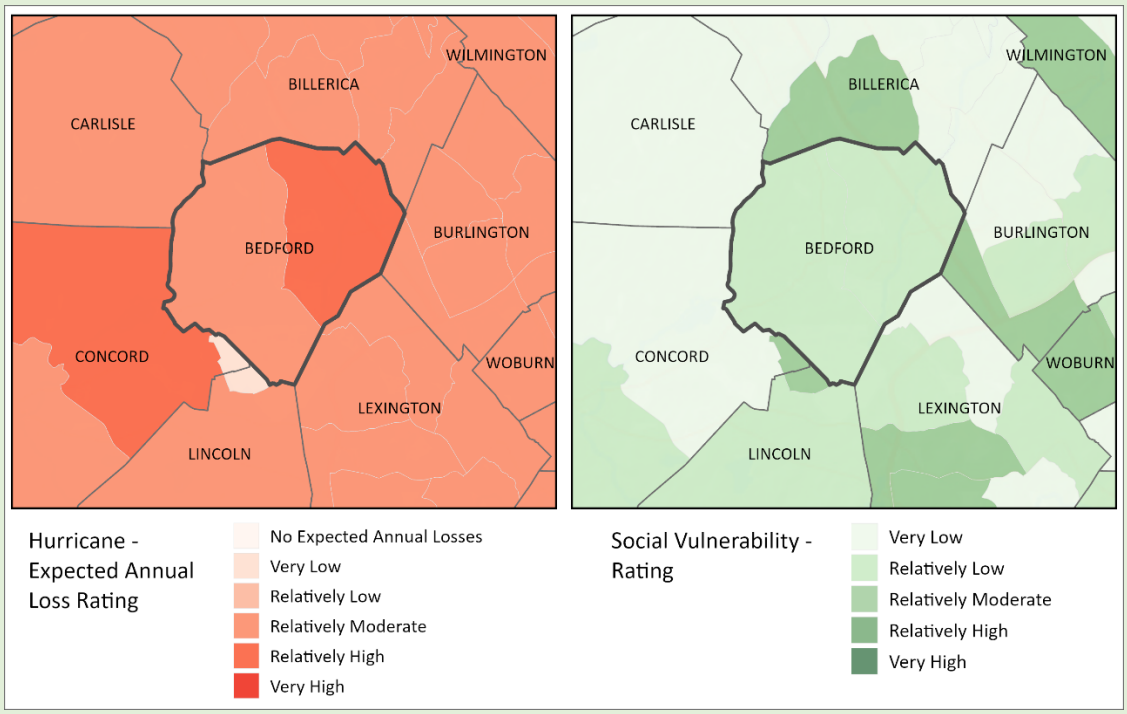
People in institutions, such as nursing facilities or correctional facilities, usually depend on staff for evacuation and emergency planning. In Massachusetts, 0.5% of the population (39,593 people) live in nursing or skilled nursing facilities. 0.2% of the population (15,286 people) reside in adult correctional facilities.[B]

Emergency responders and cleanup crews face many dangers after a hurricane, such as live power lines, fallen trees, debris, mold, chemical exposure, and heat stress.

Tourists may not know local risks or how to find help. They often lack information about where shelters or medical facilities are located, which areas flood, or how to evacuate safely.

Areas Most Impacted by Hurricanes

The maps below show two measures for Bedford. **Annual Expected Loss** estimates how much money (in dollars) hurricanes could cost each year. **Social Vulnerability** shows how likely certain social groups are to be disproportionately impacted by hurricanes. Darker shades of orange and green represent higher expected economic loss and greater vulnerability, respectively.



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Hurricane picture credit: NASA/GSFC/Jeff Schmaltz/MODIS Land Rapid Response Team

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