

ADAPTATION IN ACTION Part II 2018

Updated Grantee Success Stories from CDC's Climate and Health Program



AMERICAN PUBLIC HEALTH ASSOCIATION
For science. For action. For health.

ADAPTATION

The adjustment in natural or human systems to a new or changing environment that exploits beneficial opportunities or moderates negative effects.¹

CLIMATE CHANGE

Any significant change in the measures of climate lasting for an extended period of time. In other words, climate change includes major changes in temperature, precipitation, wind patterns, or other weather-related effects that occur over several decades or longer.²

CLIMATE AND HEALTH ADAPTATION

Steps taken to protect people and communities from the health risks associated with a changing climate.³

RESILIENCE

The capacity to predict, prepare for, and adjust to changing conditions, and to withstand, respond to, and recover from these disruptions.⁴

CLIMATE JUSTICE

Protection of the rights of certain groups, like children, the elderly, the underserved, and minority communities, that are less climate-resilient and, therefore, more vulnerable to negative health effects of climate change.⁵



The Need for Adaptation

The impacts of climate change are wide-ranging, bringing rising temperatures; increased risk of floods, droughts, and wildfires; and more extreme weather events. Climate anomalies have become increasingly frequent in recent years, and these anomalies have become a public health concern.

When burning fossil fuels, such as coal and gas, the greenhouse gas carbon dioxide (CO₂) is released. CO₂ builds up in the atmosphere and causes Earth's temperature to rise, much like a blanket traps heat. This extra trapped heat disrupts many of the interconnected systems in the environment. Long-term changes in climate may affect the ability of many communities to attain and maintain good health.

The impacts of climate change include, but are not limited to, warming surface temperatures, changes in precipitation, rising sea levels, and the increase in the frequency and intensity of extreme weather events. Each is directly and indirectly linked to negative health impacts. The need to stop or slow climate change is urgent, but so too is the need to adapt to the effects already impacting health and quality of life.

The impending health effects of climate change have been extensively reviewed. The science is clear – adaptation and mitigation are necessary for coping with changing climate. Mitigation includes technological change and changes in activities to reduce the severity of greenhouse gas emissions.⁶ Adaptation involves measures to protect people and communities from the health risks associated with a changing climate.⁷

Climate change will impact all communities, and each will need to become resilient, to have the capacity to predict, prepare for, and adjust to changing conditions and to withstand, respond to, and recover from these disruptions.⁴ Even with much preparation, some populations will remain more vulnerable to the health impacts of a changing climate. Children, pregnant women, the elderly, underserved, and minority communities face higher risks. These populations may need increased protection of their rights,⁵ as they are less climate resilient, and climate justice is deserved by all.

Climate Change Impacts Can Include:

- Poor air quality can cause heart and lung health problems.
- Changes in vector habitat may increase risk of vector-borne disease transmission.
- More frequent and intense extreme weather events and heat waves increase risk of injuries and fatalities.
- Increased flooding raises chances of food and drinking water contamination.
- Disruptions in food quantity, quality, and security hinder nutrition.
- Rising sea levels and flooding compromise infrastructure of homes and buildings.
- Displacement and forced migration increase stress and mental health strain.
- Threats to biodiversity may influence nutrition, infectious disease, and traditional medicines.

“Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and oceans have warmed, the amounts of snow and ice have diminished, sea levels have risen, and the concentrations of greenhouse gases have increased.”^{2, 6}



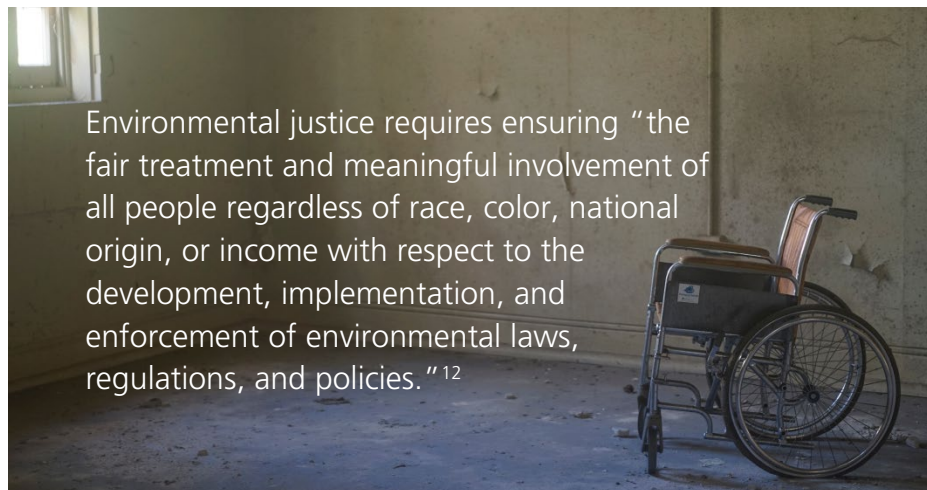
Climate Justice

Climate change is predicted to increase health disparities. The health impacts of climate change affect certain sub-populations differently. Physiological sensitivity, socioeconomic factors, and geography can contribute to an increased risk for climate-sensitive health stressors. One contributor to health disparities is environmental risks that disproportionately threaten certain populations, like children, pregnant women, the elderly, low-income communities, impoverished people with chronic conditions, those with mobility or cognitive limitations, the underserved, and some minority communities.⁸⁻¹¹

Also, geographically or socially isolated individuals and communities may be further vulnerable during and after an extreme weather event or natural disaster. Limited or nonexistent access to transportation; the lack of radio, television, or internet access; and/or impairment due to physical limitations, such as a disability, are all cause for concern. The socially isolated might not have a neighbor or family member to assist them or to call and check on them. These isolated groups are less climate-resilient.

Climate change can be especially harmful to children's health because their bodies are still developing, and conditions can impede early development, with lifelong, irreversible impacts. Additionally, the body and metabolism of a child is unique and cannot recover as quickly as that of a healthy adult. For example, a child deprived of adequate water and sanitation could contract a diarrheal disease and become weakened and die due to dehydration resulting from the illness.¹³

Senior citizens are vulnerable due to potential mobility challenges, making it difficult for them to evacuate in times of eminent danger, such as flooding, wildfires, and superstorms.^{10,14} This puts them at increased risk of injury and death. The elderly often have chronic health conditions, including cardiovascular and respiratory illnesses. These illnesses make them more susceptible to cardiac and respiratory impacts of air pollution and to more severe consequences of infectious diseases. The health of elderly persons suffer greatly in extreme heat, with increased risk of heat-related illness and even death.^{10,14}



Environmental justice requires ensuring "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies."¹²

People with disabilities can have functional impairments and fewer socioeconomic resources. If they fail to receive alert messages about health threats, or are unable to take action to avoid risks, this could lead to a higher exposure to climate-related health impacts. People with functional needs may be especially at risk if these climate-related health impacts interfere with their ability to access or receive medical care before, during, or after a natural disaster or other weather emergency. Cities are ill-planned for emergency responses to disabled people.¹⁵ Individuals who are deaf or have hearing loss, are blind, or have low vision are hindered by risk alerts that are not designed or delivered in an accessible format.¹⁶

People living in low-income communities have fewer resources and, as a result, are more vulnerable to negative health impacts of extreme heat, poor air quality, vector-borne diseases, and other climate change effects. In addition, these communities are likely to have limited adaptive capacity due to the inability to afford or to use air conditioning and window screens that cool the air and prevent mosquitos from entering the home.¹⁷ They may not have access to or the means to seek proper care or treatment following an extreme weather event.

Extreme heat or high allergy days inequitably impact communities of color, where there is a greater prevalence of chronic diseases sensitive to heat and air quality such as asthma, cardiovascular disease, and diabetes. Those diseases, coupled with burden of racism and discrimination, add a multitude of stressors for the population. For example redlining practices to restrict access to housing and services on the basis of race or ethnicity have resulted in communities overpopulated with people of color in areas that are less desirable and more climate-vulnerable, such as flood zones and urban heat islands.¹⁸ This uneven burden of climate change is, by definition, climate injustice.

In order to help all of our communities adapt to climate change, we must first recognize that some communities are not as resilient as others. As such, special attention and resources should be allocated to help all vulnerable populations.



Spotlight on Mental Wellness

The environmental consequences associated with climate change not only pose serious threats to physical health; they also threaten mental wellness. People with no history of mental illness may experience distress, anxiety, stress, loss of community identity, and despair after a climate-related disaster and displacement. Self-harm, including substance abuse and suicidal ideation, may also occur. Studies have shown that suicide rates rise after natural disasters and warmer than usual temperatures. Preexisting mental conditions may increase risk of exacerbated morbidity or mortality during a climate event.

Along with the destruction from climate change comes the devastation to the social structure of communities. The impacts of climate change may negatively affect communities' health and psychological well-being. Community impacts include social disconnection, domestic abuse, child abuse, and violence (e.g., assault and civil conflict). Groups negatively affected by social and economic inequity are less climate-resilient and, therefore, more vulnerable to mental health effects.

While public health programs focus on providing short-term assistance during and after major climate events, the public also needs long-term strategies to cope with the strain that increasing, ongoing climate change events have on mental health and psychosocial well-being. As public health departments develop climate adaptation plans, building adaptation measures to lessen the mental health burden will best serve their vulnerable populations, particularly in the long-term.

What is BRACE?

CDC takes the lead in supporting state, tribal, local, and territorial public health agencies to adapt to climate change through the work of its Climate and Health Program. CDC's Climate-Ready States and Cities Initiative is helping 16 states and two cities develop ways to anticipate the health effects of climate change by applying the best climate science available, predicting health impacts, and preparing programs to protect the communities served (<https://www.cdc.gov/climateandhealth/about.htm>). To aid public health professionals with developing adaptation plans, CDC created a framework for developing local climate change adaptation plans to manage health effects. It is called **Building Resilience Against Climate Effects** (BRACE).

The BRACE framework guides health departments in preparing for and responding to climate change. In approaching the health implications of climate change, we must find ways to understand and incorporate complex data, coupled with both short- and long-range climate projections, into public health planning and response activities. These projections and analysis enable a community to effectively foresee, prepare for, and respond to an array of climate-sensitive health impacts (https://www.cdc.gov/climateandhealth/climate_ready.htm).

The BRACE framework is a five-step series that helps health departments to identify how climate has and will affect human health. It enables health departments to undertake a systematic, evidence-based process to customize their planning and response to local circumstances. **The value of BRACE is that it provides opportunities for health departments to understand their communities' vulnerability to health impacts associated with climate-related exposure.** CDC's BRACE framework offers guidance to states and cities to develop and implement localized strategies and programs to confront the health implications of climate change.



The BRACE Framework:

Step 1: Anticipate Climate Impacts and Assess Vulnerabilities

Identify the scope of climate impacts, associated potential health outcomes, and populations and locations vulnerable to these health impacts.

Step 2: Project the Disease Burden

Estimate or quantify the additional burden of health outcomes associated with climate change.

Step 3: Assess Public Health Interventions

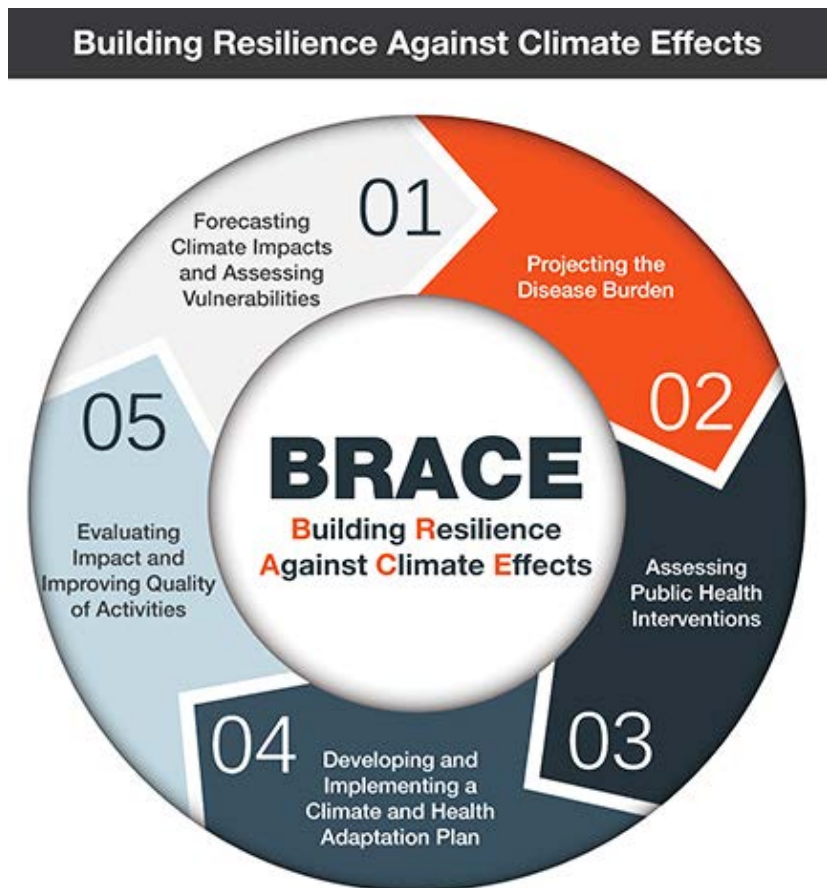
Identify the most suitable health interventions for the identified health impacts of greatest concern.

Step 4: Develop and Implement a Climate and Health Adaptation Plan

Develop a written adaptation plan that is regularly updated. Disseminate and oversee implementation of the plan.

Step 5: Evaluate Impact and Improve Quality of Activities

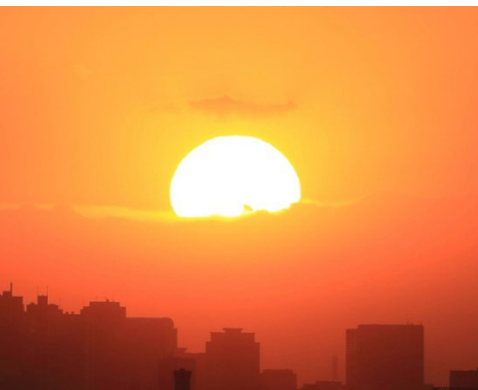
Evaluate the process. Determine the value of information attained and activities undertaken. For more information, visit: www.cdc.gov/climateandhealth/BRACE



HEALTH THREATS

There are many ways in which climate events – like heat waves, intense storms, and other extreme weather – can directly and indirectly affect the public’s health. Identifying communities and areas at risk can help health departments lessen harm and better respond after a natural disaster caused by climate change. Below are a few health threats from climate change and the public health responses that address them.





Extreme Heat

HEALTH IMPACT: Extreme heat events can trigger a variety of heat stress conditions, such as heat stroke and dehydration. These events result in increased hospital admissions for heat-related illnesses and cardiovascular and respiratory disorders. Young children, the elderly, people with chronic diseases and mental illnesses, low-income populations, and outdoor workers are at higher risk for heat-related illnesses. Also, extreme heat is linked to increased aggression, raising the number of assaults, murders, and suicides.³

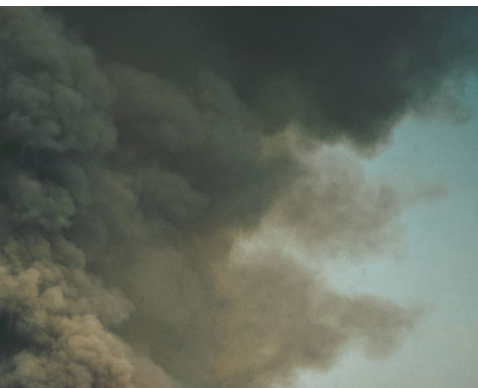
PUBLIC HEALTH RESPONSE: Detect and communicate heat wave risks by using heat wave warning systems, use advisories to communicate where people can go to cool off, open cooling centers for the public to gather for relief from the heat, and provide easy access to public drinking fountains and swimming pools.³



Vector-borne Disease

HEALTH IMPACT: Greater rainfall and warmer temperatures influence the distribution and reproduction of diseases borne by vectors, such as pathogen-spreading ticks and mosquitoes. Dengue, malaria, yellow fever, West Nile, and Zika virus are vector-borne diseases carried by mosquitoes. Ticks can carry bacterium that causes Lyme disease. Warmer temperatures broaden the geographical ranges of vectors and introduce disease risks to new regions. Greater rainfall creates conditions that are more hospitable for vector-borne disease carriers to multiply.³

PUBLIC HEALTH RESPONSE: Observe the spread and prevalence incidence of vector-borne diseases; coordinate with local officials, such as mosquito control programs, to predict and pinpoint possible hotspots for vector outbreaks; and educate local health care providers, physicians, and community members on how to eradicate conditions hospitable to mosquitoes, avoid bug bites, and identify early signs of vector-borne disease.³



Air Quality

HEALTH IMPACT: Climate change will affect human health by increasing ground-level ozone and particulate matter air pollution. Ground-level ozone, a key component of smog, is associated with many health problems, including reduced lung function. Air pollution increases risk of cardiovascular disease and respiratory conditions like asthma and chronic obstructive pulmonary disease. Increased CO₂ also causes increased pollen potency, leading to a longer and more intense allergy season. A rise in air pollution causes neuro-inflammation to the brain, which is linked to dementia, Parkinson's, depression, bipolar disorder, schizophrenia, and obsessive-compulsive disorders.³

PUBLIC HEALTH RESPONSE: Assess air quality, conduct surveillance and gather data on chronic diseases with particular attention to vulnerable populations, engage with local officials and planners on long-term community design solutions that mitigate air pollution, and partner with local organizations and agencies to educate residents about air quality.³

Flooding and Water Quality

HEALTH IMPACT: Marine bacteria that make humans sick are more likely to survive and thrive as oceans get warmer. Heavy downpours contribute to increases in severe flooding and combined sewer overflows. Floodwaters can become contaminated with agricultural waste, chemicals, and raw sewage carrying disease-causing bacteria, parasites, and viruses. With flooding and poor water quality come injury and illness. Psychiatric disorders have emerged due to these situations. Depression, anxiety, post-traumatic stress disorder, and drug and alcohol abuse risk increases as people attempt to cope.³

PUBLIC HEALTH RESPONSE: Monitor and test drinking and recreational water quality for harmful contaminants, monitor and track water contamination in agricultural waste that may lead to food-borne illness, educate and notify the public about water-borne illness hazards, and engage with local officials and planners to develop and implement design solutions that prevent water contamination.³



Drought and Wildfires

HEALTH IMPACT: Certain health hazards occur in drought conditions, including wildfires, dust storms, reduced air quality, extreme heat events, flash floods, and degraded water quality. Wildfires associated with drought conditions degrade air quality. Exposure to wildfire smoke and dust storms increases respiratory and cardiovascular hospitalizations, emergency department visits, asthma, bronchitis, chest pain, chronic obstructive pulmonary disease, respiratory infections, and medical visits for lung illnesses.³

PUBLIC HEALTH RESPONSE: Engage with local officials and planners on long-term land-use planning to reduce the risks associated with floods, restrict development in flood-prone areas, incorporate design elements that better handle storm water run-off, and identify vulnerable systems and communities in order to undertake activities to strengthen these systems and prepare measures to mitigate harm in the event of drought and wildfires. Establish strong evacuation plans, especially for those with limited resources.³



Extreme Events

HEALTH IMPACT: Climate change is expected to increase the frequency and severity of natural disasters, such as hurricanes, floods, landslides, wildfires, and heat waves. Such events come with numerous health risks, including injury and death, as well as disease related to food and water contamination and poor sanitation. People who experience severe weather disasters may also suffer from mental health illnesses or stress-related disorders.³

PUBLIC HEALTH RESPONSE: Identify vulnerable systems and communities in order to undertake activities to “harden” these systems and prepare measures to mitigate harm in the event of disaster. Identify communities or populations with barriers to receiving alerts from traditional warning systems, and identify more accessible ways to reach these groups ahead of an extreme weather emergency. Ensure equitable recovery efforts.³

ADAPTATION IN ACTION

Success Stories from Public Health Departments

The following are snapshots highlighting the work of BRACE grant recipients from across the country.





ADAPTATION IN ACTION

ILLINOIS

“We will see more extreme weather- and flood-related health concerns, a higher risk of vector-borne diseases, heat-related illnesses, mental health challenges, and exacerbated respiratory health concerns.”

Elena Grossman, MPH
Project Manager, BRACE-Illinois, School of Public Health, University of Illinois at Chicago
<https://braceillinois.uic.edu/>

THREATS TO HEALTH:

Many of the public health threats Illinois already faces today will be exacerbated by climate change. Illinois expects to experience increased respiratory disease exacerbations, heat-related illnesses, infectious disease risk related to flooding, mental health challenges, and environments more hospitable to disease-carrying vectors. This narrative highlights adaptation activities around the following factors impacting health:

- Increased risk of tick- and mosquito-borne diseases
- Exacerbated allergies and lung diseases
- Increased risk of water-borne disease
- Increased risk of heat-related illness
- Gaps in climate and health literacy among the general public and public health professionals

ADAPTATION IN ACTION:

Resources to Project Disease Burden: BRACE-Illinois estimated the burden of health outcomes due to climate change by gathering data on cases of Lyme disease, West Nile virus, and spotted fevers including Rocky Mountain Spotted Fever; asthma prevalence, hospitalizations, and death; water-borne disease cases; and heat-related emergency room visits and hospitalizations. Weather data additionally informed how water-borne diseases are associated with extreme precipitation events.

Identifying Interventions: BRACE-Illinois performed a literature review to inform the most appropriate public health interventions to address climate change. Through findings from the literature review, along with conversations with key staff, BRACE-Illinois determined education to be the greatest need. The interventions focused heavily on climate literacy, the connection between climate change and health effects, and improving knowledge and awareness about how climate change affects health.

Successes: A key area of success for BRACE-Illinois has been in its efforts to provide local public health professionals with the tools to address climate change effects in their jurisdiction. The Illinois Department of Public Health (IDPH) now requires that its Public Health Emergency Preparedness grantees consider increased severity and frequency of extreme weather events when conducting Hazard Vulnerability Assessments. In addition, BRACE-Illinois awarded mini-grants to five local health departments to build their capacity to address climate change and health.

BRACE-Illinois developed climate and health resources and educational materials for local health departments. One resource created was a heat toolkit, which contains a press release template to use when a heat wave occurs, sample social media messages, recommendations for how to assign a staff member as a heat point-person, guidance on developing an outreach plan for vulnerable members of the community, and effective messages in accordance with the National Weather Service's heat forecasts.

BRACE-Illinois established an online climate change and public health course that targets state and local health department staff employees. Employees within other state agencies can also access the course. They also collaborated with the Illinois Chapter, American Association of Pediatricians and the Illinois Academy of Family Physicians to develop two separate webinar series on climate change and public health for pediatricians and family physicians, respectively.

BRACE-Illinois also developed and disseminated two educational videos on climate change, public health, and emergency preparedness. One targets the emergency preparedness and public health professionals while the other targets the general public. In addition, a graduate-level course on climate change and public health is now offered at the University of Illinois at Chicago's School of Public Health – equipping the next generation of public health professionals with climate and health understanding.

BRACE-Illinois has also been invited to participate on regional and city workgroups and contributing a public health voice to the climate change discussion.

Challenges: While the state of Illinois provided guidance and support, much of the work occurred at the local level. The biggest challenge was ensuring that the plans developed could be realized by local health departments. This included balancing what was needed to implement any intervention with available staff, financial resources, and feasibility within local health departments.

In Illinois, many of the most effective interventions to address the adverse health impacts from climate change do not fall under the responsibilities of the public health sector (e.g.: improving the storm water management system to withstand more extreme storms). Acknowledging the limitations of the public health sector and the need for cross-sector collaboration with engineers, landscape architects, mental health specialists, and others, BRACE-Illinois worked to include sectors outside of the public health system in adaptation interventions.

Evaluation: To ensure continuous quality improvement, BRACE-Illinois prioritizes evaluating its interventions. It disseminated a climate and health survey to all local health department administrators at the beginning and end of the first BRACE grant iteration, and will compare findings to subsequent iterations. BRACE-Illinois administered a pre- and post-questionnaire with the local health department grantees to better understand the efficacy of the mini-grant process. It also assessed the awareness and use of the heat toolkit, and continually evaluates the online course based on the pre- and post-test, along with tracking views of the educational video.

VULNERABLE POPULATIONS & HEALTH EQUITY:

The Illinois Climate and Health Report and adaptation plans identified vulnerable populations, vulnerable locations, and strategies on how to best address them. To pinpoint these populations, the CDC's Social Vulnerability Index was utilized to identify and map vulnerable communities. The Social Vulnerability Index map was applied to flood disaster areas and nursing homes and showed the western part of the state along the Mississippi River to be particularly vulnerable. When BRACE-Illinois used the Social Vulnerability Index map to assess asthma deaths and ozone pollution, it found vulnerability scattered throughout the state with some clustering occurring in the southern and western areas. IDPH is currently in the process of planning a strategy to address the above areas.



ADAPTATION IN ACTION

MASSACHUSETTS

“Climate impacts are predicted to increase the number of extreme heat events and degrade air quality; compromise infrastructure, homes, and buildings from sea level rise and flooding; increase the risk of injuries and fatalities from storm events; increase the risk of food and drinking water contamination; and increase vector-borne diseases.”

Margaret Round
Kate Adams
Marc Nascarella
Cara Sardone
Environmental Toxicology
Program, Bureau of
Environmental Health,
Massachusetts Department
of Health
<https://matracking.ehs.state.ma.us/Climate-Change/index.html>

THREATS TO HEALTH:

Recognizing that the health effects of climate change will be felt most directly at the local level, the Massachusetts Department of Public Health (DPH) is working with local health partners to address climate-related impacts in communities throughout the Commonwealth. These impacts include heat-related illnesses and death; exacerbation of respiratory and cardiovascular diseases including asthma, and increases in infectious and vector-borne diseases. This narrative highlights adaptation activities around the following factors impacting health:

- Resilience planning
- Extreme temperatures
- Emergency response in extreme weather

ADAPTATION IN ACTION:

Resources to Project Disease Burden: DPH is implementing the steps of the CDC BRACE framework to support local health efforts to prepare for the health implications of climate change. A key feature of this work is leveraging the Massachusetts Environmental Public Health Tracking (MA EPHT) portal to explore climate hazards, exposures, and vulnerabilities that impact health at the community level. Providing a single source of climate-related information enables local health departments with limited resources to target public health actions in the adaptation planning process.

Identifying Interventions: Massachusetts continues to lead the nation in addressing ways to mitigate the effects of climate change by reducing greenhouse gas emissions and supporting adaptation planning both statewide and at the local level. DPH was a key participant in the 2011 Massachusetts Climate Change Adaptation Report (MACCAP), which provided a road map for developing health-based adaptation strategies across all major sectors in Massachusetts. One of the primary public health recommendations from MACCAP was to strengthen the existing public health/health care/local health infrastructure system in Massachusetts to promote resilient communities that can better respond to climate impacts in the future. Funding from CDC's Climate and Health Program has enabled DPH to build on statewide adaptation planning efforts. DPH has developed tools and guidance to operationalize and disseminate information on climate impacts, vulnerabilities, and health-based strategies to support local adaptation planning efforts.

Successes: Through a joint effort with the CDC-funded EPHT program, DPH launched a vulnerability mapping tool on the MA EPHT portal to support hazard mitigation and climate adaptation planning efforts. The tool currently provides a suite of individual- and community-level vulnerability indicators, including upstream societal factors that contribute to health inequities in populations most at-risk to the long-term impacts of climate change.

DPH awarded funds to five local health departments to either begin or enhance adaptation planning efforts in their jurisdictions. The wide range of topics explored by local health department grantees demonstrated the variety of needs across the Commonwealth in developing and implementing adaptation plans. For example, two health departments were just beginning to assess their existing programs and associated resource needs. Meanwhile, other grantees leveraged funds to coordinate with local emergency preparedness partners to develop a toolkit for operating municipal warming and cooling centers. They established partnerships between trained medical and emergency response volunteers and elders in the community to prepare for either potential evacuation or sheltering in place during an extreme weather event.

DPH also was instrumental in developing an approach for integrating the health impact assessment framework into the BRACE framework. Health impact assessments represent an important strategy to engage community stakeholders in identifying suitable public health interventions and adaptation options to reduce climate impacts at the local level. This project involved a partnership between the DPH Bureau of Environmental Health, DPH Bureau of Community Health and Prevention, and two municipalities to conduct a health impact assessment of climate action strategies in rural and urban communities in western Massachusetts. The project explored how a health impact assessment framework can be used to advance regional climate action strategies for heat-related events and energy efficiency programs.

Challenges: While DPH has made significant progress with implementing CDC-funded climate and health initiatives in Massachusetts, there is an overall lack of resources available to local health departments for adaptation planning activities.

Evaluation: During the current cooperative agreement, known as the Climate and Health Adaptation Monitoring Program (CHAMP), the CDC is placing a greater focus on evaluation of the implementation of the BRACE framework (Steps 3-5). Drafted in Year 1, the Implementation and Monitoring Strategy (IMS) will assist in providing guidance to public health agents in Massachusetts and in receiving feedback to improve our efforts to support local health and municipalities planning for the health effects of climate change.

VULNERABLE POPULATIONS & HEALTH EQUITY:

The Vulnerability Mapping Tool allows local health partners to interactively locate and quantify populations potentially vulnerable to climate effects at the community and US Census tract levels. The indicators include the following characteristics: people younger than 5 years of age and over 65 years of age, those living alone, non-white populations, people with less high school education, groups living below poverty level, communities located in a flood zone, and amount of green space in the municipality.

Users can overlay various spatial data layers associated with such factors as flood zones, infrastructure (e.g., police, fire, town hall, hospital, and long-term care facilities), location of transportation systems, and location of public utilities. A key feature of the Vulnerability Mapping Tool is to provide community and US Census tract-level data to promote the use of social determinants of health in planning efforts that target the most vulnerable populations and areas. This approach is consistent with the overall mission of the DPH to promote wellness and health equity for all people in the Commonwealth.



ADAPTATION IN ACTION

MARYLAND

“In Maryland, we focused on quantifying the health impacts associated with extreme heat and extreme precipitation. Maryland’s geography and population distribution are such that these impacts are experienced very differently – from the eastern coastal communities, to the densely populated middle of the state, to the western Appalachian areas. We also focused, from the outset, on disparities in exposure and outcomes.”

Allison Gost, MPH
Program Manager, Maryland Department of Health, Environmental Health Bureau
https://phpa.health.maryland.gov/OEHFP/EH/Pages/Climate_Change.aspx

THREATS TO HEALTH:

Maryland notes increased risk of motor vehicle accidents following extreme rainfall events, increased risk of hospitalization for asthma during times of extreme precipitation and extreme heat episodes, and increased risk of food-borne disease in coastal communities around the Chesapeake Bay and Eastern Shore (from Climate and Health Profile Report). This narrative highlights the Maryland Climate Change Health Adaptation Program’s (MCCHAP) adaptation activities around the following factors impacting health:

- Gaps around climate and health engagement across Maryland
- Community resiliency
- Community isolation
- Health disparities

ADAPTATION IN ACTION:

Resources to Project Disease Burden: The Maryland Department of Health (MDH) researchers combined historical meteorological data (1960-1989) with historical health data to calculate the exposure response functions. Calculating from the 30-year baseline meteorological data, the 95th percentile for both heat and precipitation were assessed. MDH compiled county-specific burden of disease projections using county-specific historical health data, county-level climate projections, and the results of the exposure response function.

Once all assessments, calculations, and analysis were completed, MDH assessed vulnerability. MDH applied the Environmental Public Health Tracking Project-sourced baseline health data from 2000 to 2010 and added a set of standard socioeconomic indicators to the health data to allow for inter- and intra- comparison of vulnerability across counties.

Identifying Interventions: The Maryland Climate and Health Profile Report (CHPR) provided MDH with an empirical- and data-driven understanding of what climate effects will be of greatest concern to specific populations. Through communications in meetings and collaborations, MDH determined that, for some communities, their priorities did not align exactly with the concerns the CHPR highlighted. This mismatch of priorities required the interventions to be reframed in a way that addressed the needs of the community and the disparities and projected disease burden.

To determine the most suitable interventions, MDH used prior experience, evidence-based solutions, and brainstorming with community members. MDH found that the most successful programs for communities aligned with their beliefs, way of life, and perspectives. It included these factors in the intervention development, and they were critical to its success.

Successes: MDH is advancing the evidence-based intervention options developed through BRACE by putting into operation complementary adaptation strategies that have multiple public health and environmental benefits to prevent or reduce public health impacts of climate change. To encourage resilience, MDH hosted the Building Resilient Communities Stakeholder Forum in December, 2016. This event brought together key stakeholders, including many community members, organizations, and sectors from across the state. MDH understands the benefits of multi-agency partnerships, so they play an active role in many state and regional collaboratives. The MCCHAP team has a member appointed to three of the four workgroups of the Maryland Commission on Climate Change; works closely with other state agencies, including Departments of Planning, Environment, and Natural Resources; and is an active participant in the Eastern Shore Climate Adaptation Partnership (ESCAP).

MDH capitalized on its community engagement to achieve success advancing climate and health activities. A partnership with Suitland High School's Community hub is working toward establishing a Climate Ambassador program that aims to empower school-age youth to make changes in their lives both in school, at home, and in the larger community. MDH also has seen success with the short-term collaborations with organizations such as the Healthy Anne Arundel Coalition. The community and partner engagement has led MDH to be invited as participant or speaker at a myriad of community events and be seen as a resource guide for climate, health, and resiliency building.

MDH recognizes the importance of teaching successfully in order to further climate and health goals. MDH has collaborated with the University of Maryland Extension (UME) to develop a climate change and healthy homes curriculum for both extension educators and community health workers who work within UME. The team also collaborated with a multi-disciplinary team to develop school science curriculum around climate change, titled ScienceBEAT (<http://science-beat.blogspot.com/>). MDH has established a partnership with the Maryland Department of Natural Resources to help develop a school curriculum around sea level rise, climate change, and the Eastern Shore for the school district in Somerset County, MD, as part of a B-WET NOAA proposal.

Challenges: The MCCHAP program has faced challenges in reaching individuals from some communities, in aligning the goals of the climate and health program with the concerns and priorities of the communities, and in the development and implementation of tailored interventions to achieve the goals for heterogeneous communities. However, through reaching out to the Office of Minority Health and other BRACE grantees and listening instead of talking during community meetings, MDH has been able to more effectively address challenges and integrate lessons learned into future program activities.

The MCCHAP team expects challenges to continue, some that have been experienced already and others that have not yet materialized. However, the MCCHAP team plans to address the challenges head on and work toward solutions. To overcome these future challenges, MDH plans to continue developing relationships with trusted messengers from the communities, as well as to reach out and engage with youth.

Evaluation: In conjunction with George Mason University, MDH created a longitudinal survey of attitudes toward health and climate change to inform and evaluate attitudes about climate change and public health. For Phase II (2016- 2021), evaluation will be an integral component of the Implementation and Monitoring Strategy. MDH also aims to assess and measure the co-benefits to health of climate action in Maryland.

VULNERABLE POPULATIONS & HEALTH EQUITY:

The Public Health Strategy for Climate Change, in particular, is focused on addressing health disparities within vulnerable populations as they pertain to the current and future impacts of climate change on health. This includes not only those with higher present baseline health impacts or exposures, but also looking at what populations will have higher risk or exposure as the climate changes in Maryland. MDH is improving the resiliency and health of communities to address gaps in health equity, while also improving the overall health of the population. To this end, a partnership was created with the Minority Outreach and Technical Assistance mini grant program of the MDH Office of Minority Health and Health Disparities.

To address health equity, MDH plans to work within existing networks of organizations, departments, community groups, faith-based organizations, and the library systems. Working with existing partners is especially critical in vulnerable and disenfranchised communities. MDH plans to provide resources, educational information, and technical assistance to communities through these established channels. An overarching goal is to empower these communities with resources and knowledge directly to ensure community support for adaptation activities. This, in turn, contributes to increased resiliency and adaptive capacity of individuals to protect themselves in the face of climate change.

MDH recognizes the importance of relevant communication methods and the limitations that accompany email blasts and internet flyers. The program works on the grassroots level to identify best communication practices across communities to ensure effective information and resource dissemination methods for those populations. Without the partnership of organizations working in the communities, MDH would not be able to identify and implement a successful communication strategy that is critical to the success of the overall program.



ADAPTATION IN ACTION

NORTH CAROLINA

“Extreme heat events can have huge impacts on a multitude of conditions. Extreme temperature changes in the environment can contribute to poor air quality, increasing health risks among individuals with respiratory or cardiovascular disease.”

Lauren Thie, MSPH
Environmental Program
Consultant, Occupational &
Environmental Epidemiology
Branch, North Carolina
Department of Health and
Human Services
<http://epi.publichealth.nc.gov/oeep/programs/climate.html>

THREATS TO HEALTH:

In North Carolina, extreme heat and wildfire smoke are contributing to poor air quality, raising the risk for respiratory or cardiovascular diseases. The state also is experiencing sea level rise, which can increase the risk of injuries, drowning, and displacement. This narrative highlights adaptation activities around the following factors impacting health:

- Extreme heat events
- Increased risk of wildfire smoke exposure
- Sea level rise

ADAPTATION IN ACTION:

Resources to Project Disease Burden: The North Carolina Department of Health and Human Services (NC DHHS) estimated the burden of health outcomes due to climate change by using the EPA Environmental Benefits Mapping and Analysis Program (BenMAP; software that quantifies the health and economic cost of air pollution), in collaboration with the University of North Carolina at Chapel Hill and the U.S. Environmental Protection Agency. Several public health interventions were identified to address the greatest public health concern – heat-related illness and wildfire smoke. The timeframe for implementing the adaptation plan is September 2017 to August 2021.

Identifying Interventions: To address increased risk of heat-related illness, NC DHHS conducted a systematic review of relevant literature found through keyword searches on PubMed, Google, and Google Scholar. The review identified six interventions to reduce heat-related illnesses, which include a heat-alert system, education and information, access to cooling, real-time data syndromic surveillance and warnings, built environment solutions, and development of new zoning/building regulations.

The location found to be most vulnerable to heat was southeastern North Carolina, specifically the Sandhills region. The region consists of 11 counties, and NC DHHS plans to focus on four counties within that region (Bladen, Robeson, Sampson, and Scotland). Heat vulnerability was determined by using published literature and analyzing statewide emergency department data, which showed that the highest rate of emergency department visits for heat-related illness occurs in the Sandhills.

To further refine the target population, NC DHHS used maps to determine the counties most vulnerable to heat-related illness based on socioeconomic and health indicators of heat vulnerability. The department summarized available literature into maps created in geographic information systems. Map layers were created from published data and census data. Department staff also met with local stakeholders to gather the most appropriate indicators of heat vulnerability in these communities. In addition, North Carolina’s Disease Event Tracking and Epidemiologic Collection Tool (NC DETECT) graphs were created to support state and local health departments in heat-related illness tracking efforts.

Wildfire smoke interventions were identified through literature review of keyword web database searches through Web of Science and Google Scholar. Keywords – such as response, intervention, fire, and respiratory – provided the best results. From these literature reviews, interventions were assessed based on the amount of scientific support available. The review identified five interventions to reduce the impacts of wildfire smoke, including evacuation, air filtration and cleaners (home, room, and facility), forecast warning systems, and public service announcements.

Successes: NC DHHS identified infrastructures and communities at risk due to sea level rise. North Carolina's coastline consists of over 300 miles of beaches and more than 4,600 miles of shoreline along the coastal rivers, sounds, and wetlands. Over the last century, northeastern North Carolina has experienced a one-foot increase in sea level, and scientists expect the sea to rise more than three feet by 2100. Through collaboration with East Carolina University, the North Carolina BRACE program mapped sea level rise layers (from East Carolina University) and overlaid chemical and biological sites of concern (from EPA and the North Carolina Department of Environmental Quality). This mapping project identified vulnerable health-related infrastructure in several coastal counties, which could result in environmental exposures for nearby vulnerable populations.

Challenges: Timeline difficulties have presented a major challenge to NC DHHS. On October 8, 2016, Hurricane Matthew hit southeastern North Carolina and caused catastrophic flooding in the counties where the department was planning to implement its heat and wildfire interventions. The stakeholders had expressed interest in maintaining the heat work through the fall and winter. NC DHHS decided that communities were prioritizing immediate health needs and recovery in the aftermath of flooding. This pushed its planning work back a few months.

Evaluation: NC DHHS is currently planning evaluation activities for the intervention work and anticipates that it will take two to three years to fully implement and evaluate the interventions.

VULNERABLE POPULATIONS & HEALTH EQUITY:

For heat, the most vulnerable populations in North Carolina are males aged 25-44 who work outside. Older adults and families in low-income communities are also at increased risk for heat-related illness. People most vulnerable to wildfire smoke are those with pre-existing conditions, such as cardiovascular disease and asthma. The focus of NC DHHS' adaptation interventions will center on those most vulnerable to heat and wildfire smoke. The department plans to help communities identify and implement interventions that are cost-effective and sustainable with little to no additional support.

To address health equity, NC DHHS adaptation efforts focus on mitigating the burden of heat-related illness in vulnerable populations, such as people over 65, low income communities, those with little or no access to air-conditioning, and outdoor workers. This work centers on providing equal access to those affected by climate and health impacts.



ADAPTATION IN ACTION

NEW HAMPSHIRE

“In the Northeast, our climate is getting warmer, and wetter, with more severe weather events. Our BRACE hazard assessment confirmed many of these trends in New Hampshire, and the health burden assessment continues to explore the association of weather and climate change to health impacts in New Hampshire.”

Matt Cahillane, MPH
Program Manager, Climate and Health Program, Bureau of Public Health Protection, New Hampshire Department of Health and Human Services

www.dhhs.nh.gov/dphs/climate/index.htm

THREATS TO HEALTH:

Rising temperatures in New Hampshire are linked to increased risk of hospitalization due to heat stress, renal problems, and asthma. Increased frequency of severe summer weather events is associated with injuries. And the incidence of Lyme disease has increased due to both land use changes and climate factors that extend the geographic range of black-legged ticks. This narrative highlights adaptation activities around the following factors impacting health:

- Warmer temperatures
- Vector-borne disease
- Extreme weather

ADAPTATION IN ACTION:

Resources to Project Disease Burden: The New Hampshire Department of Health and Human Services (NH DHHS) employed multiple resources to estimate the health burden associated with climate change and inform adaptation planning activities at the state and local level. Resources for adaptation included CDC BRACE science team staff, CDC guidance documents, and studies noted in the US Global Change Research Program’s National Climate Assessments. NH DHHS also encourages state adaptation partners to use an in-house dynamic data portal, called WISDOM, to perform active queries of trends in heat-related illness, asthma, injuries, and other outcomes.

NH DHHS utilized resources within the NH Environmental Public Health Tracking (EPHT) Program to distribute and train partners on a Social Vulnerability Index (SVI) query tool that can identify at-risk populations. The SVI uses data from 16 U.S. Census metrics for vulnerability spanning three categories including demographics, transportation and housing, and socioeconomics. In addition, the NH DHHS utilized in-house epidemiologists and outside contractors to assess environmental exposures and estimate climate-related health impacts like heat stress and injuries.

Staff and Partnerships to Assess Disease Burden: An environmental epidemiologist within NH DHHS used Step 2 and 3 of the CDC BRACE framework for “Estimating Disease Burden” and “Assessing Public Health Interventions” related to extreme weather and climate change. Specific tasks included accessing and formatting data, developing viable indicators for exposures and health outcomes, and using analysis techniques to discover disease patterns. For example, the epidemiologist worked with other New England BRACE and EPHT partners to estimate the association between heat index and all-cause hospital admissions in order to demonstrate the impact of moderate and extreme heat events on health across New England.

Early findings indicated that moderate heat events (85-95°F heat index) were associated with a rise in hospital admissions that equaled or exceeded the

impacts from extreme heat events alone (over 95°F). In addition, the NH DHHS funded a graduate student at Plymouth State University to look at warm-season extreme weather events and injuries. Results indicated that hot days were related to a significant increase in risk of hospital visits for heat-related outcomes, and much less significantly for motor vehicle accidents and all-cause injuries. The meteorological data analysis covered the past 35 years, and the health burden analysis assessed health impacts over the past 10 years.

Identifying Interventions: To identify the public health interventions most suitable to address the health outcomes of greatest concern for New Hampshire, NH DHHS reviewed existing intervention assessments conducted by other BRACE partners. A literature review of additional studies by topic area also took place, and stakeholder assessments were performed to determine local wants and needs. NH DHHS funded four Regional Public Health Networks (RPHNs) to develop climate and health adaptation plans, based on a specific priority climate hazard and health issue, as well as a viable intervention.

The project helped to identify viable evidence-based interventions in four areas, including: 1) education of caregivers on heat stress among rural elders living alone, 2) education of day-camp counselors on tick exposure among youth in summer recreation programs, 3) expanding access to extreme weather and community resilience via alert systems, and 4) education on heat stress prevention among urban residents via municipal emergency directors.

Successes: NH DHHS successfully executed a full implementation of the BRACE framework at the state and local level. For example, the NH team assessed climate hazards by hiring subject matter experts to model regional impacts using atmospheric and hydrologic data gathered over the past 80 years. DHHS also estimated health impacts of heat stress via a regional partnership, and contracted with a university to generate an analysis of extreme weather and injuries. The NH DHHS also funded four regional climate and health adaptation efforts, and supported the implementation of evidence-based interventions.

Challenges: Engaging stakeholders was often difficult due to limited ability to quickly distribute funds, limited technical support for complex assessments, and limited evidence-based interventions related to climate change and health. Accurate assessments of the local impacts were challenging to analyze due to limited statistical power in small populations. Also, limited funds were available for the execution of communication and outreach programs to distribute the findings.

Evaluation: DHHS worked on improving future interventions using the New Hampshire BRACE Step 5 for Evaluating Impact and Improving Quality of Activities, including assessing process measures and outcome measures. Through the process, NH DHHS monitored performance measures and used the results to advise corrective action and improve program outcomes. For the BRACE projects with education and behavior change components, regional health agencies utilized pre- and post-assessments of target groups through written surveys.

VULNERABLE POPULATIONS & HEALTH EQUITY:

By using the tools discussed above, NH DHHS scanned the state and discovered unique vulnerabilities that allowed them to better inform particular geographic areas when designing their adaptation plans. For heat stress, adaptation plans focused on the elderly living alone in the more rural Upper Valley region and lower-income neighborhoods in the urban Nashua region. For tick habitat and Lyme disease, adaptation plans focused on summer youth programs in the mid-state Lakes Region. For flooding and extreme weather, adaptation plans focused on all-hazards alert systems and community resilience in the Monadnock area near Keene. Another state-level project was supported to assess the relationship between rising water temperatures, viability of commercial oyster beds, and shellfish food safety via testing of vibrio cholera bacteria on the seacoast. The project also tested interventions to cool and shade the shellfish to reduce the risk of food poisoning.

NH DHHS plans to continue assessing the needs of its vulnerable and low-income communities with regional agencies as part of its climate adaptation activities. To support this effort, NH DHHS will collaborate on future interventions with state agencies responsible for the elderly, worker health, and emergency preparedness.



ADAPTATION IN ACTION

OREGON

“Perhaps our greatest success has been to connect climate change to all programmatic areas of public health, framing our Resilience Plan within the modernization of public health, rather than environmental health alone.”

Emily York, MPH
Program Coordinator,
Climate and Health Program,
Oregon Health Authority
[www.healthoregon.org/
climate](http://www.healthoregon.org/climate)

THREATS TO HEALTH:

Oregon has several distinct climate regions. In much of the state, air pollution from increased wildfire smoke will increase the risk of respiratory and cardiovascular illnesses. In Oregon’s agricultural communities, drought conditions are threatening family incomes and quality of life. On the coast, communities are bracing for more storms and floods that affect their infrastructure and water quality. Tribal communities risk food insecurity and further loss of native roots, berries, fish, and game. This narrative highlights adaptation activities around the following factors impacting health:

- Resilience planning
- Climate and health awareness
- Community engagement

ADAPTATION IN ACTION:

Resources to Project Disease Burden: The Oregon team published a Climate and Health Profile Report that outlined different health risks that will increase based on climate projections. The report also describes populations most vulnerable to these risks.

Identifying Interventions: The Oregon Climate and Health Program conducted a literature review of evidence-based interventions. It also reviewed over 30 existing plans recently produced by partners from public health and other sectors in the state, including community based organizations that serve populations identified as most vulnerable to climate risks.

Based on the guidance of an advisory group of 20 diverse experts, the team used a strengths-based approach, rather than a risk-based approach to prioritize interventions for a statewide Resilience Plan. Using criteria developed by the advisory group, it identified strategies ripe for collective impact to advance climate and health goals. The Resilience Plan was completed with the help of over 50 contributors and includes specific case studies of public health work already in progress.

Successes: The Oregon Climate and Health Program was successfully able to connect climate change to all programmatic areas of public health. Part of what enabled this was the decision to organize the strategies within the state’s Public Health Modernization framework, rather than by climate hazard. Cross-cutting priorities include building climate literacy among the public health workforce, improving air quality through strategies that achieve both climate mitigation and adaptation goals, integrating more ‘social cohesion’ strategies into public health service delivery, and leveraging partnerships to strengthen local food systems.

The program has created a total of 14 climate and health videos featured on its Climate and Health YouTube channel and has hosted a Resilience Speaker Series to explore definitions of resilience and make connections with various programs within the field of public health.

Stories and images were collected to illustrate different perspectives on the health effects of climate change in Oregon. The “Story Quotes” are included in the program’s publications and used in presentations and social media posts.

The Oregon Climate and Health Program has provided support and resources to five partner health departments across the state to implement climate and health interventions at the local level. Interventions have addressed a diversity of climate risks, including wildfire, drought, and extreme heat. The program has also developed a Resilience Planning Toolkit that provides guidance to local health jurisdictions based on the lessons learned from local partners.

Challenges: Approaching the planning project with a conventional risk mitigation approach presented many challenges. When the program shifted to a more strengths-based approach, it was able to successfully engage more partners and identify strategies that build resilience to multiple climate risks.

Environmental health programs are not universally implemented across the state. More than a quarter reported not having the basic capacity to conduct mandated inspections, and over 90 percent of health departments within the state reported having only partial-to-minimal ability to identify and prevent environmental health hazards.

Evaluation: The strategies in the new Resilience Plan have specific actions recommended at the local and state level. The local actions have been incorporated into an existing required annual “Capabilities Assessment” completed by all local public health preparedness planners. The findings from this annual assessment, along with the state-level actions tracked through the Public Health Division’s Strategic Plan, serve as statewide progress measures for building climate resilience within the state’s public health system.

VULNERABLE POPULATIONS & HEALTH EQUITY:

The Oregon Climate and Health Resilience Plan incorporates strategies to address health equity by including a specific Health Equity section of strategies, while also integrating health equity throughout each of the other six strategy areas. As part of the planning project, the team produced a series of animated ‘explainer videos’ to help educate viewers on the connections between climate change and health equity. The program has found success in framing climate change as a “risk-multiplier”, emphasizing how climate change creates additional stressors for those already bearing a disproportionate burden of disease. When discussing vulnerable populations, the team explains that the communities hit first and worst by climate change are the communities with the fewest resources to cope, recover, and adapt.

The program has found that addressing health equity through climate adaptation means investing more time in listening to communities on the front lines of climate change. To this end, the program has worked closely with community partners like the Confederated Tribes of Warm Springs to share community-identified concerns and priorities. These stories and partnerships can then help to inform statewide decision-makers as they grapple with the benefits and burdens of proposed climate policies.



ADAPTATION IN ACTION

WISCONSIN

“We realize that in order to plan for, implement, and evaluate our adaptation plan intervention strategies, we must use a health equity lens and work with the populations that will be most affected by climate-related health impacts.”

Colleen Moran, MPH, MS
Program Manager,
Climate and Health
Program, Wisconsin Dept. of
Health Services
www.dhs.wisconsin.gov/climate

THREATS TO HEALTH:

Climate data indicate that Wisconsin is generally becoming warmer and wetter. Heat extremes are increasing the risk of heat-related morbidity and mortality. Wisconsin has the potential for periods of drought that can adversely impact public health through changes in quantity and quality of drinking water, food insecurity, and diminished air quality from dust and airborne particles. More frequent and intense precipitation events are increasing the risk of flood-related food- and water-borne illness, injury, and drowning. Extreme winter weather can cause a variety of public health impacts, including the risk of injury and death from traffic accidents and power outages, putting critically ill patients at risk. This narrative highlights adaptation activities around the following factors impacting health:

- Increased risk of heat-related illness
- Increased flooding

ADAPTATION IN ACTION:

Resources to Project Disease Burden: The Wisconsin Climate and Health Program (WCHP) utilized results of the Wisconsin Initiative on Climate Change Impacts (WICCI) report as the primary data source for climate change projections in the state of Wisconsin. To project the burden of heat-related mortality in Wisconsin, WCHP incorporated the use of both the WICCI climate projection data and data generated from the EPA’s Environmental Benefits Mapping and Analysis Program (BenMAP; software that quantifies the health and economic cost of air pollution and heat-related mortality).

Identifying Interventions: WCHP used a combination of strategies to identify public health interventions. Following step 3 of the CDC BRACE framework (Assessing Public Health Interventions), WCHP worked to identify the best interventions for each climate-related impact in collaboration with the Midwest by Southeast BRACE Collaborative (including Michigan, Minnesota, Illinois, North Carolina, Florida, and Wisconsin).

This collaborative created a matrix to conduct a gap analysis to determine where to focus the WCHP’s future efforts. Once those topic areas were determined (flood vulnerability, vector-borne diseases, and heat/respiratory health), a second matrix was used to decide which strategies would work best to address these vulnerabilities in Wisconsin. Input was obtained from the Science Advisory Group through use of a Racial Equity and Social Justice tool to make final decisions about which strategies to include in Wisconsin’s Climate and Health Adaptation Plan.

Successes: Guided by insights gained from the WICCI climate data projections, WCHP created toolkits for weather-related emergencies. Located online, these toolkits can help local governments, local health departments, and residents prepare for or respond to extreme heat, flood, winter weather, wildfire, chemical releases, harmful algal blooms, drought, thunderstorms and tornadoes, and vector-borne disease. In addition, WCHP offers a community engagement toolkit.

Challenges: The development plan faced challenges bringing together a group of diverse people from different agencies and programs in a short period of time.

Evaluation: Although WCHP is only one year into its five-year adaptation plan, the evaluation plans are already being developed. Along the way, toolkits will continue to be updated as interventions evolve and as feedback is received.

VULNERABLE POPULATIONS & HEALTH EQUITY:

Following step 1 (Forecasting Climate Impacts and Assessing Vulnerabilities) of the BRACE framework, a Heat Vulnerability Index (HVI) and accompanying maps were created. This HVI is able to identify where the populations most vulnerable to extreme heat are located in Wisconsin. WCHP is currently in the process of creating a similar Flood Vulnerability Index and accompanying maps. It will identify the locations in Wisconsin where populations are most vulnerable to flooding events.

To work toward health equity, WCHP has created and facilitated two health equity teams. The first team is an internal Climate and Health Program Equity Advisory Team. The other is an external Health Equity Action Team (HEAT). The Advisory Team guides the program on the structure and functioning of HEAT. The members of HEAT are representatives of organizations tied to the previously identified priority populations.

The diverse perspectives of members are utilized to evaluate and improve adaptation strategies. Through the work of HEAT, WCHP plans to integrate health equity into future intervention strategy selection, implementation plans, evaluation plans, and the interpretation of the evaluation data. By working with priority populations to inform them of the work of WCHP, the program hopes to create strategies that focus on health equity first.



ADAPTATION IN ACTION

RHODE ISLAND

“While extreme heat is a major public health threat across the country, people in the Northeast may be especially vulnerable because residents are less physiologically adapted to extreme heat. Populations are older and have a higher prevalence of certain chronic diseases than in other parts of the country. Meanwhile, the availability and use of air conditioning, which is currently the best protection against extreme heat, are lower.”

Julia Gold, MA
Climate Change Program
Manager, Center for Healthy
Homes and Environment,
Rhode Island Department of
Health
www.health.ri.gov/programs/climatechangeandhealth

THREATS TO HEALTH:

In Rhode Island, an increase in both winter and tropical storm intensity poses the threat of more injuries and deaths. This is due to a potential loss of power for air conditioning, heat, or medical needs; the loss of other critical infrastructure; and difficulty accessing resources. Residents also experience declining air quality and increased pollen and aeroallergens and pollution exposure, which heighten the risk for asthma and allergy exacerbations. This narrative highlights adaptation activities around the following factors impacting health:

- Warmer temperatures
- Elderly resilience

ADAPTATION IN ACTION:

Resources to Project Disease Burden: Rhode Island Department of Health (RIDOH) used several different types of resources to assess the burden of disease, including health records of hospital visits, vital records, and insurance claims; meteorological data from the National Weather Service and the National Climatic Data Center; water quality data from the Watershed Watch and Beaches Program; pollen data from local Asthma and Allergy Centers; tick data from The Tick Encounter Research Center at University of Rhode Island (URI); URI STORMTOOLS for projected storm surge and sea level rise; Geographic Information System (GIS) mapping; U.S. Census data, on which a social vulnerability index was generated; and local stories, past events, and qualitative data from community and state partners.

Identifying Interventions: Interventions deemed most suitable to address Rhode Island’s climate-related health outcomes varied from policy development and pilot programs to direct outreach and education. RIDOH’s decisions were informed by empirical evidence, community priorities or expressed needs, opportunities for measurable impact, and positive partnerships. Community, state, and local partners, as well as an advisory committee, aided in continually assessing priorities and interventions. As RIDOH continues to develop adaptation plans, it weighs climate risks, evaluates activities used to address the respective risks in the past, and gauges opportunities for change and the ability for the program to contribute to positive outcomes. RIDOH continually reevaluates priorities and makes changes as needed.

Successes: RIDOH’s program has developed a climate change educational film, helped establish a state climate change website, and created other educational resources. All of the state agencies can use these materials to communicate about climate change to the public, vulnerable populations, and key stakeholders. The program is working with communities to develop initiatives focused on heat policies and communications, elderly preparedness

and resilience, vector-borne diseases, mental health, green infrastructure solutions, and climate change outreach and education.

Another success of the program was the creation of Northeast Regional Heat Collaborative. Made up of public health agency partners from Maine, New Hampshire, and Vermont, the group has collectively analyzed data across New England to inform public health policy. It has measured the impacts of heat on hospitalizations and deaths and has partnered with the National Weather Service (NWS) to address heat impacts and improve communications across the region. The group has successfully changed the NWS Heat Advisory Policy for all of New England to more appropriately address health risks and create an opportunity to reduce negative health impacts in communities.

Challenges: Rhode Island has found that predictions of vector populations and vector-borne disease rates, water-borne disease trends, air quality impacts, and changes connected to ecosystems are more complicated to quantify and predict future burdens. Community engagement and grassroots efforts can be a challenge for RIDOH programs that have little capacity or staff. The department relies heavily on community and institutional partnerships to be able to involve the public.

Evaluation: RIDOH has created surveys to evaluate outreach, events, and other activities included in climate and health adaptation plans. RIDOH plans to design further evaluation efforts in Phase II as new interventions and plans are developed.

VULNERABLE POPULATIONS & HEALTH EQUITY:

Rhode Island's Climate Change and Health Resiliency report documents the range of health impacts associated with climate change and identifies the most vulnerable populations.

RIDOH found elderly residents to be especially vulnerable to extreme weather, power outages, and other disasters. To ensure that elderly residents are protected from extreme events and able to remain sheltered safely in place whenever possible, it created the Senior Resiliency Project. The Senior Resiliency Project coordinates with a team of partners and stakeholders to assist long-term care facilities. This encompasses supporting residences in facilities and independent senior housing to prepare for disasters through site-specific energy resiliency audits. It also develops all-hazards emergency plans that emphasize sheltering in place rather than evacuation. The project's goal is to significantly improve emergency plans and their resilience during disasters.

The report also identified urban residents, and particularly those with limited social or financial resources, as populations vulnerable to extreme heat and extreme weather events. These populations were the focus of a Climate Change and Environmental Justice Lab developed in collaboration with Brown University. The lab was a yearlong, for-credit academic course that investigated ways to reduce the climate change-related public health risks to individuals in a pilot neighborhood in Providence. The aim was to increase the capacities of the neighborhood to respond to climate change threats. Furthermore, the lab explored the development of green infrastructure in cities and other urban design solutions to mitigate the urban heat island effect and help communities better prepare and recover from extreme weather events and power outages.



ADAPTATION IN ACTION

NEW YORK STATE

“Extreme weather has become more frequent in New York State, and the climate is becoming warmer and wetter. Our state’s diverse geography and population creates challenges for our climate and health adaption planning efforts, which focus on protecting our most vulnerable communities and citizens during extreme weather.”

Asante Shipp Hilts, DrPH,
MPH
Senior Project Coordinator,
Office of Public Health Practice,
New York State Department
of Health
[www.health.ny.gov
/environmental/weather](http://www.health.ny.gov/environmental/weather)

THREATS TO HEALTH:

As patterns in extreme weather and warmer, wetter climates shift, New Yorkers are increasingly at risk for health effects associated with this weather. These changes increase the occurrence and duration of a variety of health effects, such as seasonal allergies, respiratory conditions, cardiovascular disease, heat-related illness, and stress impacts associated with extreme heat, cold, and wet weather, and flooding. It is essential that planning and adaptation efforts take place to minimize health impacts on New Yorkers and build resiliency and protection against projected future impacts. This narrative highlights adaptation activities around the following factors impacting health:

- Emergency preparedness
- Water quality
- Increased risk of heat-related illness

ADAPTATION IN ACTION:

Resources to Project Disease Burden: The New York State Department of Health (NYSDOH) Climate and Health Profile Report (June 2015) describes New York State population trends and climate zones that challenges our public health practitioners to deliver programs that address geo-spatial climate and health needs. We have identified conditions that make New Yorkers particularly vulnerable to climate and health impacts, such as poverty, underlying health conditions, aging, or living and working in conditions subject to extreme weather and flooding.

Identifying Interventions: Building off the blueprint described in the Climate and Health Profile, NYSDOH continues to leverage resources within the agency and with other federal, state, and local partners to target scientifically proven interventions to its most vulnerable populations, and to integrate adaptation planning into existing programs across New York State. Examples of some successes are described below.

Successes: NYSDOH published an extensive study to assess the impacts of Superstorm Sandy on public health infrastructure in New York State. The findings were published in the journal *Disaster Medicine and Public Health Preparedness* and inform future public health initiatives in extreme weather preparedness and response.

New York State’s Climate Smart Communities (CSC) program continues to provide local governments with guidance on how to reduce greenhouse gas emissions, save taxpayer dollars, and advance community goals for health and safety, economic vitality, energy independence, and quality of life. It is sponsored by the Department of Environmental Conservation, the NY State Energy Research and Development Authority, the Department of Transportation, NYSDOH, the Department of State, and the Public Service Commission.

NYSDOH's drinking water program uses Recommended Standards for Water Works for all water system design approvals. These include measures for protection against flooding and power loss and encourage redundant water sources where practical. New York's Private Water Well Design Standards similarly include provisions for protection against flooding. NYSDOH's drinking water program also reviews and approves local Vulnerability Assessments and Emergency Response Plans for water systems serving more than 3,300 people. These assess vulnerability of water facilities to flooding, drought, and loss of water source(s) and develop appropriate response plans for these issues. NYSDOH's Drinking Water Program also is working to identify and provide guidance to owners on existing private water wells that may be vulnerable to climate change.

NYSDOH works closely with the Department of Environmental Conservation, local health departments and NYS Parks and Historic Preservation on comprehensive response planning to address harmful algal blooms in New York freshwaters. Response efforts address bloom impacts on water recreation and drinking water supplies.

Challenges: New York State's greatest challenges for Climate and Health initiatives relate to allocation of resources, staff, and coordination and communication of program goals and deliverables. Successes in overcoming these challenges result largely from the program's ability to integrate climate and health into existing state and local programs and coordinate efforts. However, this approach creates challenges for sustainability because, as priorities change, resources are pulled in the direction of greatest need.

Evaluation: NYSDOH is developing the evaluation plan for the intervention work. The program is currently in Year 2 of the grant, and evaluation will take place in Year 5.

VULNERABLE POPULATIONS & HEALTH EQUITY:

NYSDOH's Environmental Public Health Tracking (EPHT) Program created the [Heat Vulnerability Index \(HVI\)](#) to identify areas in the state with population characteristics that indicate vulnerability to the health impacts of hotter weather. Identifying vulnerable populations can help local health departments plan and work with program partners to decrease the potential impacts of heat on health. NYS's vulnerable populations include older adults, children, those with low socioeconomic status, minorities, those who are socially isolated, and those living in highly developed urban areas.

NYSDOH's EPHT Program mapped locations of cooling centers, which are places where people can cool off during hot days. These locations are available at <https://www.health.ny.gov/environmental/weather/cooling/>. NYSDOH works with local health and emergency preparedness agencies to identify and update locations of cooling centers each year. NYSDOH is also investigating the distribution, accessibility, and use of cooling centers across the state.

The National Aeronautics and Space Administration (NASA) awarded NYSDOH an Applied Science grant to incorporate satellite data and develop community-level indicators for surveillance of temperature trends, extreme heat events, and climate projections. The program is also compiling county heat-health profile reports that summarize these community indicators, county-specific heat-related health outcomes, population heat vulnerability, and heat-adaptation resources. The county health profiles will be added to [New York State's Environmental Public Health Tracker](#) and can help local governments understand and prepare for the impact of heat in their counties.

NYSDOH is working with local national weather service offices to lower heat warning thresholds in New York based on NYSDOH research into health effects of heat events. Efforts are underway to refine messaging for vulnerable populations during extreme heat events. This year, the program published a fact sheet warning against the use of fans during extreme heat waves. The program is working with the New York City Department of Health to validate a newly developed fine-scale dataset that will allow researchers to estimate urban heat island effects in cities. Finally, NYSDOH is sharing experiences in the use of satellite data to improve climate action with Columbia University and the City of Chicago to inform the development of their satellite-based climate surveillance program.

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A Call for Continued Adaptation

The scientific consensus is clear: climate change is happening. What is also clear: the environmental consequences associated with climate change pose serious threats to human health. As such, CDC's Climate and Health Program is a natural extension of the agency's mission to protect the public's health by safeguarding the nation against preventable disease, disability, and mortality. In facing health threats, CDC depends on its state and local partners to tailor efforts to meet the unique needs of diverse communities. CDC's Climate-Ready States and Cities Initiative is a vital part of preparing the nation for climate change.

To learn more about climate change and human health, visit
www.cdc.gov/climateandhealth and www.apha.org/climate.



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