CHAPTER 8:
Climate & Health

INTRODUCTION

The climate of Connecticut is changing and these changes pose risks to the health of our populations. Rates of Emergency Department (ED) utilization for heat-related illness are associated with annual rates of extreme heat days and differences in ED visit rates for heat-related illness are evident between race/ethnicity groups in our state. Another outcome associated with increasing temperatures globally is rates of infection with the pathogen *Vibrio*, and these rates have been on the rise in our state since the mid-1990s.

National assessments recognize populations most vulnerable to the impacts of climate change to include those with low income, some communities of color, as well as numerous other distinct vulnerable populations. National standards identify a vulnerability assessment as a necessary first step for state health departments to address the health impacts of climate change. Currently, those state health departments that undertake such assessments have dedicated programmatic support from CDC to address the health impacts of climate change in their populations.

Although DPH did a preliminary assessment of the health impacts of climate change in Connecticut at the beginning of this decade, our agency has not yet conducted a more detailed assessment to identify populations most vulnerable to climate change, nor does DPH have a dedicated program focused on climate and health. Coordination with other state agencies, local health directors, Connecticut universities, and non-governmental stakeholders will be important for addressing the impacts of climate change in Connecticut.

CHANGES TO OUR CLIMATE

Regional and local climates and weather patterns throughout the world are changing.[1;2;3] Connecticut's climate is no exception to this trend, with average annual temperatures and precipitation totals that have been increasing in the state since the late 1800s, as well as temperature and precipitation extremes that are becoming more frequent (**Figure 8.1**).[4] Our state's climate is predicted to continue to change through at least the end of this century, and consequences include increased risk of extreme weather and associated events, such as severe heat and heat waves, floods, and droughts.[4;5]

The rates of temperature increase occurring in our state are not the same across all seasons, geographic areas, nor time of day. Connecticut's winter temperatures have increased the most rapidly in recent decades compared to other seasons. Projections for the future include increases in average annual temperatures by 5°F by mid-century compared to the last three decades of the 20th century, with rates of increase being highest in the summer months for the future. In general, Connecticut's patterns of temperature increase are similar to those of other states in the Northeast, which, as a region, is warming more rapidly than the rest of the U.S.[4]

Annual average precipitation totals have also increased in Connecticut in recent decades, with most of the increases occurring during the summer and fall. As temperatures increase, rainfall becomes less frequent, yet more intense, due to the capacity of warmer air in the atmosphere to hold more moisture.[4] Extreme precipitation events, such as increases in the number of days with more than one inch of precipitation, and increases in the number of days with heavy precipitation, are projected for the future in Connecticut. As a region, the Northeast has experienced greater increases in rates of extreme precipitation

UNDERSTANDING WEATHER AND CLIMATE

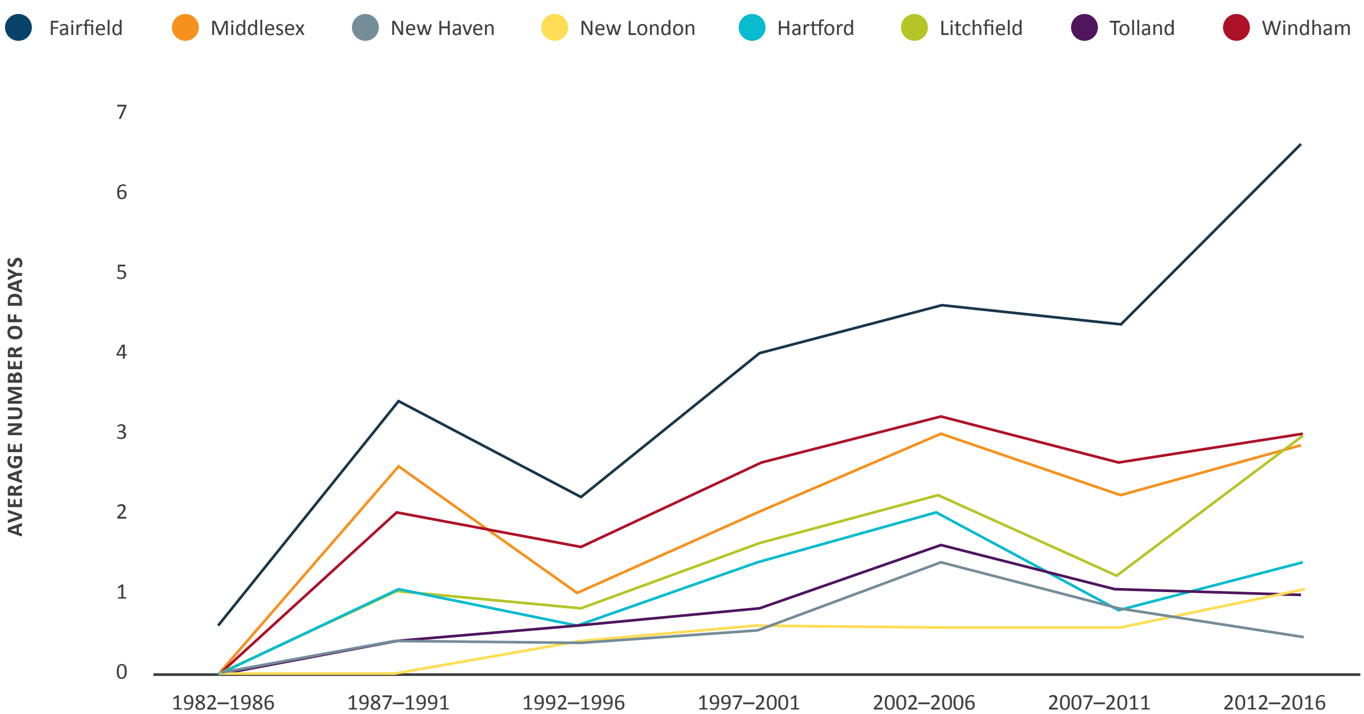
- Weather and climate are two closely related concepts that are often confused with one another. The term weather is typically defined as the state of the atmosphere with respect to precipitation, temperature, humidity, wind, visibility, and cloudiness on a daily or hourly basis in a specific location. *Climate* on the other hand, refers to average weather patterns observed for a location over a long period of time, usually longer than 30 years.[1]

- Knowledge of the climate is important to predict the probability of certain types of weather occurring in a specific region, but cannot be used to predict a specific weather event. An easy way to remember the difference is that climate is what we *expect* and weather is what we *get*.[1]

- A consensus of scientists agree that changes to climate worldwide are caused by human activities, such as extracting and burning coal, oil, and gasoline and cutting down and burning forests, which have dramatically increased the amount of heat-trapping gases, also known as "greenhouse gases," released into the atmosphere.[2;3] events, as well as sea level rise, compared to any other region in the US.[5] As such, increasing extreme precipitation and flood risk (both inland and coastal) help to characterize the experience of our populations with climate change relative to people that live in other parts of the country (**Figure 8.2**).[6]

While extreme precipitation is projected to increase in the future for Connecticut, the majority of that intensity is expected for future winters and springs. By contrast, during the summer, higher temperatures are expected to increase the risk of drought in Connecticut through at least mid-century. The length of the growing season in Connecticut is expected to increase by approximately 30 days by mid-century relative to the last three decades of the 20th century.[4]

FIGURE 8.1: Average number of days annually with maximum temperatures > 90 °F, by county and five-year time period, CT, 1982–2016



Source: *Centers for Disease Control and Prevention, National Environmental Public Health Tracking Network. Data analyzed September 30, 2019. Retrieved from www.cdc.gov/ephtracking*

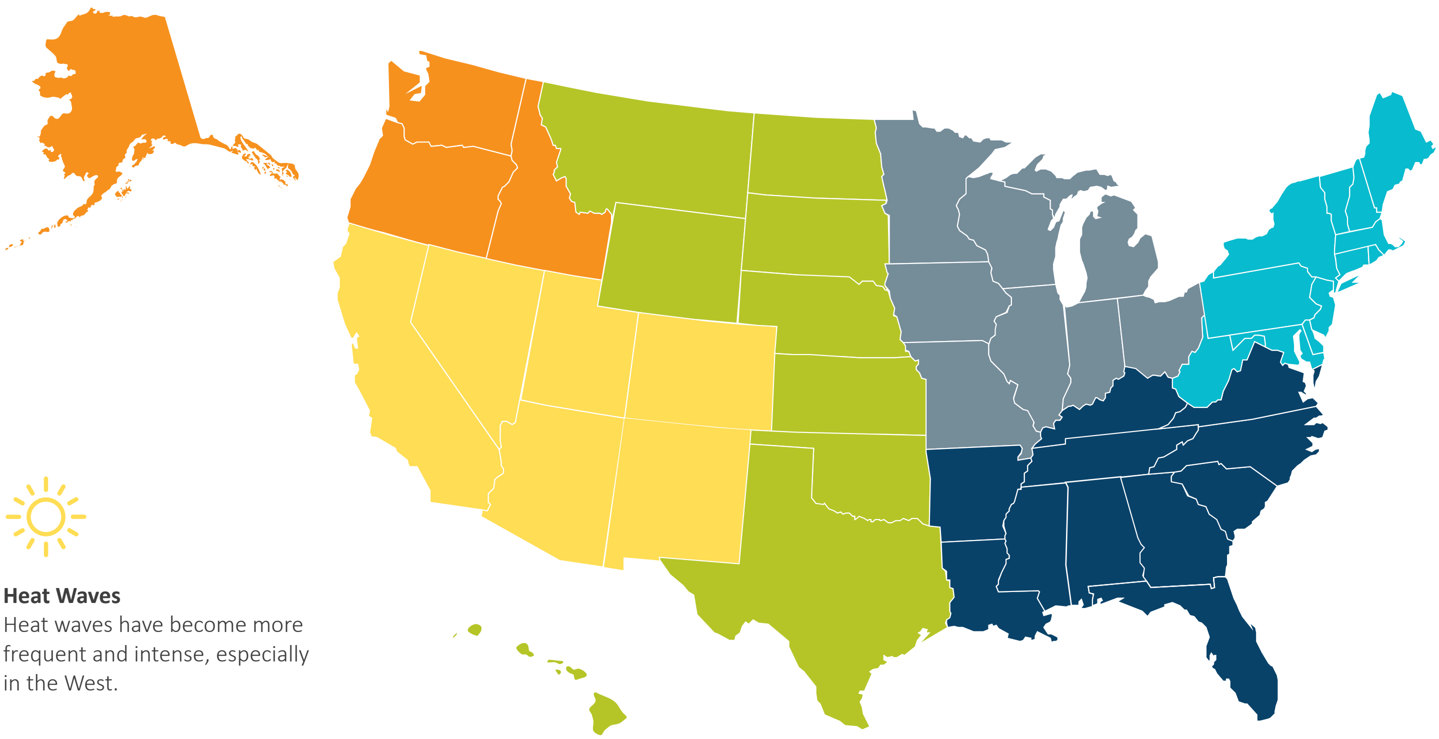
FIGURE 8.2: Major US national and regional climate trends.

Wildfires
Wildfires in the West start earlier in the spring, last later into the fall, and burn more acreage.

Rising Temperatures
U.S. average temperature have increased by 1.3°F to 1.9°F since record keeping began in 1895. Warming has been the greatest in North and West while some parts of the Southeast have experienced little change.

Floods
Floods have been increasing in parts of the Midwest and Northeast.

Extreme Precipitation
Heavy downpours are increasing nationally, especially over the last three to five decades. The largest increases are in the Midwest and Northeast.



Heat Waves
Heat waves have become more frequent and intense, especially in the West.

Drought
Droughts have increased in the West. Over the last decade, the Southwest has experienced the most persistent droughts on record.

Cold Waves and Winter Storms
Cold waves ahve become less frequent and intense across the Nation. Winter storms have increased in frequency and intensity since the 1950s and their tracks have shifted northward.

Sea Level
Sea levels along the Mid-Atlantic and parts of the Gulf Coast have risend by about 8 inches over the last half century.

Hurricanes
The intensity, frequency, and duration of North Atlantic hurricanes, as well as the frequency of the strongest (category 4 and 5) hurricanes, have all increased since the early 1980s.

Source: *Balbus, J., Crimmins, A., Gamble, J. L., Easterling, D. R., Kunkel, K. E., Saha, S., & Sarofim, M. C. (2016). Ch. 1: Introduction: Climate Change and Human Health. In The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. (pp. 25–42). Washington, D.C.: U.S. Global Change Research Program.*

FOUNDATIONAL WORK ON CLIMATE AND HEALTH

It is now recognized by a broad range of international and national organizations that changes to the climate are negatively impacting human health and will continue to do so in the future.[6;7;8] Health outcomes in Connecticut's populations are sensitive to many of the environmental hazards posed by our changing climate, as detailed throughout this chapter. DPH expects negative impacts of climate change on the health of our residents in the future, in the absence of aggressive global mitigation of greenhouse gases and development and deployment of strategies to develop adaptive capacity in our communities, a concept also described later in this chapter. This conclusion is based on a variety of assessments, both for the region and for neighboring states, which have dedicated state health programmatic support from CDC to address the health impacts of climate change.[5;9;10;11]

Support for the prediction of negative health outcomes in our populations due to climate change also comes directly from the work that DPH did in collaboration with state partners at the beginning of this decade. Specifically, our agency contributed to both an impacts assessment and preparedness plan released in 2010–2011 by the Adaptation Subcommittee of a statewide government committee dedicated to addressing the impacts of climate change on our state.[12;13] The result of this work was a series of statements about potential impacts of climate change on health in Connecticut, as well as recommendations for Connecticut to prepare for these impacts (see call-out box below). As described in the first report, the work of this subcommittee was limited due to the pressing priority of addressing the H1N1 influenza pandemic. A more comprehensive assessment was recommended. According to national standards, a climate and health assessment focused on population vulnerabilities is an essential first step for state and local health departments to evaluate and prepare for the negative health impacts of climate change.[14] Currently, it is primarily only those states with programmatic funding from the CDC to address climate and health that have released such reports.[15]

The rest of this chapter revisits points raised in the initial impacts report developed by the Adaptation Subcommittee. Although it is limited in detail and scope, due to the absence of a more detailed assessment report and limited research of Connecticut-specific health impacts of climate change, it provides data on climate and health indicators as a move towards a more comprehensive understanding and assessment of climate and health in our state. These indicators were selected primarily on recommended sets from the peer-reviewed literature and data availability. Therefore, the health outcomes associated with these indicators are not necessarily those that will contribute the most disease burden resulting from future climate change in our state. Rather, the indictors are those that our agency is in a position to report at the time of this assessment. Further, for those health outcomes detailed in this chapter, any changes in recent years observed may be caused by changing climactic variables but such a conclusion cannot be reached without further analysis. That is because patterns in climate-sensitive conditions and risk factors can also by driven by non-climate-associated changes to our environment, such as pollution, as well as changes in the vulnerability statuses within our populations.

PUBLIC HEALTH WORKING GROUP RECOMMENDATIONS TO THE CONNECTICUT CLIMATE CHANGE PREPAREDNESS PLAN

In 2011, DPH coordinated with four other state agencies as part of the Governor's Steering Committee on Climate Change to develop a preparedness plan for the state culminating in eighteen recommendations specific to three action areas for public health:

Best Management Practices

1. Consider the needs of vulnerable populations in climate change adaptation planning.
2. Evaluate ozone non-attainment alert systems.
3. Evaluate current early extreme weather events warning system and emergency response plans.
4. Continue to develop and update all municipal emergency preparedness plans for extreme weather events.
5. Develop cooling station best management practices.
6. Develop criteria for school closings and outdoor play during extreme heat events.

Research, Monitoring and Education

1. Educate other sectors of state government about public health climate change impacts and adaptation.
2. Educate local health department staff on climate change impacts.
3. Develop educational materials concerning poor air quality.
4. Continue to monitor health ailments caused by ozone non-attainment.
5. Assist local health departments with climate change adaptation.
6. Incorporate climate change preparedness strategies into public health education.
7. Develop a database of morbidity and mortality caused by climate change.
8. Intensify vector associated disease monitoring.
9. Increase airborne pollen monitoring.

Policy, Regulation, and Funding

1. Develop legislation to allow regulatory agencies to respond to extreme heat conditions in occupational settings.
2. Continue to support funding to provide for adequate updates to municipal sewage infrastructure.
3. Support funding to provide for adequate updates to municipal water infrastructure.

WEATHER-RELATED MORBIDITY AND MORTALITY

Weather[1] is associated with morbidity and mortality in our populations, and these impacts on our health are easily monitored by classifying them by associated weather type, including heat-related (includes hyperthermia), cold-related (includes hypothermia), or flood-, storm- and lightning-related.[16] When instances of illness and death are recorded in DPH datasets, for example, the deaths registry or the hospitalization datasets, it is possible to analyze whether the weather exposure was listed as the primary cause of death or complaint, or an associated cause. Unless otherwise specified here, weather-related deaths or ED visits refer to those for which weather-exposure was the primary or an associated condition. As part of the growing emphasis on analyzing weather-related morbidity and mortality due to concerns about climate change globally, it has been recognized that health outcomes associated with weather may be underreported in datasets that rely on medical coding.[16]

Heat-related Illness

Humans need to maintain internal body temperatures within a safe range to avoid consequences such as damage to the brain and other vital organs and, in severe, untreated cases, death. We naturally do this through a process known as thermoregulation, which allows us to remain cool when exposed to excessive heat. Thermoregulation includes sweating and changes to the surface of our skin to allow for heat exchange between our bodies and the surrounding air. The set of conditions that can occur when a person stops being able to thermoregulate to overcome a rising body temperature due to exposure to excessive natural heat are collectively referred to as heat-related illness, often called heat stress. Heat-related illness can manifest in a number of clinical outcomes, ranging from mild heat edema and rash, fainting, and heat cramps to heat exhaustion.

Connecticut's populations are susceptible to heat-related illness. Between 2014 and 2018, there was an average of 410.6 ED visits for heat-related illness each year and the average age-adjusted rate was 11.4 per 100,000. Between 2000 and 2018, the annual age-adjusted rate of ED visits for heat-related illness did not change statistically for the entire population. Rates for the entire population are strongly associated with the number of days each year for which the heat index was over 95°F, a threshold used by the National Weather Service for issuing a heat advisory (**Figure 8.3**).[17]

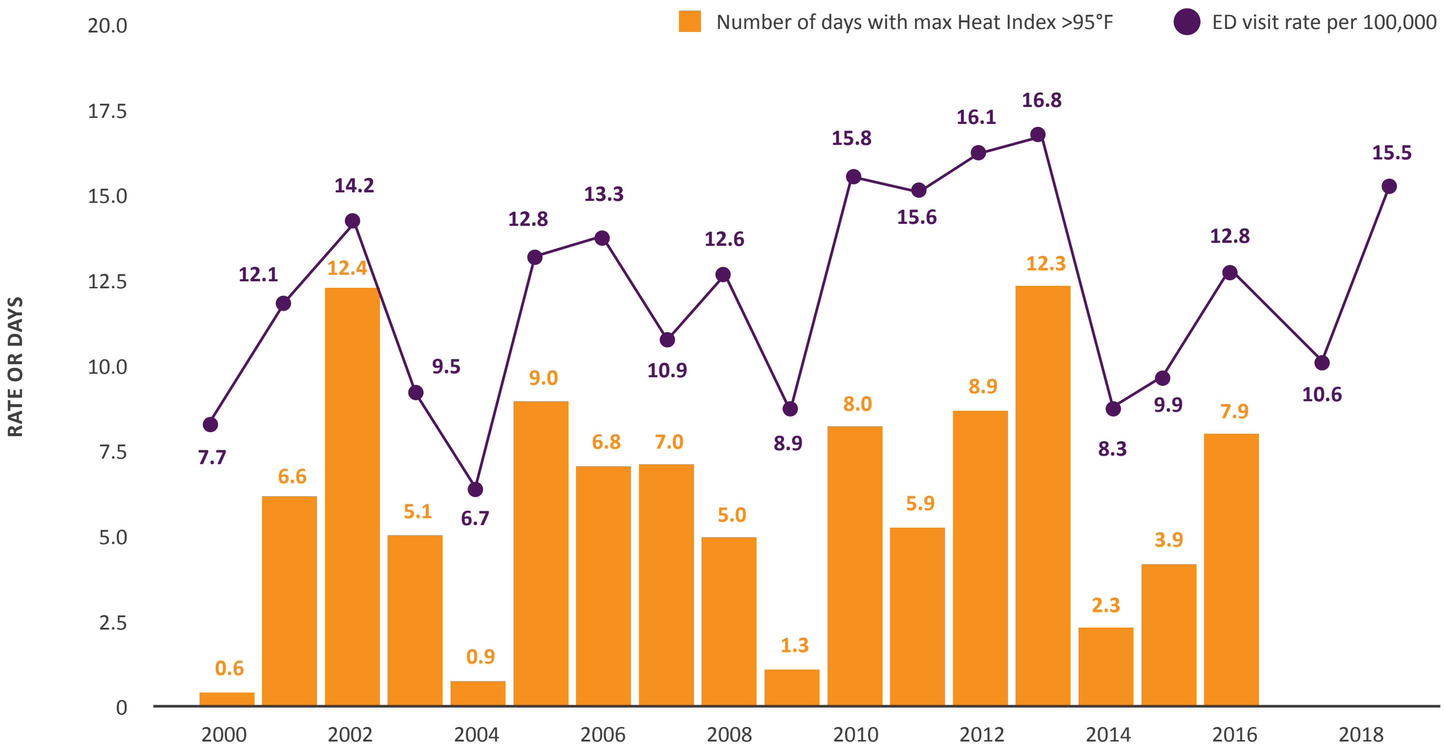
Populations most vulnerable to heat-related illness generally include people with chronic health problems (cardiovascular disease, diabetes, and obesity), infants and young children, outside workers, and older people. Adults, teens, and children that exercise in heat are also vulnerable.[18] In Connecticut, men are at an increased risk for ED visits for heat-related illness compared to women (**Figure 8.4**).

Non-Hispanic Black populations are at higher risks for heat-related illness compared to both non-Hispanic White and Hispanic populations, based on age-adjusted rates of both ED visits for the period 2014–2018 (14.5 visits per 100,000 versus 11.8 and 10.2 visits per 100,00, respectively). Non-Hispanic Asian populations have the lowest rates of ED visits for heat-related illness over this same period, with an age-adjusted ED visit rate of 2.1 visits per 100,000.

Weather-related Mortality

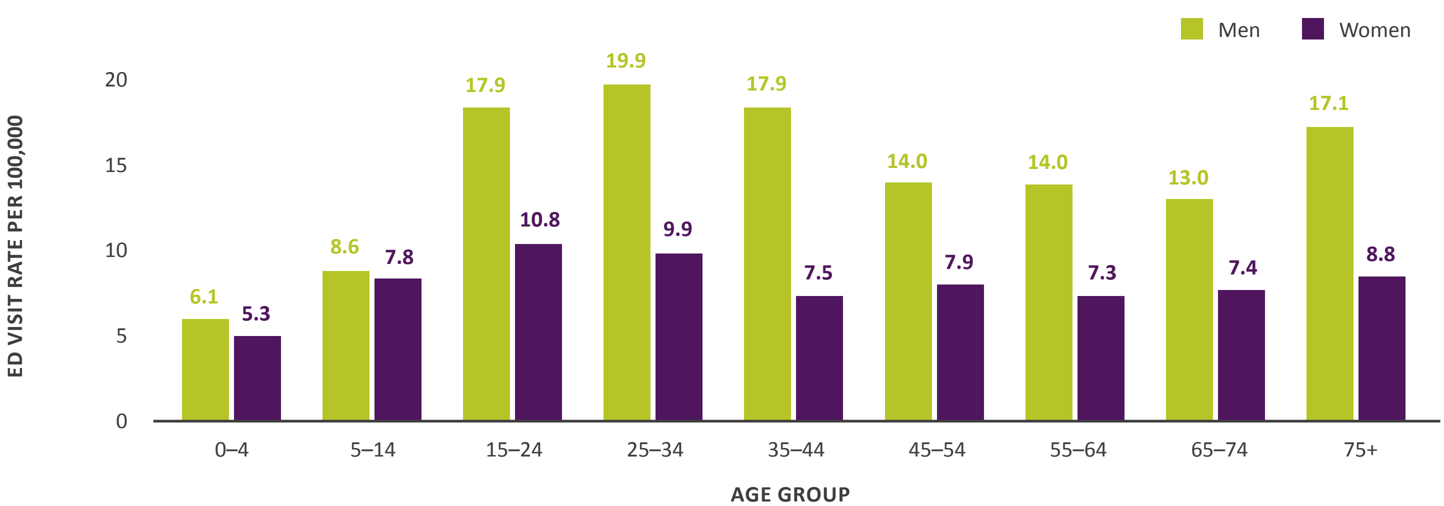
Exposure to weather can result in death, either as a primary or associated cause, in Connecticut's populations, with an average of 16.4 weather-related deaths each year between 2014 and 2018. The age-adjusted mortality rate over this period was 3.5 deaths per 100,000. The vast majority (89%) of the weather-related deaths for 2014–2018 were cold-related (**Figure 8.5**). Among the 73 cold-related deaths, exposure to excessive natural cold or hypothermia was listed as the primary cause of death in 47% of deaths. By contrast, weather exposure was the primary cause of death for seven of the nine heat-related and flood, storm, and lightning-related deaths between from 2014 to 2018.

FIGURE 8.3: Annual age-adjusted rates for total population of emergency department visits for heat-related illness by year, CT, 2000–2018; number of days with heat Index > 95 ° F, averaged over counties, CT, 2000–2016



Source: *Connecticut Environmental Public Health Tracking Network, Connecticut Emergency Department Visit Dataset. Data analyzed October 10, 2019; Centers for Disease Control and Prevention, National Environmental Public Health Tracking Network. Data analyzed September 30, 2019. Retrieved from www.cdc.gov/ephtracking*

FIGURE 8.4: Rate of emergency department visits for heat-related illness by age group and gender, CT, 2014-2018



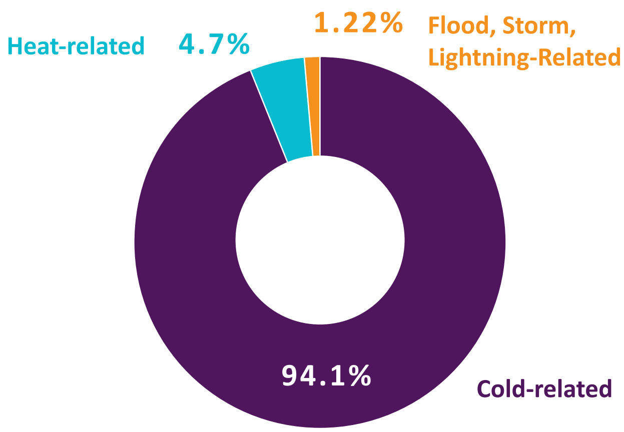
Source: *Connecticut Environmental Public Health Tracking Network, Connecticut Emergency Department Visit Dataset. Data analyzed October 11, 2019.*

BEST & PROMISING PRACTICES: PREVENTION OF HEAT-RELATED ILLNESS

Important precautions during periods of extreme heat can help prevent heat-related illness:

- Air conditioning is the strongest protective factor against heat-related illness. Seek air conditioned buildings if you do not have access to an air conditioner in your home.
- Limit or avoid outdoor activities during heat advisories and heat warnings.
- Contact relatives age 65 and older twice a day during heat waves.
- Do not leave children or pets in parked cars, even with open windows.
- Drink fluids regularly, not waiting until you are thirsty to drink. Water and sports drinks are best — avoid sugary drinks and alcohol.
- Protect your body from sunburn by wearing UVA/UVB-labeled sunscreen, sunglasses and a hat. Sunburn increases the body's temperature and can lead to dehydration.
- Become familiar with the differences in the warning signs of heat stroke and heat exhaustion and understand the ways to treat them (www.cdc.gov/disasters/extremeheat/warning.html).

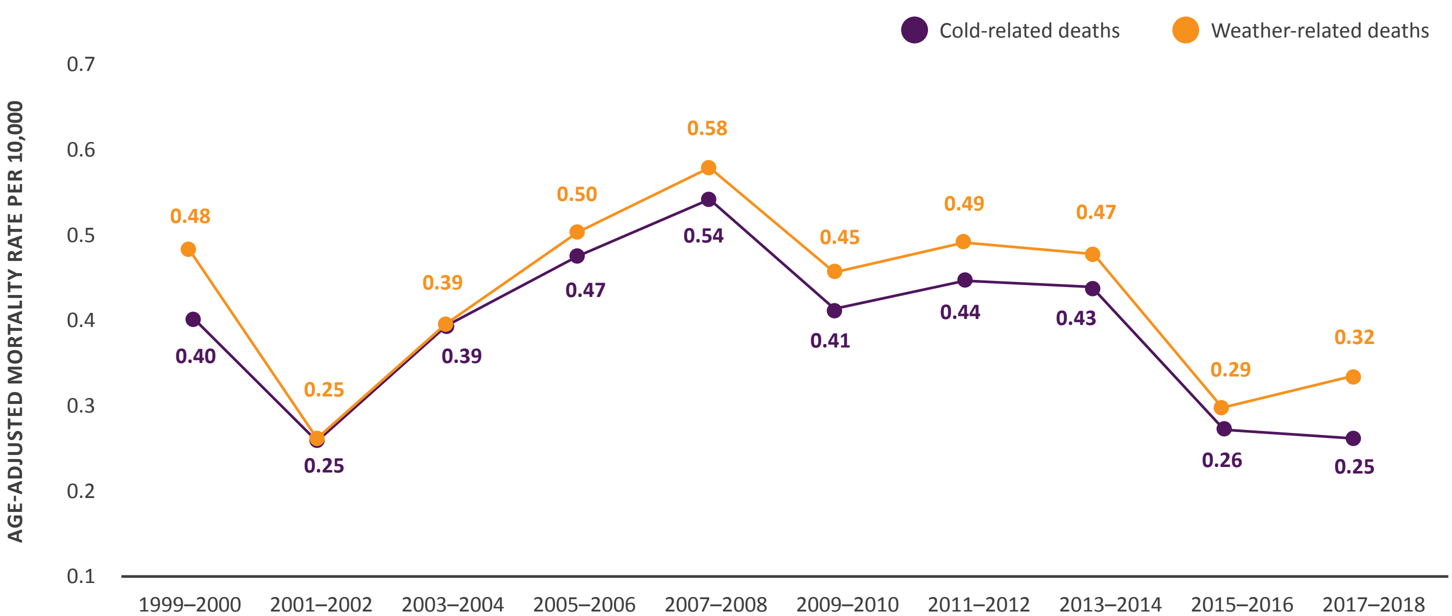
FIGURE 8.5: Percentage of weather-related mortality by type, CT, 2014–2018



Source: *CT DPH Surveillance Analysis and Reporting, CT Death Registry, 2014–2017, 2018 (provisional). Data analyzed October 2, 2019.*

As a region, the Northeast has a higher rate of weather-related deaths than most other parts of the country.[19] Rates of cold-related mortality in Connecticut closely follow those for all weather-related mortality over the period 1999–2008 (**Figure 8.6**); counts are aggregated to allow for age-adjustment. Rates of all weather-related mortality do not exhibit a statistical annual trend over the period 1999–2018. Projections of weather-related mortality rates indicate that rates of cold-related deaths in our region will decrease in the future due to warmer winters, but rates of heat-related deaths will increase. Overall, the premature mortality rate for deaths due to weather are expected to increase in the absence of aggressive greenhouse gas reduction and adaptation to increasing temperatures in our populations by mid-century.[19] Long-term predictions for weather-attributable mortality rates, i.e. for the end of this century, depend on assumptions of mathematical models used to project future temperatures.[19;20]

FIGURE 8.6: Age-adjusted rate of weather- and cold-related mortality by year and cause, CT, 1999–2018



Source: *CT DPH Surveillance Analysis and Reporting, CT Death Registry, 1999–2017, 2018 (provisional). Data analyzed October 2, 2019.*

AIR AND WATER QUALITY

Recent decades have been witness to significant improvements in air and water quality in our state, as detailed in the Environmental Health chapter of this State Health Assessment. Climate change, however, is expected to pose a growing challenge to such improvements on a number of fronts.

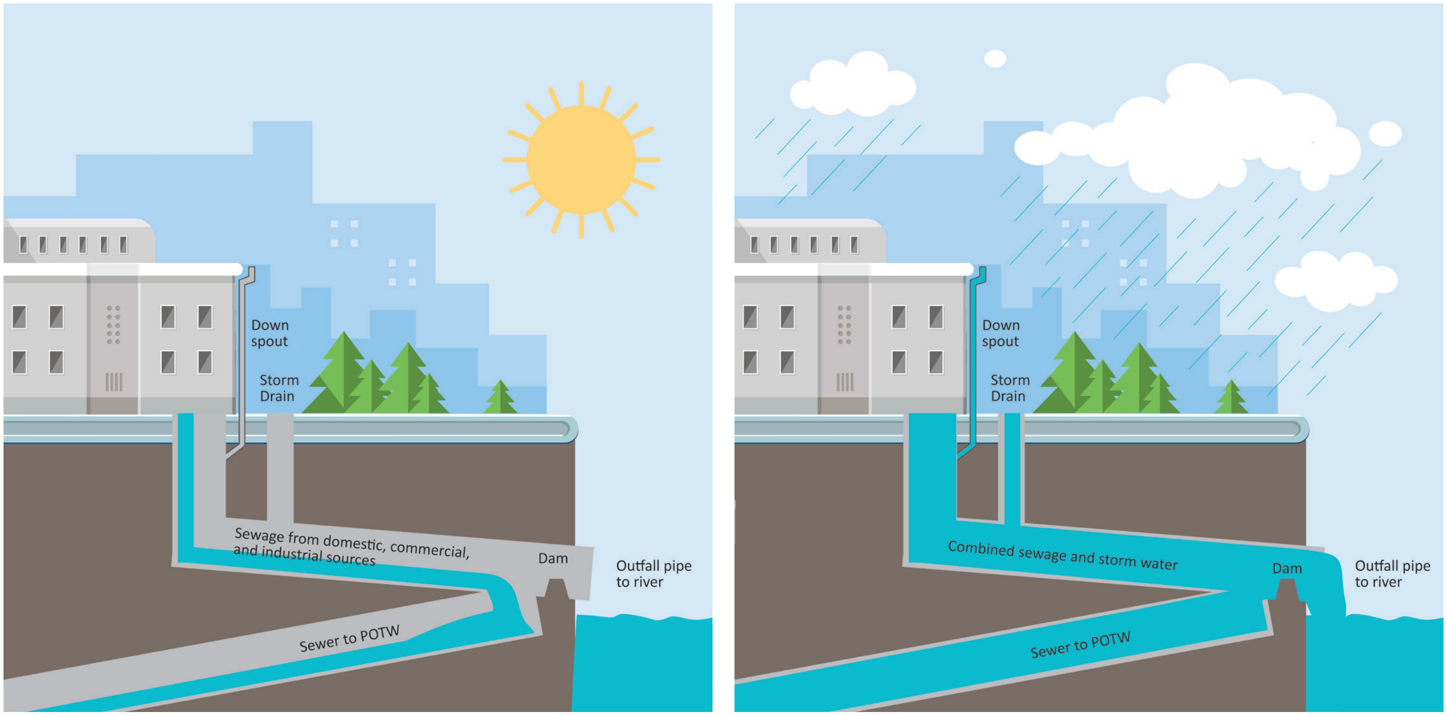
When it comes to outdoor air quality, three main types of pollution sensitive to climate change are of most concern.[5;21] The first of these is ground-level ozone, a pollutant described in the Environmental Health chapter. Ground-level ozone is sensitive to increasing temperatures because it forms when ozone precursors react with sunlight and heat. Ground-level ozone rates in Connecticut are currently declining. However, the effects of increasing temperatures may reverse this trend in the future.[13;22] The second concern for outdoor air quality associated with Connecticut's changing climate is pollen, in particular, ragweed pollen. Ragweed pollen is the cause of the most common type of seasonal allergy, hay fever. Throughout the Northeast, ragweed pollen seasons are expected to increase both in length and intensity, due to both rising temperatures, as well as greater available of carbon dioxide in the atmosphere due to greenhouse gas emissions. Finally, wildfires are predicted to increase in intensity and frequency due to climate change, and their emissions are expected to contribute significantly to PM2.5, also described in the Environmental Health chapter. Although increasing risk of wildfire is primarily a concern for the western United States, emissions from wildfires can travel hundreds of miles.[5;22]

Indoor air quality is also predicted to be impacted by climate change.[5;22;23] Increased rates of extreme precipitation and other types of extreme events, including flooding and winter storms, can damage buildings and allow for entry of moisture. Increasing humidity outdoors can also increase condensation and dampness indoors. Indoor moisture and humidity can then foster the growth of mold, among other indoor air pollutants. Additionally, storms and floods, and their associated power outages, can reduce ventilation in buildings and reduce indoor air quality. Power outages during storms and floods also put our residents at risk for carbon monoxide poisoning due to improper use of backup power generators, as well as improper indoor use of wood-burning and other appliances intended for outdoor use.[21]

Intense rainfall events can also overwhelm the older sewer systems found in our more urban towns in Connecticut and the quality of water in surrounding areas.[5;24] These older sewer systems, known as combined sewer systems, were designed and built during the early- to mid-19th century. They allow for flow of sewage from homes, commercial, and industrial sites and storm water from separate points of entry into a single set of pipes to wastewater treatment plants (**Figure 8.7**). When these systems were built, intense rainfall events were less frequent and pipe capacity could could accommodate both types of waste without the system causing an overflow events most of the time. In cases where volumes were too large, overflows built into the system allow for dumping of sewage system contents to nearby water bodies and rivers. Contaminants include raw and partially treated sewage (screened for solids), industrial wastewater, and storm water.[25] These overflows are a public health concern, primarily because of potential exposure to viruses and bacteria, and risk of diarrheal illness to anyone exposed to contaminated waters. Currently, six towns within Connecticut have combined sewer systems, and information about locations and timing of events when discharge is released from overflow locations is available from CT DEEP.[26] Since 1970, towns in Connecticut with combined sewer systems have been working to update sewer systems to eliminate the existence of such overflows.[26]

Climate change also poses challenges for our drinking water, as described in the Environmental Health chapter. Access to potable drinking water is a concern during floods and storms because water systems, both public and private, can fail during these types of events due to power outages.[24] Public water systems supply drinking water to residential areas, but also critical community facilities that become particularly important during emergency and natural disaster response. These critical facilities include care facilities, city and town halls, community centers, emergency medical services, schools, and shelters. Nearly 80% of the 1,617 priority critical facilities in Connecticut's four coastal counties (Fairfield, New Haven, Middlesex, and New

FIGURE 8.7: Combined sewer overflows



Source: *U.S. Environmental Protection Agency (2004). Report to Congress: Impacts and Control of CSOs and SSOs. Document No. EPA 833-R-04-001. Retrieved from www.epa.gov/sites/production/files/2015-10/documents/csossortc2004_full.pdf*

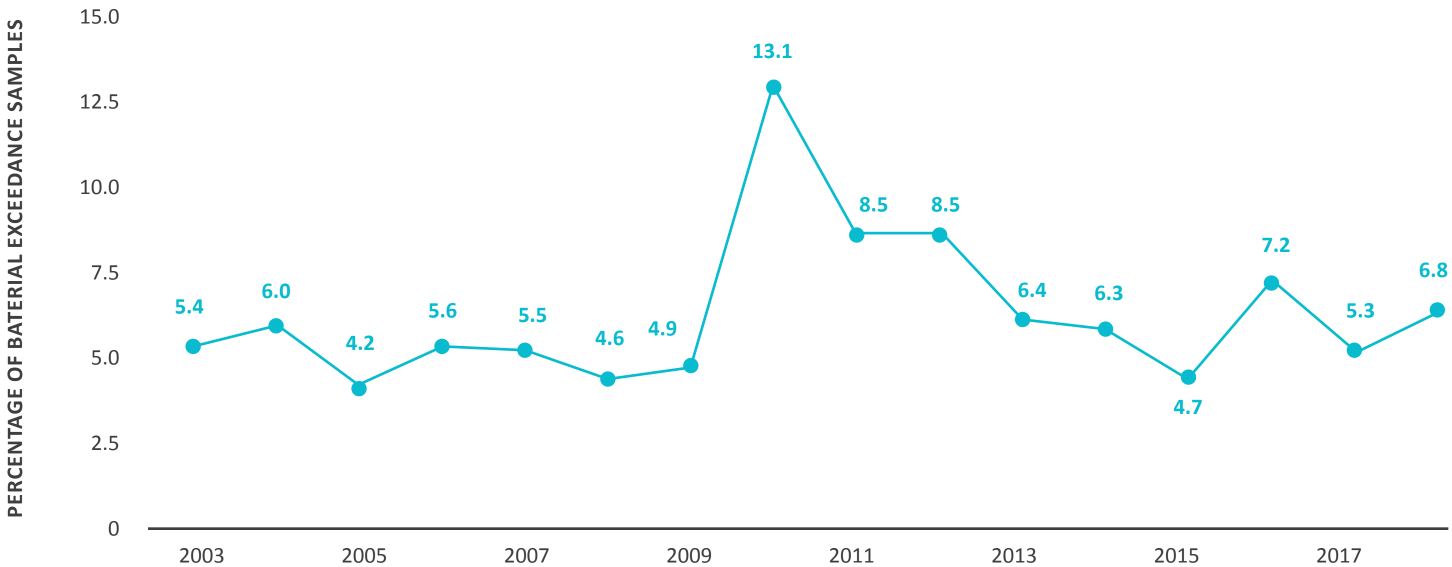
London Counties) have been associated with a public water system potentially vulnerable to a flood event due to their proximity to a Federal Emergency Management Agency (FEMA) flood zone and improved flooding infrastructure resilience is recommended for many of those systems. Additionally, an estimated 72% of Connecticut public water systems either lost power or relied on a generator during extreme weather events over the past decade.[27]

Bacterial Sampling at Marine Beaches

As described in the Environmental Health chapter, beach closures occur when local health officials suspect that water quality is adversely impacted by storm water runoff. One of the ways that public health officials monitor this potential is by measuring the amount of enterococci, a common bacteria found in human and animal waste, in water samples taken on a weekly basis at beaches along our coast. Enterococci are typically not harmful to humans, but rather, their presence indicates possible presence of other microbes from fecal contamination that can make us sick in our water supply. Sources of enterococci in recreational waters typically include sewage from combined sewer overflow events, agricultural and urban runoff, as well as direct input by animal defecation, bather shedding, and boats, among other sources.[28] Sources can vary greatly based on beach formation and distance from rivers, canals, and marshes.[29]

Levels of enterococci that exceed threshold set by the US Environmental Protection Agency (EPA) indicate possible contamination of beach water with disease-causing microbes due to fecal contamination. A sample for which this threshold is exceeded is known as a bacterial exceedance sample, and the percentage of all samples taken on a weekly basis that exceed this threshold provides a measure of changes in the water quality at our beaches from year to year. Because some of the possible sources of enterococci in beach waters in Connecticut are sensitive to heavy rainfall, rainfall may be one of the drivers of high bacterial exceedance rates and one may expect these events to be increasing.[30;31] Analysis of the trend of the bacterial exceedance rate by year for Connecticut beaches does not show a trend of increasing or decreasing over the period 2003–2018 (**Figure 8.8**). Continued bacterial monitoring at Connecticut beaches and determination of sources of enterococci to inform beach closures is important to limit exposures in our residents to fecal contaminants at our beaches.

FIGURE 8.8: Percentage of bacterial exceedance samples from marine beaches by year, CT, 2003-2018



Source: *CT DPH Recreation Program. Data analyzed October 4, 2019.*

VECTOR-BORNE DISEASE AND FOOD SAFETY

The potential challenges to water quality in our state as described above may put our residents at a greater risk of diarrheal disease due to exposure of viruses, bacteria, and parasites in our water systems. Other types of disease caused by these organisms are likely to be impacted by our changing climate, including vector-borne diseases and food-borne illnesses.

Vector-borne diseases are defined as diseases spread by mosquitoes, ticks, and fleas. The most common vector-borne diseases in Connecticut are spread by ticks, including Lyme disease, anaplasmosis, and babesiosis. In addition, diseases spread by mosquitoes such as West Nile and Eastern equine encephalitis virus are a concern in some years. The incidence of vector-borne disease peaks in the summer months when ticks and mosquitoes are most active. However, the tick that transmits Lyme and other diseases, the blacklegged or 'deer' tick, can be active on warmer days during the winter.

The numbers and activity of ticks and mosquitoes in the environment are influenced by winter and summer temperatures, humidity, and rainfall. Research suggests changes in these climatic factors could impact the abundance and geographic distribution of vector species and extend the period during the year when vectors are active.[32;33] Nationally, the incidence of vector-borne diseases has increased over the last 15 years and new viruses and bacteria which can infect humans have been identified.[34] In Connecticut, increases in certain vector-borne diseases, such as anaplasmosis, and emergence of other diseases, such as Powassan virus, have been identified in recent years. These increases might be due to increases in recognition and diagnosis or reporting. Continued surveillance for vector-borne diseases is necessary to monitor the incidence and distribution of these diseases in coming years.

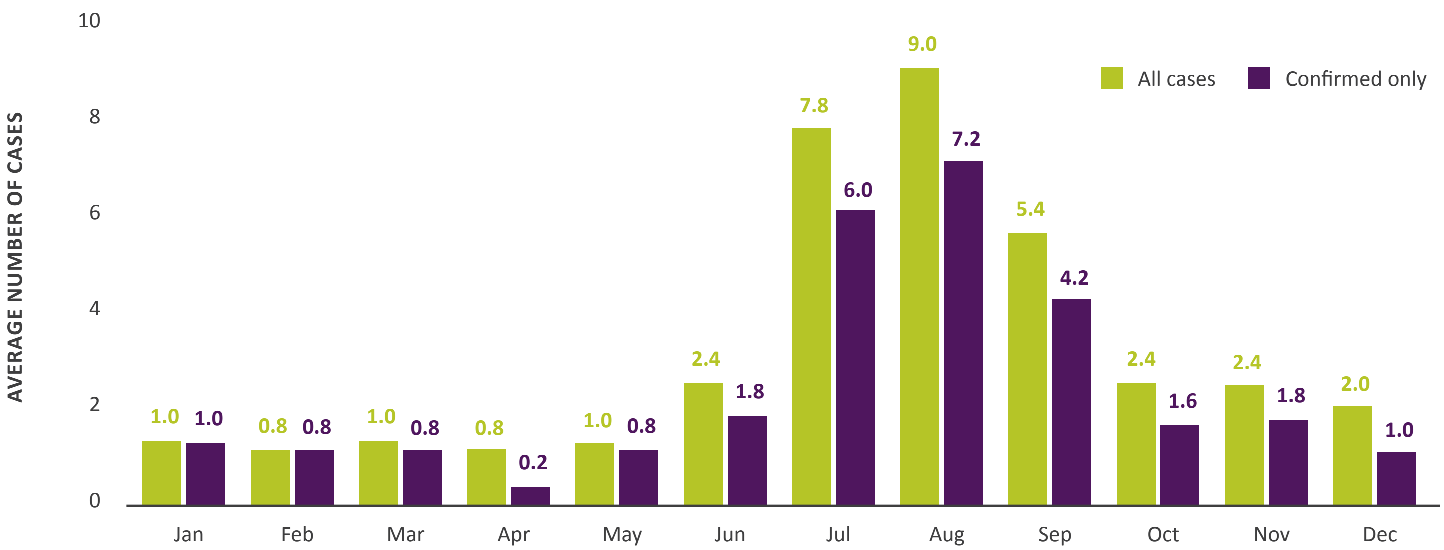
Food safety and the incidence of foodborne disease have the potential to be greatly affected by some of the environmental variations associated with climate change.[5;35] As was mentioned in previous sections, changes in weather patterns can lead to severe events, such as flooding, drought conditions, and an increase in ambient air temperature and humidity. Keeping the foods we eat safe can become more difficult with these added factors. Flooding waters may contain raw sewage and can affect the quality of water used to irrigate the growing fields as well as water used to rinse produce. Flooding can also contaminate the soil in which crops are grown and animal feed. Maintaining certain foods at safe temperatures is also an important step in preventing the growth of some bacteria that can cause illness when consumed. Many pathogens prefer warm and moist conditions, which is a concern with an increase in temperature. Refrigeration units must be able to maintain foods at safe temperatures amid the rise in the temperature outside, and power outages due to storms and floods can pose risk for food-borne illness.[35] One type of food-borne illness that has gained much attention due to association of the change in abundance and geographic range of the pathogen that causes it and rising global temperatures associated with climate change is the *Vibrio* infection.[24;36]

Vibrio Infections

Vibrio infections are caused by the bacteria *Vibrio*, which naturally live in certain coastal waters. Most people become infected by eating raw or undercooked shellfish, particularly oysters. Typical symptoms include watery diarrhea, abdominal cramping, nausea, vomiting, fever, and chills. Symptoms usually occur within 24 hours of ingesting the bacteria. Severe illness is rare but can occur, particularly in people with weakened immune systems. *Vibrio* bacteria can also cause skin infections when open wounds are exposed to salt or brackish water.

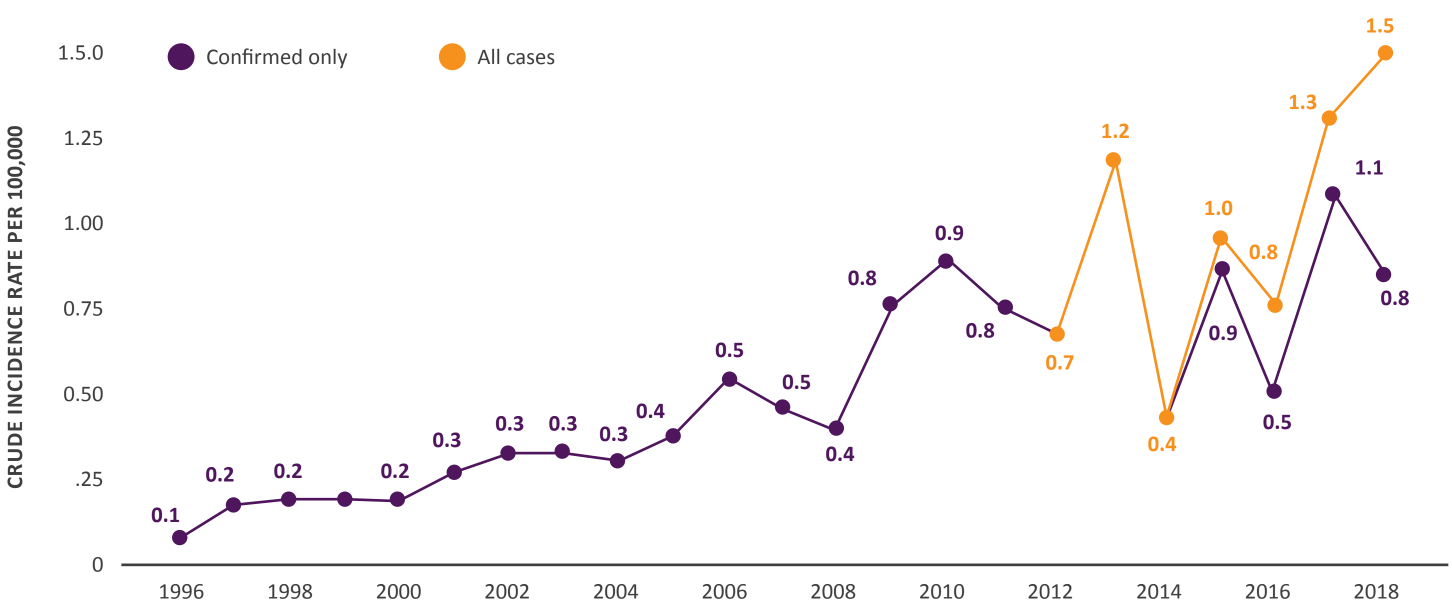
Active laboratory-based surveillance for *Vibrio* was started in Connecticut in 1996 through the Foodborne Disease Active Surveillance Network, a collaborative program between DPH and CDC. The number of reported *Vibrio* cases is highest during July through September. This seasonal peak in human infections coincides with higher concentrations of the *Vibrio* bacteria being present in the water between Mayand October when water temperatures are warmer (**Figure 8.9**). Overall, the annual incidence of confirmed *Vibrio* infections has been increasing since 1996 (**Figure 8.10**). Warming of coastal waters, which contributes to growth and persistence of *Vibrio* bacteria, has been proposed as a factor. The increase in infections in more recent years might also be due, in part, to more infections being diagnosed. Newer testing methods that do not require confirmation by culture have become more widely used and has contributed to the increase in incidence of all *Vibrio* infections.

FIGURE 8.9: Average annual number of cases of *Vibrio* infections by month, CT, 2014–2018



Source: *Centers for Disease Control and Prevention. FoodNet Fast. Retrieved from www.cdc.gov/foodnet/foodnet-fast.html*

FIGURE 8.10: Crude incidence rate of *Vibrio* infections by year, Connecticut, 1996–2018



Source: *Centers for Disease Control and Prevention. FoodNet Fast. Retrieved from www.cdc.gov/foodnet/foodnet-fast.html*

VULNERABILITY

The three factors that comprise vulnerability — exposure, sensitivity, and adaptive capacity — intersect with the social determinants of health. Therefore, reducing health disparities and achieving health equity in Connecticut requires also addressing the impacts of climate change, particularly on vulnerable populations.

Climate change will not affect everyone equally, as some people are more vulnerable to the impact of climate change than others.[37]Vulnerability is determined by three main factors. First, some people have more *exposure* to the climate hazards detrimental to human health. Exposure is influenced by circumstances including occupation, socioeconomic status, community infrastructure condition, and compromised mobility or cognitive function. For instance, during a hurricane, a person's ability to get out of harm's way may be limited by physical mobility, access to a vehicle, and the condition of the local emergency evacuation routes. As another example, outdoor workers have more exposure to temperature extremes than those who work indoors. Second, some people have higher *sensitivity* to climate hazards. Sensitivity is influenced by biological traits including health status and age, as well as by socioeconomic factors. For instance, the elderly are generally more physically susceptible to heat-related illness, as are those with certain chronic medical conditions like heart disease or mental illness. Third, vulnerability is influenced by an individual or community's *adaptive capacity*, that is, the ability to adapt to or cope with change. Therefore, supporting strategies for Connecticut residents and communities to build adaptive capacity will help to reduce the possible health effects of climate change. Building social cohesion, providing emergency preparedness resources, and adapting infrastructure to new climate conditions are all examples of actions that would contribute toward greater adaptive capacity.[37]

These three factors — exposure, sensitivity, and adaptive capacity — intersect with the social determinants of health (**Figure 8.11**). Therefore, reducing health disparities and achieving health equity in Connecticut requires also addressing the impacts of climate change, particularly on vulnerable populations. Across the United States, populations of most concern for vulnerability to the negative health impacts of climate change are indigenous peoples, children and pregnant women, older adults, outdoor workers, persons with disabilities, persons with chronic medical conditions, and communities of color, low income, immigrants, and limited English proficiency groups.[37]

FIGURE 8.11: The intersection of social determinants of health and vulnerability

Source: *Gamble, J. L., Balbus, J., Berger, M., Bouye, K., Campbell, V., Chief, K., . . . Wolkin, A. F. (2016). Ch. 9: Populations of Concern In The Impacts of Climate Change on Human Health in the United States: A Scientific Assessment. (pp. 247–286). Washington, DC: U.S. Global Change Research Pro-gram.*

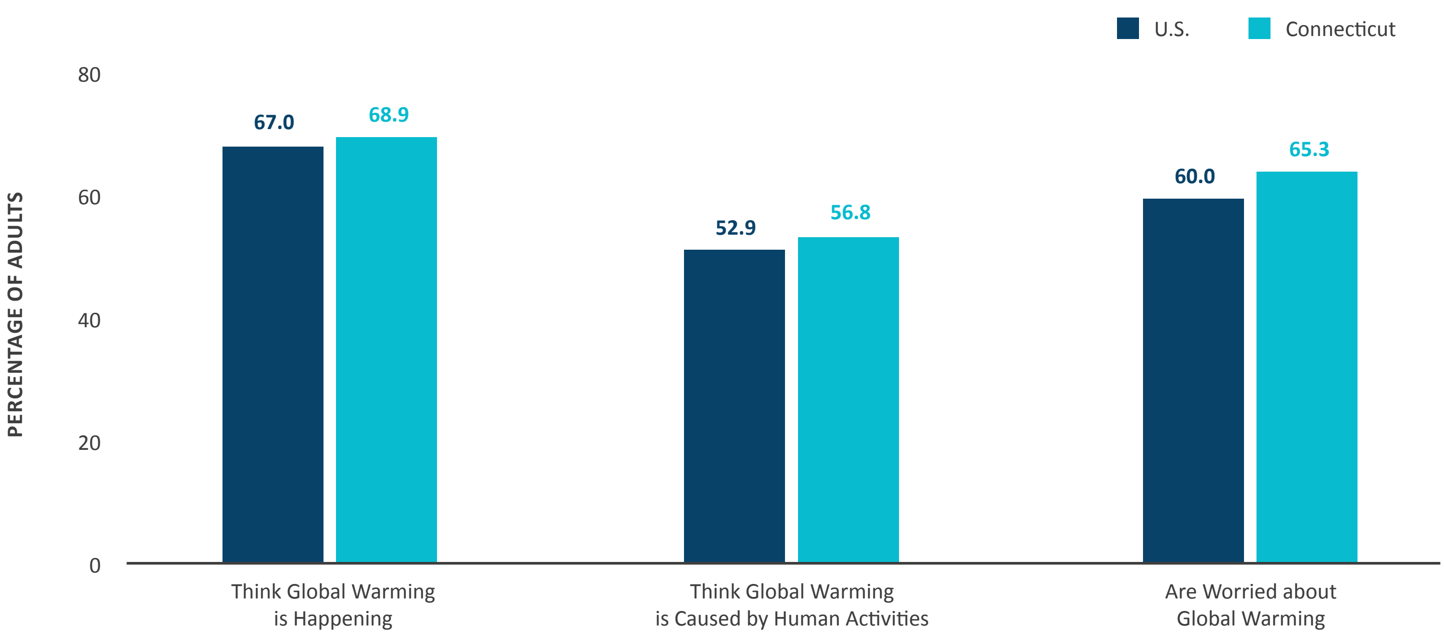
OUR OPINIONS ABOUT CLIMATE CHANGE

Researchers that specialize in communicating about climate change recognize that knowledge of how climate systems work and the causes, consequences, and solutions associated with climate change is associated with how interested and engaged an individual is in taking personal or collective action to address it.[38;39]

Comparison of absolute percentage values for three key beliefs and risk perceptions that are positively associated with support for public action to address climate change suggest slightly higher values for Connecticut versus the U.S. (**Figure 8.12**).[40] Nonetheless, from an absolute perspective, only 57% believe that climate change is caused by human activity. Moreover, only approximately 70% of Connecticut residents believe that climate change is happening (**Figure 8.12**).

Opinions about climate change vary strongly among subgroups of Americans, and individuals among these subgroups tend to be different in how they receive and react to messages about climate change.[41] Thus use of effective yet varied climate change communication strategies that resonate with different populations is necessary to improve knowledge and understanding of climate change.[42] Communication about climate change and health risks posed by it to local populations is part of the work currently being undertaken by state health departments with programmatic support from federal sources.[15]

FIGURE 8.12: Attitudes and beliefs of Connecticut adult residents about climate change, CT, 2019



Source: *Yale Program on Climate Change Communication, Yale Climate Opinion Maps 2019. Retrieved from https://climatecommunication.yale.edu/visualizations-data/ycom-us/*

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