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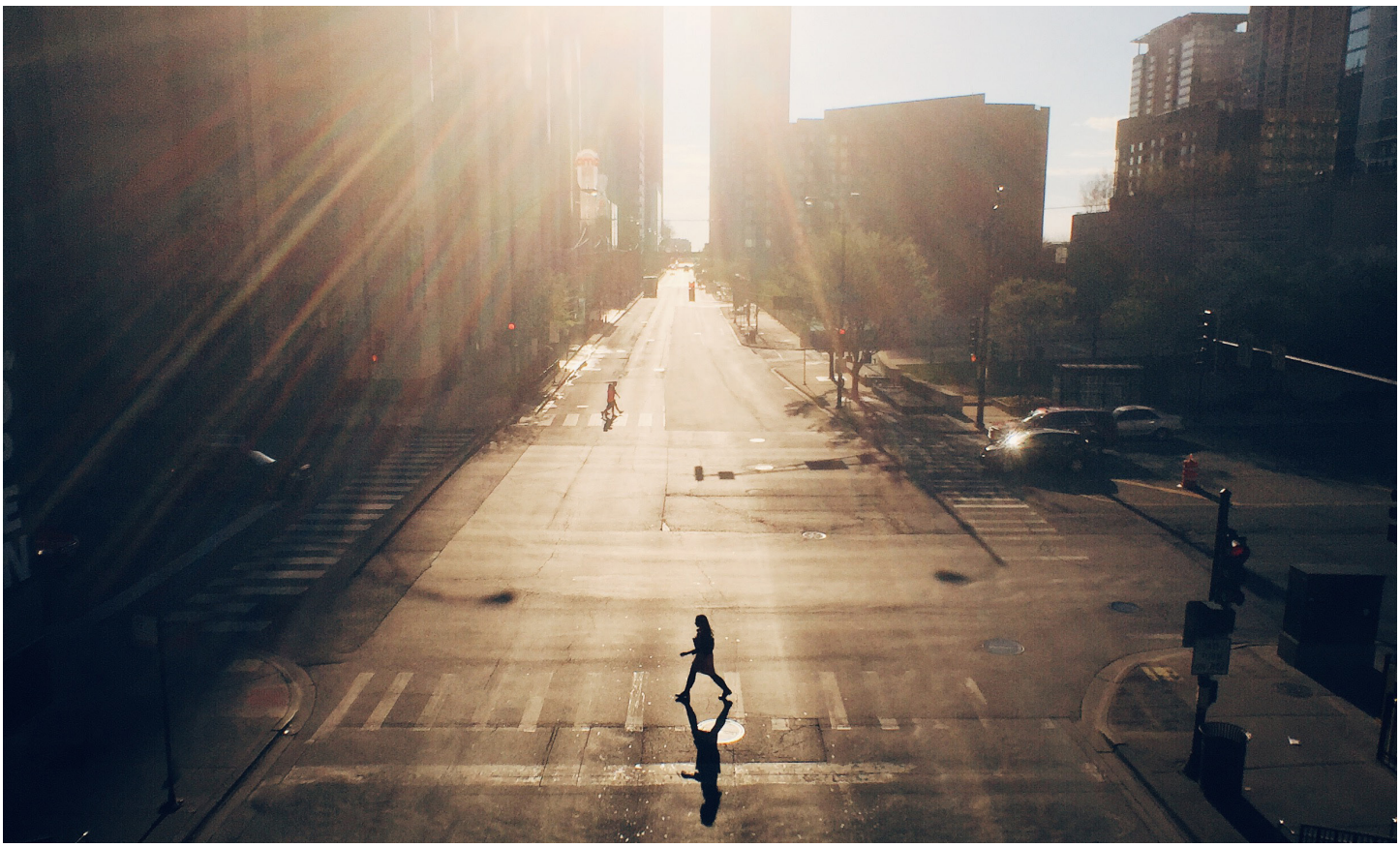
ISSUE BRIEF

CLIMATE CHANGE AND HEALTH IN ILLINOIS

Climate change is altering seasonal patterns, making hot days more intense, and increasing the frequency of extreme weather events like Illinois's record-breaking nighttime heat in July 2019.[1] As a result, Illinoisans face a variety of health threats, including more heat-related illnesses such as breathing and heart problems, food and water contamination, traumatic injuries, mental health challenges, and increased exposure to infectious diseases.[2] These threats will only grow as transportation systems and big polluters continue to pump climate-changing pollution into the air.

Illinoisans can protect themselves from these risks by implementing cleaner and more efficient energy strategies and preparing more effectively for future climate and health crises.[3] Illinois's communities and health departments must also have the resources and capacity to deal with present-day health threats.[4]



LEAD AUTHOR/ MEDIA CONTACT:
Juanita Constible
jconstible@nrdc.org

CONTRIBUTING AUTHORS AND RESEARCHERS:
Denise Patel, Dr. Samantha Rubright, Clare Morganelli

REVIEWERS (alphabetical order):
Elena Grossman, Mary Heglar, JC Kibbey, Dr. Kim Knowlton, Dr. Vijay Limaye, Leah Stecher, Brian Urbaszewski

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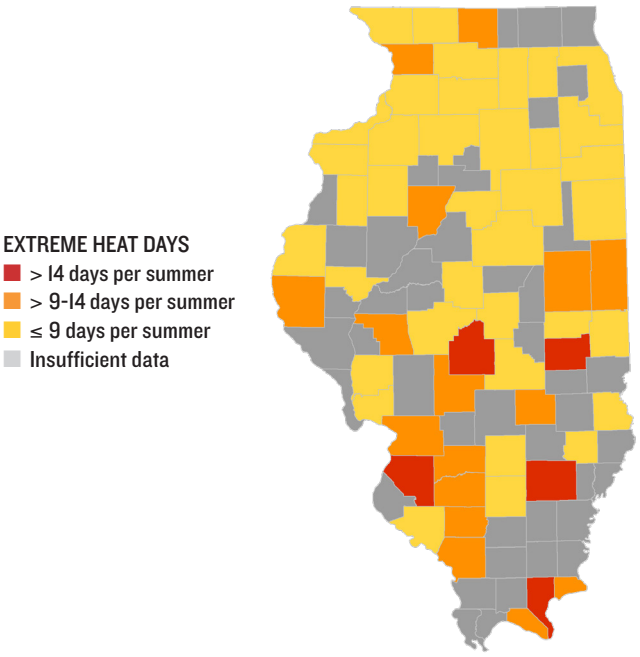
EXTREME HEAT IS BAD FOR ILLINOISANS' HEALTH—AND COULD BECOME MORE DEADLY

Extreme heat is already the leading cause of weather-related deaths in the United States.[5] In Illinois, summers are getting longer, hotter, and more dangerous to residents' health.

In Illinois, annual average temperatures have climbed more than 1 degree Fahrenheit since 1895.[6] More than 1.7 million Illinois residents—about 13.5 percent of the state population—lived in counties that experienced more than nine extreme heat days per summer from 2007 to 2016 (Figure 1).[7]

FIGURE 1: AVERAGE NUMBER OF EXTREME HEAT DAYS EACH YEAR IN ILLINOIS COUNTIES, 2007–2016

"Extreme heat days" are defined as June, July, and August days on which the maximum temperature at a given weather station fell within the top 10 percent of readings made at that station from 1961 to 1990. Nine extreme heat days per summer, on average, would be expected if temperatures were not increasing in recent decades. More detail on methodology and data sources can be found in NRDC's 2017 "Climate Change and Health: Extreme Heat" map.[8]



If current carbon emission levels continue, Chicago could experience nearly a month's worth of extremely hot and humid days every summer by the 2060s.[9] By 2080, Peoria could feel more like Sikeston, Missouri (more than 300 miles to the south), and Carbondale could feel more like Monroe, Louisiana (more than 460 miles to the southwest).[10]

In addition to causing premature death, heat and humidity pose numerous nonfatal threats to Illinois residents. These range from minor illnesses such as heat cramps to more severe conditions like heat-related heart problems.[11] Anyone can get sick from extreme heat, but outdoor workers, young children, older adults, people living in poverty, and people with chronic diseases like diabetes, heart disease, and chronic obstructive pulmonary disease (COPD) are particularly vulnerable.[12] For example, an average of 308 people in Illinois were hospitalized annually for heat-related causes from 1987 to 2014. People above the age of 80 accounted for nearly a quarter of these hospitalizations.[13]

One particularly heat-vulnerable group in rural Illinois and other Midwestern states is corn detasselers. For about three weeks each summer, local children as young as 12 and migrant farm workers cut the tops off corn plants to create hybrid seed varieties.[14] Because the work must be completed within a limited window of time, detasselers can be in the fields for up to 15 hours a day, seven days a week.[15] In 2012, a worker from Mexico died from heatstroke while detasseling.[16] Concerns about heat stress have prompted some corn companies to staff their seed corn fields with nurses and EMTs.[17]

Cook County, which is home to Chicago, accounted for more than 44 percent of Illinois's heat-related hospitalizations between 1987 and 2014.[18] This is in part due to the urban heat island effect, which can make daily summer temperatures more than 2 °F higher in cities, on average, than in rural areas.[19] This phenomenon, which adds to the climate warming driven by carbon pollution, is caused by elements of the urban built environment, such as heat-absorbing asphalt and airflow-blocking tall buildings. The double whammy of climate warming driven by fossil fuels and the urban heat island effect is particularly problematic for low-income neighborhoods and communities of color. During Chicago's infamous heat wave of 1995, which killed more than 700 people, most of the deaths occurred in majority-Black neighborhoods with the lowest per capita incomes. These neighborhoods also had the highest homicide rates, which may have prompted residents to keep their windows closed and drive up interior temperatures.[20]

However, while urban areas see greater overall *numbers* of heat-related hospitalizations, the hospitalization *rate* between 1987 and 2014 was nearly 2.6 times higher in the state's most thinly populated counties than in the most urban ones.[21] This surprising disparity may be due in part to an inability to pay for air-conditioning or a more general lack of access to health services.[22] Nearly every rural county in central and southern Illinois was designated as a Health Professional Shortage Area for primary care by the federal Health Resources and Services Administration as of mid-2019.[23] Furthermore, rural, low-income households have a high energy burden, meaning they spend a disproportionately high share of their income on energy bills, and may have a harder time affording air-conditioning.[24] Census data for 2015 indicate that the median energy burden among low-income rural households in the U.S. census region that includes Illinois is nearly three times the national average.[25]

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CLIMATE CHANGE PUTS ILLINOIS'S PROGRESS TOWARD CLEANER SKIES AT RISK

Smog is a form of air pollution that exacerbates asthma and other lung conditions and is linked to additional serious health problems like cardiac arrest, memory disorders, and birth defects.[26] Ground-level ozone, the main ingredient of smog, is formed when sunlight and heat chemically react with pollution from sources such as vehicles, power plants, and natural gas wells.[27] Hot weather can speed up those smog-forming chemical reactions, meaning that the rising temperatures associated with climate change will increase smog production.[28]

Although the average smog values in Illinois were within federal standards in 2017, there were 27 unhealthy smog days in cities and towns such as Chicago, Evanston, Alsip, and Zion.[29] In 2019 the American Lung Association ranked the Chicago-Naperville area as the 18th-most ozone-polluted area in the country.[30]

In 2017, an estimated 214,300 children and 879,200 adults in Illinois suffered from asthma, which is complicated and costly to treat.[31] In 2012 alone, asthma patients in the state had an average of $2,205 in medical costs per person, and the cumulative statewide economic impact of missed work and school days due to asthma was $131.2 million.[32]

The burden of worsening air quality will fall especially heavily on children, low-income people, and communities of color. In 2015, African-American children accounted for about 63 percent of Chicago's childhood emergency room visits for asthma.[33] This disparity in asthma prevalence may be due to diet, poorer-quality housing, higher exposure to air pollution, less access to high-quality and affordable health care, and other factors.[34]

ALLERGY SEASONS ARE GETTING LONGER AND MORE SEVERE

Seasonal pollen allergies, also known as hay fever, are common across Illinois.[35] Hay fever symptoms such as congestion and headache can range from mildly annoying to downright disruptive, affecting sleep, mood, and quality of life.[36]

Rising carbon dioxide levels, rising temperatures, and changes in precipitation are boosting overall pollen production and changing the timing and length of pollen season in the Midwest.[37] For example, growing seasons (i.e., the freeze-free season) in six cities across Illinois lengthened by an average of 15 days between 1970 and 2018.[38]

The risk of more severe asthma attacks increases when there's more pollen in the air. In 2010, asthma triggered by oak and birch pollen led to an estimated 25,000 to 50,000 emergency room visits across the United States, and grass pollen led to approximately 10,000 visits.[39] Climate change will make matters worse. Under a high carbon pollution emissions scenario, emergency rooms across the country could see nearly 3,700 more asthma visits related to oak, birch, and grass pollen in 2030, and more than 6,000 additional visits in 2050.[40] More than 32 percent of the added visits would occur in the Midwest.

HEAVY PRECIPITATION AND FLOODING POSE MYRIAD HEALTH RISKS IN ILLINOIS

Illinois is no stranger to serious floods. Eighty of the state's 102 counties have had one to three federal disaster declarations for severe storms and flooding since 2008.[41] As urban development in Illinois expands, as the state's water infrastructure further ages, and as rainstorms get more intense, flooding will become increasingly dangerous and challenging.[42]

In Illinois, average annual precipitation increased by more than 4 inches from 1895 to 2017.[43] Heavy precipitation events (greater than 2 inches per day) have also increased, with a record number of heavy events in the five years between 2010 and the end of 2014.[44] However, per capita costs of flood damages in Illinois are more strongly associated with extreme runoff, which is driven by a combination of precipitation and land use patterns rather than by precipitation alone.[45] In the Illinois River Basin, the fraction of precipitation that manifests as runoff increased 14 percent from 1975 to 2013, likely because of a rapid expansion of the agricultural sector.[46] Increases in rainfall

and runoff can also lead to more 100-year floods, which are severe floods with a 1 percent chance of occurring in any given year.[47] Between 2040 and 2060, greater rainfall and runoff could increase the frequency of 100-year floods by more than 500 percent in many parts of Illinois, relative to the period from 1950 to 2000.[48]

Floods bring a wide array of health threats, including drowning and vehicle accidents. In 2015, Illinois set a record for the annual number of flood fatalities in the state when 14 people were swept away while trying to cross flooded roads.[49] Data from 1996 to 2000 suggest the relative risk of vehicle accidents with injuries significantly increased with more intense rainfall in 18 of Illinois's 102 counties.[50] In Lake, McHenry, Cook, Will, Rock Island, and Sangamon Counties specifically, the risk of car accidents with injuries was more than 41 percent higher on days with more than 2 inches of rain than on dry days.[51]

Flooding can also block critical roads and disrupt medical facilities. In July 2017, Northwestern Medicine Lake Forest Hospital evacuated or discharged 93 patients and shut down for more than four days after the city of Lake Forest got 6.7 inches of rain in just 14 hours.[52] In February 2018, northern Illinois suffered major river flooding after 3 to 6.5 inches of rain fell on frozen ground over two days.[53] The resulting floodwaters inundated Mercyhealth Hospital–Rockton Avenue in Rockford, forcing officials to send all incoming patients to other facilities.[54] Interruptions to medical services can be especially serious for people who require regular care for chronic conditions such as diabetes and drug addiction.[55] Unfortunately, these conditions present more regularly in Illinois than in the rest of the nation: in 2016, the number of adults in Illinois diagnosed in their lifetime with diabetes was 9 percent higher than the national average, and the rate of overdose deaths from opioid addiction was 15 percent higher.[56]

Increases in extreme precipitation and flooding will likely lead to more contaminated runoff from streets and farms, and more failures of Illinois's aging drinking water, stormwater, and wastewater systems.[57] Contaminated runoff and sewer leaks or overflows can spread disease among communities; in fact, heavy precipitation preceded more than two-thirds of the outbreaks of waterborne diseases, such as the diarrheal illness giardiasis, in the United States from 1948 to 1994.[58]

Illinois cities Chicago, Peoria, and Quincy are among the nearly 860 cities across the United States with combined sewer systems.[59] These outdated systems, which carry sewage and stormwater in the same pipes, were designed to overflow into lakes, streams, and rivers during heavy rain or snowmelt.[60] If just two-thirds of an inch of rain falls in 24 hours, the Chicago River can become so swollen with sewage and stormwater that the river changes course and flows into Lake Michigan instead of away from it.[61] In 2014 alone, 41 Illinois communities with combined sewer systems

reported discharging 500 million gallons of untreated water during storms.[62] That's enough to fill more than 750 Olympic swimming pools.[63] The sewage and other contaminants dumped by combined sewer systems can cause a variety of illnesses. In Ohio, for example, a study of 2010 to 2014 data found that combined sewer overflows near homes increased the odds of childhood emergency room visits for gastrointestinal illnesses by 16 percent.[64]

Multiple studies have consistently found increases in post-traumatic stress disorder, anxiety, depression, and substance abuse after inland flooding associated with heavy rain.[65] People who experience significant personal or economic flood losses, who are living in poverty, or who have pre-existing mental health problems tend to be more vulnerable to psychological problems in the aftermath of flooding.[66] According to the 2019 *State of Mental Health in America*, nearly 16 percent of Illinois adults experience mental illness, and more than 12 percent of Illinois youth had at least one major depressive episode in the prior year.[67] More than 21 percent of Illinois adults with mental illness report unmet mental health needs, potentially reducing their resiliency to flooding disasters.[68]

TICK-BORNE INFECTIONS ARE INCREASING

Rising temperatures and changes in rainfall patterns expand habitat for ticks and allow them to be active earlier in the year.[69] That increases the likelihood of contracting a tick-borne illness, which is particularly bad news for the more than 74,680 Illinois residents who work in outdoor occupations such as farming, landscaping, and highway construction.[70] It also affects the millions of Illinoisans who enjoy outdoor activities, including visiting parks and picnicking.[71]

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Lyme disease, the most common illness transmitted by ticks in the United States, causes flulike symptoms in its early stages.[72] Weeks or months after a bite by an infected tick, people with untreated Lyme disease can suffer debilitating muscle and joint pain, headaches, memory problems, and even fatal heart damage.[73] In Illinois, 2,144 confirmed or probable cases of Lyme disease were reported from 2008 to 2017.[74] Blacklegged ticks, the main carrier in the United States of the bacteria that cause Lyme disease, are expanding to new counties in Illinois. In 1996, the ticks were reported or established in only 51 of the state's 102 counties; by 2015 their documented range had increased to 64 counties (Figure 2).[75] The spread of blacklegged ticks is potentially due to a combination of warmer temperatures caused by climate change, increases in tick-friendly habitat because of reforestation, and local increases in populations of deer and mice that carry ticks.[76]

FIGURE 2: COUNTIES IN ILLINOIS WHERE BLACKLEGGED TICKS WERE REPORTED (FEWER THAN SIX TICKS OF A SINGLE LIFE STAGE) OR ESTABLISHED (SIX OR MORE TICKS OR TWO LIFE STAGES) IN 1996 AND 2015.

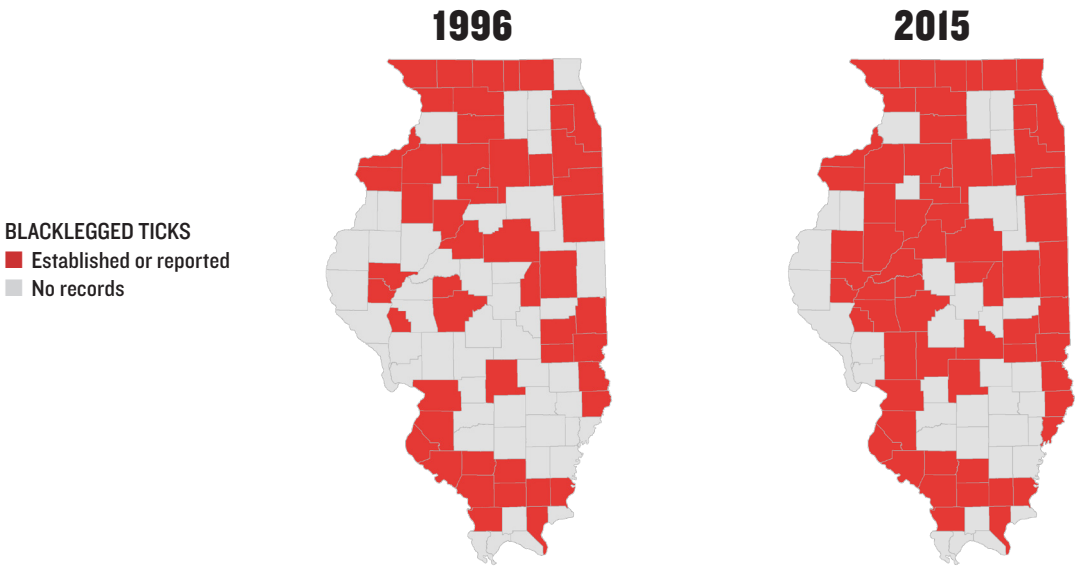

Figure adapted from Eisen et al. in the *Journal of Medical Entomology* 53, no. 2 (2016).

While Lyme disease poses a threat to all Illinois residents, majority-white counties with higher levels of education and more seasonally vacant housing had a higher incidence of the disease nationwide from 2007 to 2013 than did lower-income people of color.[77] This may be due to a combination of human behavior (i.e., people with vacation homes spending more time outside) and more vegetation and mice around homes that aren't occupied year-round.

The risk of contracting diseases from lone star ticks is also expected to increase in Illinois as the climate changes. Lone star ticks are "very aggressive" biters that can transmit a suite of diseases to humans, including Rocky Mountain spotted fever.[78] Rocky Mountain spotted fever kills 5 to 10 percent of people who contract the disease, making it one of the deadliest tick-borne illnesses in the United States.[79] From 2000 to 2009, Rocky Mountain spotted fever was most common in southern Illinois.[80] However, lone star ticks have been expanding northward in the Upper Midwest since the 1970s and likely will become firmly established in northern Illinois as temperatures rise.[81]

ACTING ON CLIMATE CHANGE CAN PROTECT OUR HEALTH

The good news is that switching from fossil fuels to cleaner energy will help limit the dangerous effects of climate change and protect our health.

Illinois has already reduced its total carbon dioxide emissions, cutting them by more than 16 percent from 2005 to 2016.[82] From 2007 to 2015, Illinois's wind and solar power plants averted about 49.1 million metric tons of carbon dioxide emissions, equivalent to the emissions from passenger vehicles driven about 120 billion miles.[83] These renewable power plants also averted more than 80,000 metric tons of sulfur dioxide, another dangerous air pollutant, and nearly 27,000 metric tons of nitrogen oxides, key building blocks of smog and particle pollution.[84]

In 2016 Illinois passed the Future Energy Jobs Act, which has already helped increase energy efficiency and drive growth in renewable energy generation.[85] Reductions in particle pollution under the act have the potential to cumulatively avoid an estimated 17,890 asthma attacks, 1,650 heart attacks, and 2,800 premature deaths between 2018 and 2030.[86]

In January 2019, Governor J. B. Pritzker deepened the state's commitment to a cleaner energy future by joining the U.S. Climate Alliance.[87] The alliance is a bipartisan group of states working to advance the United States' commitments to cut carbon pollution based on the goals of the international Paris Agreement on climate change.[88]

An important next step for Illinois is to clean up transportation, which was the state's largest source of carbon dioxide pollution in 2016.[89] In 2019 the state issued a Long Range Transportation Plan (LRTP) that promotes a diversity of travel options beyond single-occupant vehicles as well as housing development patterns that make it easier for people to get to work, school, and play without using a car.[90] Importantly, the LRTP calls for the Illinois Department of Transportation to make funding decisions based in part on how well new projects and programs limit emissions of carbon dioxide and other climate-changing pollution. Fully implemented, the LRTP could deliver numerous health benefits, including less traffic-related stress, improved response times by paramedics, higher birth weights because of improved air quality, and fewer premature adult deaths thanks to increased physical activity.[91]

Cleaner transportation could also deliver substantial economic savings. Increasing the percentage of light-duty electric vehicles in Illinois from approximately 13,000 today to 2.1 million in 2050 could slash 29.1 million tons of carbon dioxide and save drivers a cumulative total of $35.2 billion in vehicle operating costs from 2030 to 2050.[92]

Illinois has started to grow the public health system's capacity to effectively address health impacts from climate change at both the state and local levels.[93] The Building Resilience Against Climate Effects team at the University of Illinois at Chicago (BRACE-Illinois) and the Illinois Department of Public Health (IDPH) are working with the Centers for Disease Control and Prevention's Climate-Ready States and Cities Initiative to assess climate-related health threats in Illinois and to identify the best public health interventions to minimize harm, otherwise known as "climate adaptation."[94] BRACE-Illinois is working closely with some local health departments to promote climate change in public health planning, design and implement climate adaptation strategies and tools, expand the knowledge base by contributing to the literature on public health practice and climate change, and increase knowledge and awareness among various audiences.[95]

At the local level, the Chicago Department of Public Health and the Champaign-Urbana Public Health District included climate change as a health threat in their most recent Community Health Improvement Plans.[96] Local health departments and health care facilities should continue to improve their climate adaptation efforts by making full use of the communication, planning, and analytical tools developed by BRACE-Illinois and the IDPH. For example, BRACE-Illinois and the IDPH developed a flood preparedness map to identify long-term care facilities, hospitals, dialysis centers, ambulatory surgical treatment centers, and pharmacies located in or near floodplains.[97] Decision makers can use information like this to prioritize floodproofing measures and develop evacuation plans.

The bottom line is that Illinois residents have much to gain from climate action—and lives to lose if we fail to cut our emissions and build resilience to the damage already being done.

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