

SENIORS AT RISK: HEAT & CLIMATE CHANGE

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Research brief by
Climate Central

We would like to thank our reviewers for their insightful comments on this report as these comments led to an improvement of the work. They include [George Wang](#), MD, PhD, FACP, Founder and Physician, Wisdom Health & Wellbeing; Katherine Shea, MD, MPH, Environmental Health Consultant; and [Claudia Tebaldi](#), Earth Scientist at Joint Global Change Research Institute (JGCRI) and Senior Science Advisor to Climate Central. Any remaining errors are the responsibility of Climate Central.

SOCIAL ISOLATION, HEAT SAFETY, & COVID-19

Days of dangerous heat have increased in cities all over the U.S. in recent decades as greenhouse gas emissions warm the climate. Heat is [the top killer among all types of weather events](#), surpassing hurricanes and tornadoes. The baby boomer generation (born between 1946-1964) will be among those hardest hit by climate change, as their increasing vulnerability to extreme heat coincides with rising temperatures.

An estimated 12,000 Americans die of heat-related causes annually, [according to research](#) by scientists at Duke University, a number roughly comparable to [annual deaths from gun homicides](#). More than 80 percent of heat's victims are over 60, [other researchers have found](#).

Several factors make older people vulnerable to heat, said [Dr. Jay Lemery](#), a professor of emergency medicine at the University of Colorado School of Medicine, who has written two textbooks on climate and health. As we age, our bodies regulate internal temperature less effectively, with declining ability to sweat and circulate blood to the skin, and a weaker cardiovascular system. In addition, elders often have medical conditions or use medications that affect temperature regulation or hydration.

A mildly dehydrated or overheated elder can become confused or unaware of their situation, behaving listlessly and failing to react to a growing threat of dangerous overheating, Lemery said. If a family member or friend offers a cold glass of water or turns up air conditioning, that action alone could be enough to head off a developing crisis. But many seniors live by themselves, including [44 percent of women over 75](#).

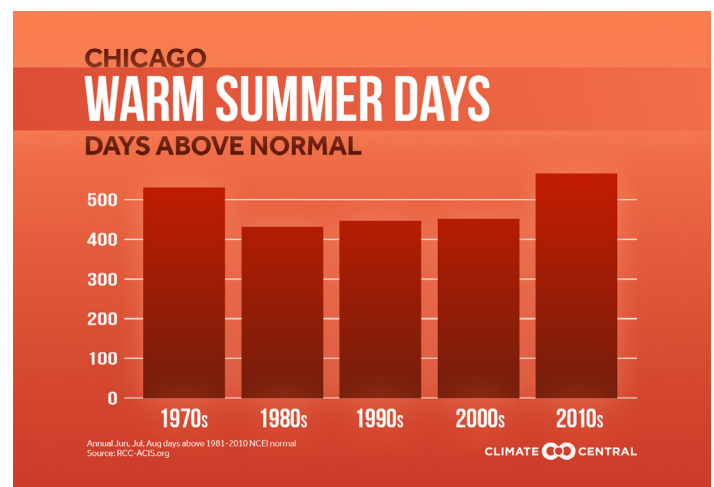
Researchers recognized social isolation as a cause of heat deaths after a [historic disaster in Chicago](#) in mid-July, 1995, which killed more than 700 people. Over four days of exceptional heat, refrigerated trucks filled with bodies outside overwhelmed morgues. [Eric Klinenberg](#), now a sociologist at New York University, [studied the Chicago event](#) and found that victims were mainly seniors living on their own. Deaths concentrated in neighborhoods with high crime and weak community connections. "Being socially isolated was the leading epidemiological risk factor for dying that week," Klinenberg said.

He said America's [rapidly increasing elder population](#) means more people than ever are living alone at the same time we are seeing [increasing summer heat](#). For example, Chicago saw 27% more hotter-than-average summer days during the past decade than in the 1990s, according to a [Climate Central analysis](#).

Along with additional days of hazardous heat, [most cities are also logging warmer nights](#), with sticky sleeping conditions that make it difficult to recover from the day. [The cost of cooling has risen](#), too, as longer and hotter summers strain many seniors' fixed-income budgets.

"We're expecting to see more frequent and more extreme events," said [Jeffery Shaman](#), director of the Climate and Health Program at Columbia University's Mailman School of Public Health. "That's certainly what we've witnessed over the past 30 years. So it is going to be a big problem, and it's something where we're not necessarily yet fully equipped."

Communities' responses to heat hazards vary widely. Some cities deploy sophisticated heat emergency systems, using



strategies such as health surveillance, public alerts, telephone hotlines, field assessment teams, cooling centers, transportation services, utility subsidies for air conditioning, community planning to reduce urban heat, and even ambassadors to help seniors at risk. [Philadelphia](#) and [Phoenix](#) have both developed programs, and the [EPA](#) has shown these efforts to have saved many lives.

But even these highly aware cities are scrambling during COVID-19. Social distancing could prevent the usage of traditional cooling centers or local air-conditioned sites like shopping malls or libraries, as older residents, vulnerable to the virus, avoid public places and personal contact.

[Cities' new ideas](#) include additional money for air conditioners and utility bills, closing streets to allow more outdoor space, parking air-conditioned buses as dispersed cooling centers, and even renting hotel rooms for vulnerable homeless people.

Low-cost options can help, too. Volunteers and community groups can keep tabs on seniors, with responsibility for just a city block or two each. Lemery said how we can all do that, even without a city-organized plan. He suggested connecting now with neighbors, taking on a street or a building and getting to know seniors. With relationships in place, you will be ready to check in on senior neighbors when hot days arrive.

PREPARING FOR HEAT EVENTS DURING THE COVID-19 PANDEMIC

Physicians and emergency planners say seniors' best defense against heat is social connection, with family and neighbors checking on elders who are alone in sweltering weather. Unfortunately, social distancing makes that help harder to give.

"The stakes are higher," said [Dr. Jay Lemery](#), a professor of emergency medicine at the University of Colorado School of Medicine. "As the summer months roll around, if you are isolated, if you are elderly and it's hot out, and you are concerned about Covid, we're kind of entering the perfect storm for bad things to happen."

[Eric Klinenberg](#), a sociologist at New York University, fears the social isolation of Covid-19 could increase risk of heat-related deaths.

"This coming summer, with people staying at home and sheltering in place and public places shut down, I have real concerns about social isolation turning deadly on a massive scale," Klinenberg said. "Everyone should be aware that this summer there may be more vulnerable people home alone and isolated than ever before. And the combination of extreme summer heat and millions of people home alone and isolating is potentially catastrophic."

Covid-related budget cuts and health concerns forced Philadelphia to close swimming pools used as cooling centers, said [Christine Knapp](#), director of the city's Office of Sustainability. Covid is forcing Philadelphia to rewrite plans it pioneered in the 1990s. She worries that tactics used in the past to combat heat deaths won't be possible in the future.

The economic downturn has left many even less financially prepared to protect themselves as temperatures climb, increasing the likelihood that seniors will face greater chances of dying from extreme heat. Early summer saw [record high temperatures](#) in the Northeast and Southwest, and [public health officials](#) in cities were rethinking their heat event preparedness plans so vulnerable populations can follow social distancing guidelines. In June, the [Global Heat Health Information Network](#) issued a peer-reviewed [technical brief](#) that outlined the compound risks of hot weather and COVID-19 and included recommendations for communities and health systems to increase coordination and communications, and plan strategically to prevent avoidable illness and death.

CLIMATE AND HEAT DEATHS

Summers are warming, inflicting [more days of extreme heat](#) on cities across the United States, and increasing risks for heat-vulnerable populations, including low-income individuals, communities of color, and seniors. Future climate

projections envision spreading zones of reduced habitability and thousands more deaths annually.

But the heat of our summers in the future—and the ability of seniors to survive them—depend on the choices societies make today. Grim projections of deaths assume continued emission of greenhouse gases and failure to adapt to the changing climate.

The [2018 National Climate Assessment](#) published by the federal government projects 9,300 additional extreme temperature related deaths annually in the 49 largest U.S. cities under a scenario of unchecked greenhouse gas emissions (technically known as RCP 8.5). If humanity reduces emissions enough to limit warming to roughly 2°C (3.6°F), the projected increase by 2100 would be 3,900 annual deaths (RCP 4.5).

To project deaths, public health experts and scientists face a larger set of uncertainties than those making future climate projections, including assumptions about how people will behave.

[Kristie Ebi](#), a professor in the Center for Health in the Global Environment at the University of Washington, who was lead author on the health chapter in the 2018 Assessment, said the estimate of deaths does not take into account future adaptation, such as more air conditioning or community cooling centers, which could help alleviate the problem. But it also doesn't take into account a factor that could make the problem worse—as America ages, the number of vulnerable seniors will increase.

"We don't know all the different reasons people are dying in the heat," Ebi said. "A lot of cases are missed because people are not necessarily in a hospital when they die during a heatwave."

[Researchers have concluded](#) that the numbers of such deaths have gone down in the United States as air conditioning and heat awareness have gone up. But often when seniors die in the heat, perhaps with cardiac arrest or kidney failure, the death certificate lists that diagnosis, not the heat that was the precipitating cause, ultimately leading to death. Ebi said that cases are also missed when victims are not in hospitals. As a result, the [Center for Disease Control asserts](#) that its official statistics undercount heat deaths.

Ebi worked with a team of researchers at Duke University, led by [Drew Shindell](#), a professor of climate science, to calculate a more accurate number of heat deaths. They looked at deaths in 10 U.S. cities, regardless of cause, and compared the numbers during heat events to how many died on similar days when the weather was normal. Using that method, and extrapolating across the country, they estimated 7,500 to 16,500 Americans die prematurely every year (as noted above). They projected that number to rise to 60,000 to 134,000 by 2100, under the unchecked emissions scenario (and excluding the effects of adaptation and a changing population).

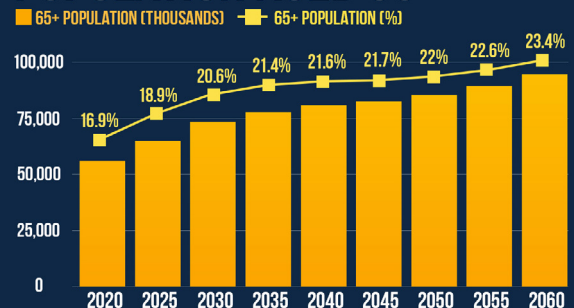
[The study](#), published in April 2020 in the journal *GeoHealth*, dramatically increased the estimates of current deaths and future deaths, exceeding the National Climate Assessment's 2100 projection by a factor of 10.

CHECKING ON ELDERLY NEIGHBORS: WHAT TO LOOK FOR

Here's advice from Dr. Jay Lemery, a professor of emergency medicine at the University of Colorado School of Medicine.

- Get to know your older neighbors before the weather gets hot.
- During hot weather, check in by phone or video, or by socially distancing at the door.
- Ask detailed questions. Check for a bright mood and conversational ability.
- Ask about hydration and the temperature in the home.
- Urination reflects hydration. Yellow, smelly urine indicates dehydration.
- If you are unsure how the senior normally presents, get help from a friend or relative.
- If the senior seems confused, listless or unresponsive, call 911.

UNITED STATES POPULATION AGED 65+



Source: U.S. Census Bureau, Population Division

CLIMATE CENTRAL

[Patrick Kinney](#), a professor of environmental health at the Boston University School of Public Health, who was not involved in the study, said it is challenging to obtain a reliable estimate of the number of heat-related premature deaths for the U.S. as a whole. He called the study an important advancement in our understanding of the impacts of extreme heat, and in how a changing climate could affect those impacts. Shindell said the study's method is simple and matches up with previous work, pointing out that no significant flaws have been found in other studies, whose only limitation was not covering the whole country.

Shindell and Ebi's review of deaths also showed that the risk of dying from heat is higher in northern states, a finding that mirrors the [experience of health officials](#). Ebi and others hypothesize that in the southern U.S., where [almost all homes have air conditioning](#), residents have already adjusted to hot summers. In northern cities, temperature spikes hit residents who are less prepared to deal with them.

Also, constant warm temperatures [acclimatize our bodies to heat](#). Weeks of exposure make us less sensitive to heat, with a lower resting core temperature, increased blood flow to the skin, and greater ability to sweat, among other changes.

By routinely (and safely) spending time outdoors during the summer, we can acclimatize and suffer less, said [Jennifer Vanos](#), of the Arizona State University School of Sustainability. Summertime acclimatization also helps explain why equivalent heat events are deadlier in May than August, Ebi said. But in order to safely spend time outdoors in hot and humid weather conditions, older persons should ideally be accompanied by someone who can monitor their temperature, hydration, and mental status. A consultation with a physician, based on a clinical evaluation of underlying medical conditions and vulnerabilities, should occur before attempting to acclimate.

But will Americans' adaptation continue as the climate warms? [A study](#) by an international team of scientists, including [Tim Kohler](#), an archeologist at Washington State University, found that projected climate warming may push areas of the United States out of the environmental niche humans have primarily occupied for 6,000 years.

Every species depends on surroundings that meet its biological needs, called its niche—even human beings. Kohler's group compared past climate and where people lived through millennia of civilization, finding our species thrived in a defined band of temperatures. That environmental niche probably reflects the ability of people to survive the heat as well as the success of our most common crops and livestock.

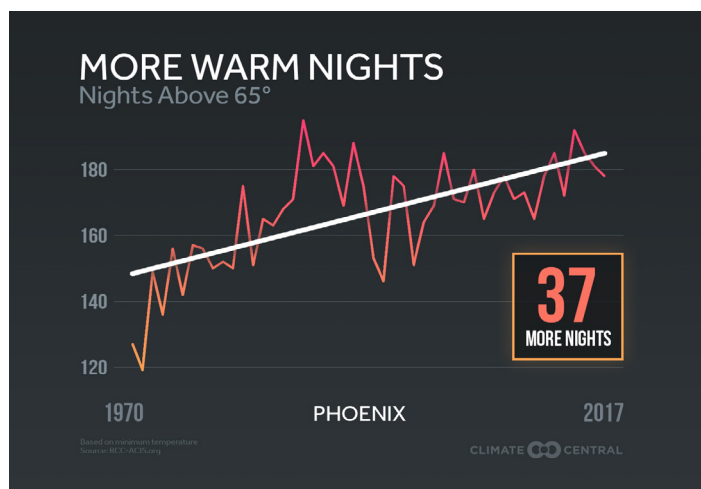
In 50 years, if greenhouse gas emissions continue on the current path, large parts of the southeast U.S., and areas in the Southwest and California, will be outside the niche, the researchers found. "By 2070 or thereabouts, if we keep going the way things are, people are really going to want to get out of major chunks of the Southeast," Kohler said.

TRYING TO STAY COOL IN A CHANGING CLIMATE

Technology could help people continue to live in the hot zones, with air conditioning and new crops and farm animals that can handle more heat. Parts of Florida are already outside humans' traditional niche, Kohler said. He points out that the use of air conditioning, which broadens our niche to make those areas more attractive, accelerates global warming.

[Air conditioning affects warming](#) by consuming energy that is generally produced with fossil fuels, causing greenhouse gas emissions and air pollution. In urban areas, air conditioners shed hot air from buildings, [further warming their surroundings](#).

However, air conditioning is a necessity for the 4.5 million residents of Phoenix and surrounding Maricopa County. About 40 percent of heat fatalities in the area occurred indoors in 2017, often in the presence of air conditioners that seniors can't afford to use or keep working, according to [county statistics](#).



Deaths could happen on far a wider scale in a sustained power outage, said [David Hondula](#), a researcher at the Urban Climate Research Center at Arizona State University. In Hollywood, Florida, [12 seniors died](#) of heat-related causes in a nursing home that lost power for air conditioning during Hurricane Irma in 2017. Hondula said days without air conditioning in Phoenix would pose a threat as great as a major natural disaster.

The threat of longer and more frequent outages is increasing, according to the federal government's [2018 National Climate Assessment](#). Even as the need for [air conditioning becomes more critical](#), hot weather and drought are reducing the efficiency of some [power plants](#) and power transmission facilities. [Sea level rise](#) and stronger storms powered by climate change also make the grid vulnerable, according to the report.

"Unless other mitigation strategies are implemented, more frequent, severe, and longer-lasting extreme heat events are expected to make blackouts and power disruptions more common, increase the potential for electricity infrastructure to malfunction, and result in increased risks to public health and safety," the report said.

Hondula wonders about the limits of human adaptability to heat. Even with an internationally recognized program to address heat health, the Phoenix area has struggled with high fatality rates for the last four years. With fatalities rising and temperatures projected to rise more, Hondula wonders what may happen next.

HEAT STRESS AND OTHER HEALTH RISKS

At the extremes, heat can cause organ failure and death. Brain cells break down as proteins denature in heat, cooking like an egg, said Dr. Jay Lemery.

But far short of classic heat stroke, which [occurs with body temperature above 103 degrees](#), senior citizens can get into serious danger, as heat and dehydration stress bodies already challenged by age and chronic medical conditions or made more vulnerable by medications.

[Physiological studies show](#) that even healthy elders are less able to sense heat or to sweat, and are less apt to feel thirst and seek fluids when dehydrated, compared to younger adults. Older bodies don't regulate internal heat as well, and poor physical fitness or being overweight makes these problems worse. Since 1999, people over 65 have been [several times more likely to die](#) from heat-related cardiovascular disease than the general population, while non-Hispanic blacks generally have had higher-than-average rates.

Chronic medical conditions common among the aged add to their vulnerability, including high blood pressure, diabetes, and cardiovascular and respiratory diseases.

[Medications](#) can contribute to heat risks, too. Some high blood pressure medications make hydration more difficult or impair the body's ability to optimally regulate heat. Some medications may prevent thermoregulation in older persons, such as beta blockers, calcium-channel blockers, and [anticholinergics](#). Over-the-counter antihistamines such as Benadryl can also have anticholinergic properties. Diuretics, used for the treatment of high blood pressure or heart failure, have the potential to cause dehydration.

Among the stages of hyperthermia, or overheating, heat exhaustion and heat stroke are the most serious, [according to the Centers for Disease Control](#).

A person with heat exhaustion may feel cool to the touch, but has a fast, weak pulse and rapid, shallow breathing. Symptoms may include muscle cramping, fatigue, headache, nausea or vomiting, dizziness or fainting. The condition is dangerous, especially for elders with other medical conditions, and can progress to heat stroke without intervention to cool the victim.

You can help a person with heat exhaustion by moving to a cool location, giving cold drinks, having the victim lie down with feet elevated, and cooling with a sponge or spray of cold water. If in doubt, call 911, Lemery said. Knowing an older person's normal behavior or demeanor helps recognize the effects of heat. An elder should be able to answer questions and communicate in an outgoing way. Listlessness or vague answers to questions are a concern.

A person with heat stroke has a temperature above 103°F, with red skin that is hot to the touch, but may not sweat. Other symptoms include a rapid, strong pulse, throbbing headache, dizziness, nausea, confusion, strange behavior

and unconsciousness. Heat stroke is a medical emergency and may require hospital admission. Even if a patient with heat stroke survives, [recovery can take two months to a year](#). The Mayo Clinic publishes handy first aid guides for [heat exhaustion](#) or [heat stroke](#) online.

COMMUNITY PLANNING AND COORDINATED RESPONSE

Heat disasters in the 1990s woke up American cities to the threat to their senior citizens. Today, as temperatures rise further, some communities are innovating new solutions to keep up.

Planning for excessive heat varies across the U.S., reflecting climate and community differences. Heat events can be deadliest in cities with lower average temperatures, where residents are less adapted to heat, and [in low-income areas](#) where seniors are less able to afford air conditioning, the housing is of [lower quality](#) (absorbing and retaining more heat), and [communities of color](#) make up a disproportionate fraction of the population.

Despite the differences, however, experts have found common strategies all communities can use to avert senior heat deaths. The [EPA published a manual](#) in 2006, updated in 2016, to help cities and counties develop their own plans.

Philadelphia has such a plan. And the city's first lesson was the importance of data.

In July 1993, temperatures hit 100 degrees for four days and Philadelphia morgues filled, but [only 17 of the dead met the official definition](#) as victims of the heat. Until that time, a death would be attributed to heat only with a measured internal temperature of at least 105 degrees, an indicator of heat stroke. That left out anyone who died outside a hospital—with no temperature taken—or who died of cardiac arrest or another underlying condition aggravated by the heat.

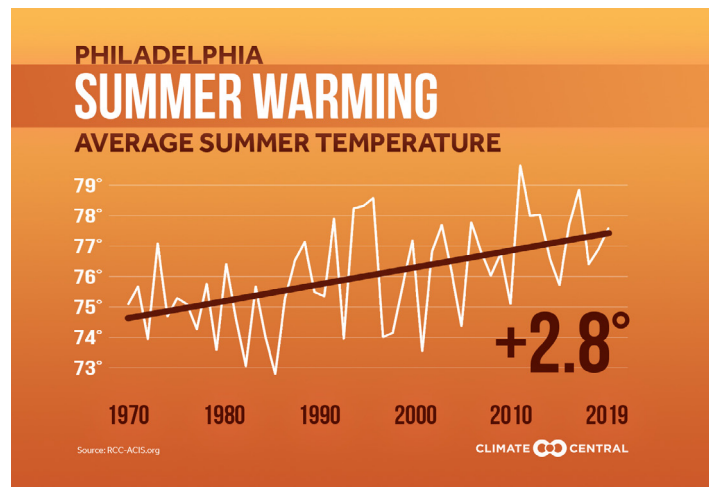
[The Philadelphia Inquirer reported](#) what happened next. Medical Examiner Haresh Mirchandani decided that the official definition left out most victims and, with new, more inclusive measures, determined the heat event had killed 118 people. His new way of measuring the problem revolutionized the response.

With recognition of the numbers of seniors dying, Philadelphia's government and local agencies collaborated on a heat program involving multiple stakeholders—another important lesson for other cities. [Allen Glicksman](#), director of research and evaluation at the Philadelphia Corporation for Aging said heat emergencies require coordination and awareness by health and senior citizen agencies, social services, first responders, emergency managers, media and community leaders.

Philadelphia has begun focusing on relationships between aging, poverty and heat to save more seniors.

The city's [Office of Sustainability](#) recently [mapped heat in Philadelphia](#) neighborhoods. Large variations emerged due to the urban heat island effect, with lack of shade, black roofs and paving, and other aspects of the built environment intensifying heat. Overlaying that information with the location of vulnerable residents, including the aged poor and communities of color, they found that the hottest neighborhoods—with temperatures up to 22°F higher—were also the poorest, housed the most elderly, and had the least cooling resources, said [Christine Knapp](#), the sustainability office director.

Knapp's office chose the hard-hit [neighborhood of Hunting Park](#) as a pilot project. Following the example of the community-based network in Phoenix, Philadelphia sought to build social connections by listening to residents about how to solve the heat problem. Paid and volunteer ambassadors distributed surveys, recruited community groups, and asked houses of worship to open as cooling centers, offering movies and games to make them more attractive and help connect the community. The project also includes planting trees and other improvements to reduce heat in the long term. Knapp said Philadelphia hopes to build community as a key to beating heat deaths.



Under Philadelphia's system, heat predictions activate media warnings with tips for how to keep cool and encourage residents to check on older friends and family. Cooling centers are opened, utility cut-offs halted, and outreach increased to the homeless. Block captains covering the city organize checks on seniors and distribute information on heat.

Announcements include the phone number for the Heatline, operated by the Philadelphia Corporation on Aging. Callers to the Heatline can get advice from a nurse and might receive house calls from field assessment teams dispatched by the city Health Department.

[A 2018 study](#) found Philadelphia's program saved an average of 45 lives per year. A heat event in 1995, which was similar to the 1993 event, caused 60 to 70 deaths, a reduction of almost half, [according to the EPA](#).

But 1995 proved to be disastrous elsewhere. In Chicago, where more than 700 died during a July heat wave, dispute also erupted over the numbers, but the severity of the tragedy was illustrated by the sheer quantity of dead senior citizens overwhelming city morgues. Chicago implemented a system with elements like Philadelphia's, and in 1999 a similar heat event killed about 100 people, an 85 percent reduction, according to the EPA guide.

Unfortunately, extreme heat has become more common as the climate has warmed. In 2003, [35,000 died](#) during the hottest summer in Europe in 500 years, [an event attributed](#) partly to climate change. In 2010, it got even hotter in eastern Europe, and [56,000 Russians died](#) in heat and wildfire smoke.

In Phoenix, an exceptionally hot summer hit in 2005. The well-publicized death toll of 75 people led Maricopa County, which includes the city, to innovate a system of heat-death surveillance that examined every case for a link to heat and causes that could possibly be mitigated, the EPA guide describes.

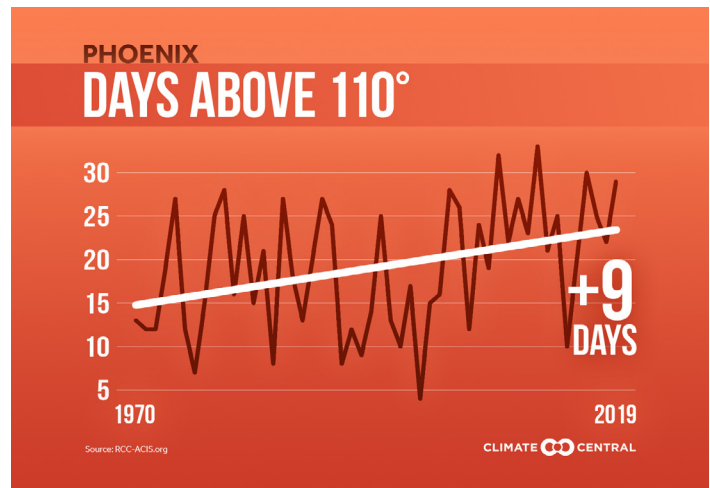
Using that information, local leaders assembled a cooperative approach to keeping residents safe, drawing on government, non-profit agencies, faith-based organizations and businesses. Their [Heat Relief Network](#) offers numerous dispersed cooling and hydration stations, heat refuges, and water donation sites. [Phoenix also has worked](#) on improving its urban design, encouraging shade and cool outdoor corridors.

Heat deaths in Phoenix briefly went down, but now they are [again rising dramatically](#), setting new records in each of the last four years and reaching almost 200 in 2019. The cause of the increase isn't completely known, and probably relates to social changes as well as longer, hotter summers, said David Hondula.

Hondula called the numbers particularly discouraging despite the attention paid to Maricopa County's heat problem by a community of researchers, public health officials and other partners. He said, "This is not something that we're sleeping on, and yet the numbers are moving in exactly the wrong direction."

For seniors, fighting poverty might be a key. Among people who died indoors in Maricopa County last year, 91 percent had air conditioning, but either the electricity was off, the unit set too low or turned off to save power, or it was broken, according to Maricopa County's mortality reports. Financial assistance could save lives, but Hondula said the federal government's [Low Income Home Energy Assistance Program](#) (LIHEAP) covers only a tiny minority of the need in Phoenix.

"People should know that heat deaths are also deaths of isolation, and when the weather gets very warm, everyone should reach out to older and more vulnerable people," said Klinenberg. "It really has been lethal in the past and threatens to be even more deadly as the planet warms and heat waves become longer and more intense," he said.



A TOOLKIT OF COMMUNITY STRATEGIES

Research shows that inexpensive local programs can save lives during heat events. The EPA studied successful community responses, in partnership with other agencies, and published the [Excessive Heat Events Guidebook](#) to help local officials. Here are some insights from the guidebook combined with ideas from cities with successful programs.

BEFORE THE HEAT

- Plan ahead. Like all emergencies, being ready is a key for response to excessive heat.
- Gather accurate data. Learn the health impacts of heat in your community. What areas and populations are most at risk? Consider senior residences, public housing, and congregations of the homeless.
- Convene all stakeholders. An effective response requires ongoing coordination with weather forecasters, media, health officials, senior social service workers, and local government.
- Establish a warning system. Coordinate weather forecasters and media to provide warnings and advice at temperatures that cause health risks in your area. Thresholds that trigger warnings may vary across different regions of the U.S.
- Provide funding for cooling. Focus and strengthen programs providing utility assistance to low-income seniors so they can use air conditioners. Some communities are giving away air conditioning units.

DURING THE HEAT

- Check on vulnerable seniors. Make organizations and individuals aware of the need to look out for elders.
- Provide cooling centers. Some communities open senior centers, libraries, pools, and other public buildings. Other communities include voluntary spaces, such as houses of worship. Malls and other businesses can shelter seniors, too.
- Provide transportation. Some communities dispatch professionals and volunteers to help seniors. Others provide free or discounted transportation for them to get to cooling centers during emergencies.
- Provide advice and intervention. Some communities maintain phone lines to help isolated seniors who need advice or rescue in heat emergencies.
- Prepare health care. Hospital emergency rooms and public health nurses may need additional staff during heat events.
- Stop utility cut-offs. Electrical service for air conditioning should remain on during a heat event.

MITIGATING THE HEAT

Human actions influence climate change and the urban heat islands that increase the threat of heat deaths. The [National Integrated Heat Health Information System](#) provides extensive information and strategies some communities and individuals are taking to mitigate future heat.

- Study heat islands. Urban features such as dark pavement and roofs and lack of shade can raise temperatures more than 20°F compared to nearby neighborhoods. Mapping the heat locates areas needing change. [This post](#) from the NIHHS explains how to start a mapping campaign.
- Identify and prioritize the most vulnerable populations. Demographic information can help local governments focus on areas with low-income seniors most at risk in a heat event. Local community groups, agencies, and individuals can find isolated seniors to check on when the heat comes.
- Change the urban landscape. Community planning can address heat islands through a [variety of strategies](#), including green infrastructure, tree and vegetation plantings, green or cool roofs and other solutions appropriate for the local climate.
- Consider emissions of greenhouse gases. Projections show the increasing pace of heat events depends on the future emissions of carbon dioxide from fossil fuels and other greenhouse gas releases. Decisions affecting emissions now will help determine the severity of heat emergencies in decades to come.