

Extreme Heat, Climate Change and Health

DID YOU KNOW?

CDC defines extreme heat as “summertime temperatures that are substantially hotter and/or more humid than average for that location at that time of year.”



Extreme heat has direct effects on health, and heat kills more people than any other extreme weather event. In this brief, we focus on the health impacts of climate change and heat in the U.S.

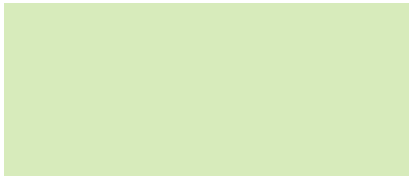
Extreme heat threatens health

- Extreme heat results in excess death and illness through [heat stroke](#), [heat exhaustion](#) and exacerbations of chronic illness.
 - Heat stress and associated dehydration can exacerbate existing renal disease and may be linked to new epidemics of chronic kidney disease among individuals without other traditional risk factors.¹
 - Heat increases ozone levels, exacerbating asthma, other respiratory disease and cardiovascular disease.
 - [Some medications](#) inhibit sweating or reduce the ability to sense overheating, increasing the risk of heat illness.
- Heat causes more deaths than any other type of natural disaster.
 - From 1999-2010, 7,415 people died from heat-related illness in the U.S., an average of 618 per year.²
 - The 2006 California heat wave resulted in 655 excess deaths, over 16,000 additional emergency room visits, and a 10-fold increase in admissions for heat-related illness.^{3,4}
 - Extreme heat events in Europe (2003) and Russia (2010) resulted in over 70,000 and 55,000 deaths, respectively.⁵
- Heat waves and concurrent drought contribute to crop and livestock loss, resulting in rising food prices and increased food insecurity. In 2015 the California drought resulted in \$900 million in crop revenue loss, \$350 million in livestock and dairy loss, tens of thousands of lost jobs, and a total economic impact estimated to be \$2.7 billion.⁶

What is extreme heat?⁷

Because individuals acclimate to their local climate, extreme heat is not defined by an absolute temperature, but rather by a relative change from past local conditions. CDC defines extreme heat as “summertime temperatures that are substantially hotter and/ or more humid than average for that location at that time of year.”

- California defines extreme heat days as those days above the 98th percentile of maximum temperatures, based on 1961-1990 data for a given location’s warmest months.



FAST FACT:

Heat causes more deaths than any other type of natural disaster.

What is extreme heat? continued

- For example, in San Francisco the extreme heat day threshold is 85°F for daytime temperature, while in Los Angeles it is 91°F.
- The National Weather Service issues Excessive Heat Warnings or Advisories based on a “Heat Index” that combines heat and humidity, because high humidity levels decrease the body’s ability to regulate heat through sweating.

Climate change increases extreme heat exposure

Due to climate change, extreme heat events are increasing in frequency, severity, and duration. In 2011 and 2012, the number of extreme heat waves was nearly triple the long-term average.⁸

- California’s average temperature is projected to increase by 3-5° F by mid-2030s and 2.8-10.8°F by the end of the century.⁹
- Rising average temperatures are projected to result in 2,100-4,300 excess deaths in California in 2025 and 6,700-11,300 excess deaths in 2050.¹⁰

The table below shows projected increases in the number of extreme heat days for various regions of California.¹¹

CITY	2050	2099
Bakersfield	48	93
El Centro	60	101
Fresno	46	90
Los Angeles	78	110
Redding	35	75
Sacramento	44	85
San Diego	76	129
San Francisco	39	126
San Jose	71	111
Truckee	41	83

Climate change, extreme heat and health equity

Social and economic inequities, as well as individual characteristics, place some individuals and communities at greater risk than others for the effects of extreme heat:

- **Urban heat islands:** Low income and communities of color are more likely to be located in “urban heat islands” — dense urban areas with fewer trees, less green space, more buildings, higher energy use, and more impervious asphalt and concrete. These characteristics create “urban heat islands,” where nighttime temperatures may be as much as 22°F higher than surrounding areas. These vulnerabilities map onto areas of historical residential segregation.¹⁸
- **Poverty:** For people living in poverty, the urban heat island effect is compounded by poor housing conditions, lack of air conditioning, or fear of using AC due to high-energy costs or fear of opening doors and windows for safety concerns.



DID YOU KNOW?

Heat-related deaths are 20 times higher among crop workers.

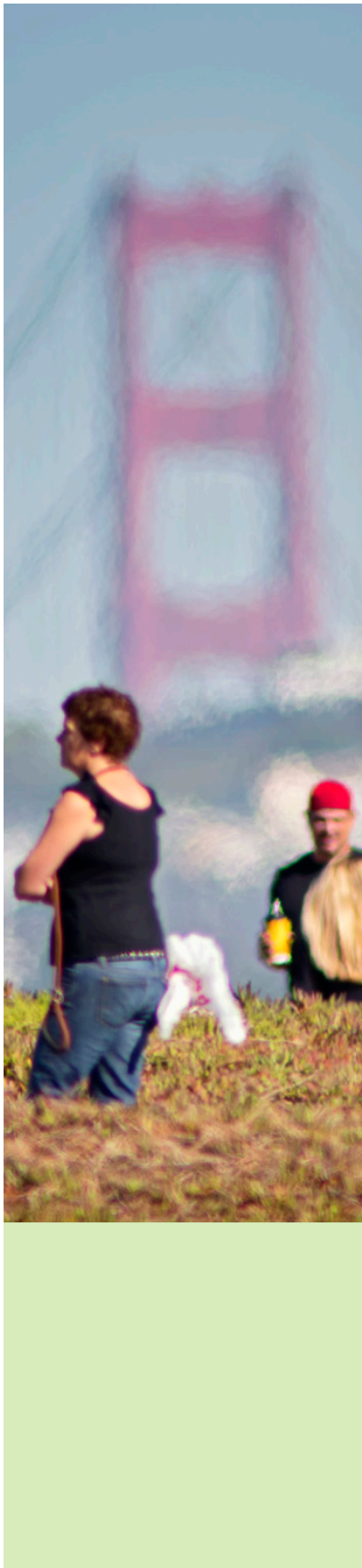
Forty percent of heat-related deaths among crop workers in California from 1999-2002 occurred in Mexican, Central or South American workers.



- **Working conditions:** Farm workers and other outdoor workers are at greater risk of exposure to extreme heat and heat illness. Heat-related deaths are 20 times higher among crop workers.¹⁴ More than ¾ of California’s agricultural workers are Latinos¹⁵ and 40% of heat-related deaths among crop workers in California from 1999-2002 occurred in Mexican, Central or South American workers.¹⁶
- **Social isolation:** Social, cultural, and linguistic isolation are all risk factors for heat illness.¹³ In the European heat wave of 2003, elders living alone had the highest mortality rates.
- **Physical or cognitive impairments:** Limited mobility increases the risk of isolation, and the ability to move to a cooler location. Cognitive impairment may limit the ability to recognize risk or seek assistance during an extreme heat event.
- **Age:** The very young and the elderly are less able to sense and adapt to changes in temperature, due to limitations in body temperature regulation.
- **Chronic Illness:** Those with conditions such as obesity, diabetes or renal, cardiovascular and respiratory diseases are at higher risk of heat illness, including changes in medication effects and other complications.¹² See [handout on medications and extreme heat](#).

What can physicians do to address climate change and extreme heat?

- Talk with patients about the risks and dangers of extreme heat and how to prevent heat-related health impacts
 - Make sure patients are aware of their own risks of heat illness and how to prevent it; provide fact sheets to patients and their families (see For More Information section below for links to patient materials). The basics include:
 - Use air conditioning, or get to a cool place like a cooling center or air conditioned shopping center or public building
 - Although there are real concerns that the use of fans in hot weather simply recirculates hot air, [a new study](#) suggests that fans can help prevent heat-related increases in heart rate and body temperature for healthy adults¹⁹.
 - Stay hydrated — drink plenty of cool water. Avoid dehydrating drinks such as alcohol and caffeinated beverages.
 - Use cool water for showers and baths.
 - Never leave children, elderly people, or pets unattended in homes with no air conditioning and particularly in vehicles, even if the windows are ‘cracked’ or open, as temperatures quickly rise to unsafe levels.
 - Inform patients about the risks of some medications and heat.
 - Some medications increase the risk of heat illness, such as psychotropic medications, diuretics, tranquilizers, and some medications for Parkinson’s disease. See [handout on medications and extreme heat](#).
 - Other medications, such as insulin, may lose their effectiveness if subject to very high temperatures.



- Encourage individuals to check in on neighbors, friends and relatives during extreme heat events. Encourage patients to make sure they have a “heat buddy” who will check in on them.
- Advise patients with pre-existing respiratory illness (asthma, COPD) to check [air quality levels](#) during extreme heat events and to limit outdoor air exposure when air quality is poor.
- Connect patients to resources for financial support in coping with heat, such as Low-Income Home Energy Assistance Program ([LIHEAP](#)). Air conditioning is cited as a key coping strategy, but many people are concerned about the high-energy costs of air conditioner use.
- Educate your colleagues and community on the links between climate change, extreme heat and health, and what can be done to prevent negative health impacts.
- Encourage development of a neighborhood response network to check in on vulnerable individuals during extreme heat events.
- Make sure your hospital and local health department have an extreme heat emergency preparedness contingency plan.
- Promote mitigation and adaptation strategies related to climate change and extreme heat.
 - Advocate for “urban greening” – planting trees and building green infrastructure – in neighborhoods that are tree and park poor, to increase shade and cooling. See the [Urban Greening & Green Infrastructure Climate Change and Health](#)
 - Support policies that mandate the use of cool roofs and green roofs and cool pavements, for example [Los Angeles Cool Roof ordinance](#)
 - Support policies that increase energy efficiency and the use of clean, renewable energy. This limits global warming, but also reduces local impacts like the creation of urban heat islands, which often result from increased energy use at the local level. See [Energy, Climate Change and Health](#)
- Support policies and programs in your community and in your health system that authentically engage and partner with community residents in addressing climate and health problems. Advocate for investments in disadvantaged and highly impacted communities to reduce social and economic vulnerability risks of heat health, for example, education and job opportunities and social service support.



DID YOU KNOW?

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For More Information

- Preparing California for Extreme Heat: Guidance and Recommendations http://www.climatechange.ca.gov/climate_action_team/reports/Preparing_California_for_Extreme_Heat.pdf
- CDC Extreme Heat Preparedness site <http://emergency.cdc.gov/disasters/extremeheat/faq.asp>
 - English site and materials: <http://emergency.cdc.gov/disasters/extremeheat/index.asp>
 - Spanish site and materials: http://www.cdc.gov/extremeheat/espanol/materials_esp.html
- Resources for urban greening in California
 - [Urban Releaf](#)
 - [California ReLeaf](#)
 - [CalFire Urban and Community Forestry Program](#)
- Resources for “cool” infrastructure in California
 - [Climate Resolve](#)
 - [CoolCalifornia.org](#)

Photo page 3: USDA; page 5: Jessica Lucia; page 6: Chameleon/Shutterstock.com.

Citations

- 1 American Society of Nephrology (ASN). (2016, May 5). Climate change may contribute to rising rates of chronic kidney disease. *ScienceDaily*. Available at: www.sciencedaily.com/releases/2016/05/160505222718.htm
- 2 Center for Disease Control and Prevention. (November 14, 2012). QuickStats: Number of Heat-Related Deaths by Sex-National Vital Statistics System, United States, 199-2010. Available at <http://www.cdc.gov/mmwr/preview/mmwrhtml/mm6136a6.htm>
- 3 Morello-Frosch, R., Pastor, M., Sadd, J., Shonkoff, S. (n.d.) *The climate gap: Inequalities in how climate change hurts Americans & how to close the gap*. Available at: University of California Program for Environmental and Regional Equity website: <https://dornsife.usc.edu/pere/climategap/>
- 4 California Climate Action Team, Heat Adaptation Workgroup, *Preparing California for Extreme Heat: Guidance and Recommendations*, Sacramento, CA 2013. Available at http://www.climatechange.ca.gov/climate_action_team/reports/Preparing_California_for_Extreme_Heat.pdf
- 5 Ibid.
- 6 Howitt, R., MacEwan, D., Medellín-Azuara, J., Lund, J., Sumner, D. (2015). Economic analysis of the 2015 drought for California agriculture. UC Davis Center for Watershed Sciences.
- 7 California Climate Action Team, Heat Adaptation Workgroup, *Preparing California for Extreme Heat: Guidance and Recommendations*, Sacramento, CA 2013. Available at http://www.climatechange.ca.gov/climate_action_team/reports/Preparing_California_for_Extreme_Heat.pdf
- 8 US Global Change Research Project (2014). National Climate Assessment: Climate Change Impacts in the United States. Washington, D.C. <http://nca2014.globalchange.gov>
- 9 California Climate Action Team, Heat Adaptation Workgroup, *Preparing California for Extreme Heat: Guidance and Recommendations*, Sacramento, CA 2013. Available at http://www.climatechange.ca.gov/climate_action_team/reports/Preparing_California_for_Extreme_Heat.pdf
- 10 Ibid.
- 11 Ibid
- 12 Ibid.
- 13 Gronlund, C.J. (2014). Racial and socioeconomic disparities in heat-related health effects and their mechanisms: a review. *Current Epidemiology Reports*, 1(3):165-173. Available at: <http://link.springer.com/article/10.1007/s40471-014-0014-4/fulltext.html>



- ¹⁴ Kjellstrom, T., Lemke, B., Otto, P.M., Hyatt, O.M., Briggs, D.J., & Freyberg, C.A. (2015). Heat impacts on work, human performance and daily life. In B.S. Levy & J.A. Patz (Eds.), *Climate change and public health* (pp. 77) New York, NY: Oxford University Press.
- ¹⁵ Morello-Frosch, R., Pastor, M., Sadd, J., Shonkoff, S. (n.d.) *The climate gap: Inequalities in how climate change hurts Americans & how to close the gap*. Available at: University of California Program for Environmental and Regional Equity website: <https://dornsife.usc.edu/perc/climategap/>
- ¹⁶ Ibid.
- ¹⁷ Ibid.
- ¹⁸ Jesdale, B., Morello-Frosch, R., & Cushing, L. (2013). The racial/ethnic distribution of heat risk-related land cover in relation to residential segregation. *Environmental Health Perspectives*, 121(7):811-817.
- ¹⁹ Ravanelli, N.M., Hodder, S.G., Havenith, G., & Ollie, J. (2015). Heart rate and body temperature responses to extreme heat and humidity with and without electric fans. *Journal of the American Medical Association*, 313(7). 724-725.



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Created with the support of Kaiser Permanente and The Kresge Foundation

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