The Health Effects of Extreme Heat

Introduction

Extreme heat events (EHEs), often referred to as heatwaves, are linked to a range of adverse health outcomes.[1,2] While there is no one universally agreed upon definition of an EHE, the U.S. National Oceanic and Atmospheric Administration (NOAA) defines extreme heat as, "A period of abnormally hot and dangerous temperatures, with or without high humidities, that can result in negative impacts to people, animals, and infrastructure."[3] EHEs can be difficult to define in part because what is considered extreme heat varies depending on the local climate and infrastructure, both of which can affect how prepared a region is for an EHE[1,2] In addition to temperature, humidity, air movement, and solar radiation (i.e., energy from the sun) all impact the severity of an EHE.[4] Effects also vary depending on the duration of the event, with longer events often posing a greater health risk.[4] Worldwide, an estimated 489,000 deaths occur from extreme heat each year,[5] making EHEs one of the most deadly natural hazards.[2,6,7] In fact, extreme heat is the number one weather-related cause of death in the United States.[5] As climate change increases the frequency, intensity, and duration of extreme heat events, the health impacts of these events are becoming even more important to understand.[1] This factsheet provides an overview of the health impacts of exposure to extreme heat as represented in the current literature.

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Risk Factors and Vulnerable Populations

While anyone can be impacted by an EHE, certain groups tend to be at higher risk. Vulnerable populations include:

- Children and infants[2]
- Older adults[1]
- Pregnant people[1]
- People with chronic conditions, including mental health conditions[2]
- Unhoused people[8,9]
- Workers with occupational heat exposure including outdoor workers (e.g., agriculture, construction, firefighting) and individuals with occupations that require physical exertion or work in hot indoor environments (e.g., mining, manufacturing)[10]
- Undocumented individuals[10]
- People of color, due to the effects of systemic racism[1]
- Low-income households[1]
- Socially isolated individuals[1]
- People who use drugs and alcohol and those who take certain prescription medications[2]

Heat-Related Illnesses

The health impacts associated with exposure to extreme heat are known as heat-related illnesses (HRIs).[2] HRIs can be divided into four categories: acute heat illnesses, pregnancy complications, chronic disease exacerbations, and behavioral and other emergencies associated with extreme heat exposure.[2]

Acute Heat Illness

Acute heat illness occurs when the body is not able to cool itself quickly enough, resulting in an increase in core body temperature.[2] Because humidity limits the body's ability to cool itself through sweat, the risk for acute heat illness can be higher in more humid locations.[11,12] Acute heat illness can vary from mild to severe and life-threatening.[2] Mild heat illness is unlikely to require medical attention and causes symptoms like heat cramps and swelling, also called "edema".[2] Moderate heat illness, known as heat exhaustion, includes symptoms such as dizziness or loss of consciousness, referred to as "heat syncope", fatigue, weakness, intense thirst, nausea, vomiting, and diarrhea.[2,11] Heat exhaustion is the most common HRI.[2] If untreated, heat exhaustion may progress to heat stroke, a severe and life-threatening HRI.[2,11] In addition to any of the symptoms present in heat exhaustion, symptoms of heat stroke may include neurological impairment like confusion, seizures, or, in the most severe cases, coma.[2,11] During heat stroke, the body reaches a core temperature above 40 degrees C (104 degrees F), a condition known as hyperthermia.[2,11] If left untreated, heat stroke can lead to organ failure and death.[2] Even after initial symptoms resolve, heat stroke can have a lasting impact, putting heat stroke survivors at higher risk of mortality from other causes.[2]

Pregnancy Complications

Exposure to extreme heat increases the risk of pregnancy-related emergency hospital admissions and pregnancy complications, including preeclampsia and hypertension, gestational diabetes, preterm delivery, stillbirth, and low birth weight.[1,2,14]

Chronic Disease Exacerbations

Exposure to extreme heat can exacerbate existing diseases, including cardiovascular disease, respiratory disease, kidney disease, and endocrine-related conditions like diabetes.[2,7,13,15] In fact, cases of chronic disease exacerbation often outnumber acute heat illnesses during an extreme heat event.[2,7] Those with preexisting cardiovascular, pulmonary, renal, endocrine, neurologic, and psychiatric disease are at increased risk during EHEs.[2,16] Individuals who take certain medications, like diuretics and some psychotropic medications, are also at higher risk because these medications can impact water and electrolyte balance, affecting hydration levels and altering the body's ability to regulate its temperature.[2]

Injuries

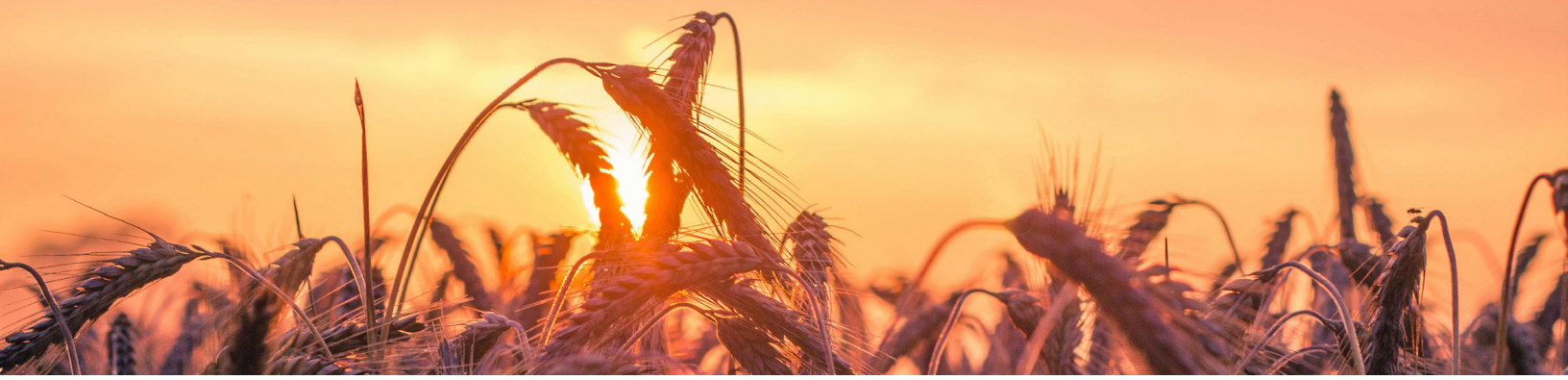
Behavioral changes that are associated with EHEs can increase the risk of injury.[2] For example, as people seek ways to cool off, there may be an increase in the number of individuals that go swimming or visit bodies of water during an EHE, which has been associated with higher rates of drownings.[2] Additionally, extreme heat is linked to an increase in falls and other accidental injuries.[7,17] There are also associations between EHEs and an increase in aggressive and violent behavior, including assault and domestic violence, although the reason for the association is not well understood.[2,1,18,19]

Mental Health Impacts

While further research is needed to better understand the mental health impacts of EHEs, extreme heat is associated with increased anxiety and depression, as well as increased suicidality.[1,20]

Infrastructure and Healthcare Impacts

EHEs can negatively impact infrastructure and the healthcare system in several ways. EHEs can negatively affect agricultural yields, impacting the food supply, and reduce the availability of water, especially when coupled with drought.[1,4] EHEs may put strain on the electric grid, decreasing efficiency at a time when there is likely to be an increase in demand, as more people run air conditioning units and fans to stay cool.4 As more individuals seek medical attention for HRIs, EHEs can increase the rate of health service utilization, including increased ambulance usage and hospital visits.[27,21,22] Increased health service utilization can increase healthcare costs.[23] The burden of these costs often falls disproportionately on women, older adults and low-income individuals.[2,21] Additionally, EHEs may compound the effects of droughts and wildfires, making their impacts more severe,[4] or occur at the same time as other natural hazards or infectious diseases.[2] For example, during the COVID-19 pandemic, individuals may have had to put themselves at increased risk of exposure to COVID-19 in order to access public cooling centers, which aren't always easily accessible to those who need them most, even without the added barrier of a global pandemic.[24–26] When hazards like these co-occur, there is an increased likelihood of infrastructure failure and strain on the healthcare system.[2,7]



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