

## Heat and Heart Health

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### GEH Global Environmental Health Chat

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**Narrator:** This is Global Environmental Health Chat, the podcast that explores environmental health issues that transcend national boundaries. This podcast is produced by the National Institute of Environmental Health Sciences.

**Narrator:** As Earth's climate warms, heat waves are becoming more frequent and severe. Health experts are concerned, for good reason: Heat stress is a leading cause of weather-related deaths in the United States each year.

**Narrator:** In this episode, we speak with Dr. Sameed Khatana, Assistant Professor of medicine at the Perelman School of Medicine at the University of Pennsylvania in Philadelphia. He is also a practicing cardiologist at the Philadelphia Veterans Affairs Medical Center. Dr. Khatana shares with us how exposure to excessive heat affects the body's organs, particularly the heart.

**SK:** The body can't really tolerate its core temperature being significantly above its baseline, which is around 37 degrees centigrade, or 98.6 degrees Fahrenheit. And so there's several mechanisms that the body uses to make sure that its core temperature stays within that range, or near that baseline.

**Narrator:** As Dr. Khatana explains, our heart and blood vessels are instrumental in moving excessive heat away from the body's core.

**SK:** The cardiovascular system's main job is to take heat away from the central part of the body and get it to peripheral areas so that it can be dissipated."

**Narrator:** Other bodily systems also kick in. The process of sweating is a big one, says Dr. Khatana. As sweat evaporates into the air, the body cools.

**SK:** Evaporation, by far, is the most important way for the body to dissipate heat, and that occurs at the skin as well as in the respiratory tract. The human body will ~~also~~ start breathing faster and harder ~~as well~~ to try and get rid of heat.

**Narrator:** Faster, harder breathing leads to a higher demand for oxygen. And as the body works harder to cool down, its energy demands go up, Dr. Khatana explains.

**SK:** When the temperature is increased, to a significant degree, there's an increase in oxygen consumption as well as the metabolic rate of the body. That leads to a faster heart rate. When the heart beats faster and harder, it needs more oxygen.

**Narrator:** These physical demands can be particularly difficult for someone suffering from other cardiovascular problems.

**SK:** So if you have someone who has blockages in the blood vessels of the heart, something that we also call coronary artery disease, the supply of oxygen to the heart itself is compromised. And so when the heart demands more oxygen, there's a mismatch in the supply and demand of that oxygen.

**Narrator:** That mismatch can lead to a condition called ischemia, which occurs when the heart doesn't receive enough oxygen. Ischemia can reduce the heart's ability to pump blood, cause severe blockage to the heart's arteries, and even lead to a heart attack.

**Narrator:** Other signs of heat stress, such as dehydration and changes in blood flow, can also contribute to heart attacks, as well as strokes.

**Narrator:** In a recent publication, Dr. Khatana and collaborators identified a connection between extreme heat and cardiovascular health. For their study, they used thresholds widely used by regulatory agencies to define extreme heat. In particular, they looked at a measure called heat index.

**SK:** Heat index, combines both the temperature as well as the humidity levels an area to really get at how the body experiences heat. And so we first obtained daily levels of the maximum heat index for a given county for every summer day between 1979 and 2017.

**Narrator:** They found a striking trend among adults ages 20 and over in the continental United States.

**SK:** We estimated that between 2008 and 2017, the summer months, which we defined as May through September, there were approximately 6,000 to 7,000 excess deaths amongst adults 20 years of age and older in the contiguous United States.

**Narrator:** They also found that one additional day of extreme summer heat per month was associated with a zero point one three percent in cardiovascular-related deaths at the county level.

**SK:** That number by itself might not seem like a large amount, especially in a world where we're used to a large numbers of deaths due to COVID and other public health issues. But we have to realize that that's due to one extreme heat day. And so when you count up the number of extreme heat days in every county across the entire country over a 10-year period, the number of dots adds up.

**Narrator:** The health effects of extreme heat don't occur equally across communities. Low-income neighborhoods and communities with a higher proportion of people belonging to racial or ethnic minorities experience significantly more heat-related health effects than wealthier and predominantly white neighborhoods.

**SK:** We looked at race and ethnicity subgroups, and here, interestingly, we found that non-Hispanic Black adults had a greater association than non-Hispanic White adults.

**Narrator:** Dr. Khatana attributes this inequality in heat-related health to several factors, including the urban heat island effect

**SK:** The urban heat island effect pretty much means that urban areas are hotter and they retain more heat compared to surrounding rural and non-urban areas. And-so we know based on some previous studies-that minority populations are more likely to live in neighborhoods that are impacted to a greater degree by the urban heat island effect. We also know that minority individuals, both on an individual level and a neighborhood level, also have less of an access to air conditioning, which is the primary way that people can really survive in extreme heat climates.”

**Narrator:** Dr. Khatan’s team also learned that some geographic regions are more vulnerable to the health effects of extreme heat than others.

**SK:** One interesting finding was that in areas that actually experienced fewer extreme heat days, there's a greater increase in or there's a greater association between extreme heat and-cardiovascular mortality than areas that traditionally experienced more extreme heat days.

**SK:** It's hard to say what the reason for that is, but one possibility is that areas that traditionally are not used to extreme heat might be less well-prepared for when extreme heat does happen. And so, communities that have been living in extremely hot climate for, for generations, they probably have infrastructure, and a culture that's probably more well suited to extreme heat.

**Narrator:** Alleviating the health effects of extreme heat exposure requires long-term, national and global policies. But in the short term, there are things that individuals and local governments can do to prepare for extreme heat.

**SK:** I think one thing that should be done on an individual level, but then also healthcare providers and other people who interact with them, is identifying people who are going to be at risk for extreme heat. And so those include people with heart conditions, with diabetes. People who are taking medications, particularly-for cardiovascular disease.

**SK:** I think it's important for, for people like that, and for their providers-to make sure that when, extreme heat is projected to occur,-which is increasing year on year, that people are told to avoid exposure to the outdoors, try and find cooler areas, see if they can reach areas that have air conditioning.

**SK:** And so that’s where then we start thinking about what are some of the structural things that can be done and so some areas, but not every area, might have access to cooling centers. Those can be as simple as buildings or tents that have air conditioning or other ways of keeping the temperature cooler, and so making sure that people who don't have access to air conditioning themselves know how to get to such areas.

**Narrator:** Dr. Khatana adds that tackling climate change is critical to reducing the health threat of extreme heat exposure

**SK:** Getting a complete understanding of how climate change is going to impact human health, cardiovascular health, and then which populations are going to be impacted the most is an extremely complex issue. And I think that's something that will require collaboration across disciplines. So, I'm a

cardiologist, I'm a health services researcher, also do some work in the health economics. And obviously, this research that we did here is something that's traditionally done more in the environmental health field. And so people across different disciplines need to work together to try and really get at how climate change is going to impact human health.

**Narrator:** The National Institute of Environmental Health Sciences funds research to better understand the health effects of climate change. You can learn more about the institute's research by visiting our website at [www.niehs.nih.gov/GEH](http://www.niehs.nih.gov/GEH). Thanks again to Dr. Sameed Ahmed Khatana for joining us today. You've been listening to Environmental Health Chat, brought to you by the Global Environmental Health program at the National Institute of Environmental Health Sciences.