



**Health impacts  
of extreme heat  
and  
how to address  
them?**

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Over the last several years, there has been a considerable rise in the minimum and maximum temperatures of all the regions in India. Previous records of the highest temperature are constantly getting exceeded. Further increases in temperatures due to climate change have also been predicted.

Extreme heat leads to various adverse effects on human health. Let us learn about these.

- ✓ How is the human body temperature regulated?
- ✓ What is Heat Stress?
- ✓ What is the impact of extreme temperature on the human body?
- ✓ What level of temperature is the most detrimental to health?
- ✓ Who are most susceptible to the health impacts of extreme heat?
- ✓ What are the first aid measures for heat-related illnesses? When to seek medical help?
- ✓ What precautions are necessary to avoid the impact of extreme temperatures on health?
- ✓ What is a heatwave?
- ✓ What are Heat islands in urban areas?
- ✓ What strategies are implemented at the administrative level to reduce the impact of extreme heat on human health?

## **How is the human body temperature regulated?**

Our body constantly makes an active effort to regulate its temperature. When the external temperature rises, we start perspiring to regulate our body temperature.

The evaporation of the sweat helps the body to cool down. (To understand this, let us consider the example of how the water in an earthen jar becomes cool. When the water percolates through the pores of the jar and evaporates, it consumes the heat from the water inside the jar. Thus, the water temperature inside the jar reduces, and the water becomes cool.) In addition, high temperature induces dilation of small blood vessels under the skin, leading to increased amount and speed of blood flow. This allows more heat to be lost, thereby reducing body temperature.

## **What is Heat Stress?**

The average human body temperature is 36° to 37° Celsius (97° to 99° Fahrenheit). Our body suffers from any further rise in the temperature. When the atmosphere's temperature rises beyond a particular limit (especially when both the temperature and humidity are high), the body's temperature regulation process is strained. The body temperature increases, posing a risk to health.



## What is the impact of extreme temperature on the human body?

Increasing stress on the temperature regulation mechanism leads to mild to severe adverse health effects.

**Mild effects** – There may be headache, dry throat, nausea, vomiting, or cramps in arms and legs.

**Severe effects** – When body temperature rises above 41°Celsius (106°Fahrenheit) for more than 15 minutes, the body's temperature regulation system completely collapses. Functions of various organs get compromised. This is called **Heatstroke (or Sunstroke)**. There are symptoms such as giddiness, delirium, unconsciousness, seizures, organ failure, etc. Delay in treatment may result in death. Heatstroke manifests in two ways;

**Type 1** – This is typically observed among youngsters. It occurs after intense physical exertion (such as long-distance running or trekking) in extreme heat. Excessive labor in humid conditions can induce heatstroke even at lower temperatures.

**Type 2** – This occurs mainly during heat waves and in the case of young children, old or sick persons. Heatstroke can happen indoors or outdoors, even without physical exertion, as extreme temperatures disrupt body temperature regulation. The distress worsens gradually, making diagnosis difficult.

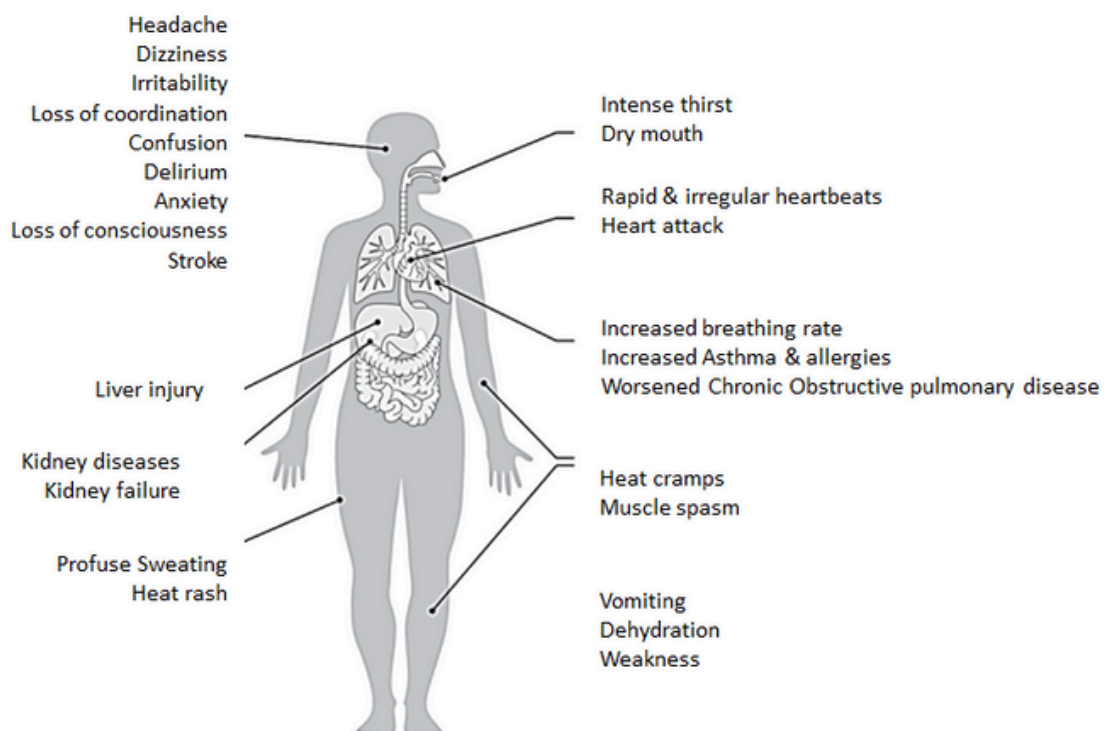


**Stress on the heart** – In high temperatures, the dilation of small blood vessels under the skin, which occurs as a part of the body temperature regulation process, diverts blood supply towards the skin. This puts additional pressure on the pumping action of the heart. This additional stress on the heart can lead to the possibility of aggravating heart problems, heart attacks, and heart failure.

**Stress on kidneys** – In case of inadequate water intake during profuse perspiration, the body's water is reduced. The body gets dehydrated. Consequently, urine formation is affected, and kidneys can suddenly stop functioning. If heat and inadequate water intake continue over more extended periods, chronic kidney disorders may crop up.

**Other impacts** – Excessive heat can induce respiratory disorders like inflammation of the lungs or difficulty in breathing. It can exacerbate mental disorders like stress, depression, and irritability. There can be increased outbreaks caused by contaminated food and water.

Apart from the health impacts, heat waves also affect people's productivity. Additional factors like scarcity of water and disrupted supply of electricity commonly prevailing in summer worsen the situation.



## What level of temperature is the most detrimental to health?

While investigating the impact of an excessively heat on human health, researchers assessed the relationship between the day-to-day temperature of a city and the number of deaths that occur every day in the city. They found that after a certain temperature during the day and night, each additional degree of rising temperature coincides with a rapid increase in deaths. This particular level of temperature is called the critical level of temperature (or threshold temperature). Research conducted in different cities reveals that the threshold temperature is not the same everywhere. Wherever the weather is humid, the adverse effects of heat are apparent at a much lower temperature. Humidity prevents the evaporation of sweat, which helps regulate body temperature. In such a situation, even if the actual weather temperature is low, the body feels it to be more. For example, when humidity is 70%, the temperature at 35°Celsius is felt as 50°.

In short, the critical temperature of a place depends on multiple factors such as the actual temperature, humidity, wind velocity, number of intense heat days, etc. The critical temperature of each city should be determined by considering the overall climate condition of the particular place.



## **Who are most susceptible to the health impacts of extreme heat?**

Persons above the age of 65 years, persons suffering from heart problems, high blood pressure or diabetes, young children, pregnant women, persons suffering from obesity, and persons who have consumed alcohol are more susceptible to adverse effects of high temperatures.

Those who work in the sun or in high-temperature environments (for instance, farm laborers, laborers working on construction sites or at brick kilns, street vendors, policemen, or outdoor sportspeople) are also vulnerable.

The human body adapts to rising temperatures, but this process is gradual. When individuals living in cold climates are suddenly exposed to hot weather (for example, tourists), they are more likely to suffer from the adverse impacts. Similarly, if a person unaccustomed to regular exercise suddenly ventures into heavy exercise such as running a long-distance race or trekking on a hot day, one can face a threat to health.





**What are the first aid measures for heat-related illnesses? When to seek medical help?**

Disorder	Symptoms	First aid care
<b>Heat rash</b>	Reddening of skin, watery blisters. Itch.	Oils close skin pores and reduce perspiration thus preventing the natural cooling of the body. This can be avoided by using soap for bath. Frequent body sponging with cold water Covering blisters with sterilized dressing. Medical treatment if necessary.
<b>Heat cramps</b>	Pain or cramps in muscles, particularly in muscles of the abdomen or legs. Profuse perspiration.	Shift the person to a shaded place. Put gentle pressure on muscles or massage them gently. Give water to drink repeatedly and in small amounts at a time (but no water to be given if there is nausea).
<b>Heat exhaustion</b>	Profuse sweating, pale skin, headache, nausea or vomiting, slow pulse	Shift the person to a cool place equipped with a fan, cooler or air conditioner and make the person lie down. Loosen the clothes and wipe the body with a towel soaked in cold water. Give water to drink repeatedly and in small amounts at a time (but no water to be given in case of nausea or vomiting). In case of no relief, shift the person to a hospital.
<b>Heat syncope</b>	Fainting after standing or working in the sun for a long time. Those not accustomed to working in the sun are more prone to suffer.	Shift the person to a cool place equipped with a fan, cooler, or air conditioner and make the person lie down. Give water to drink repeatedly, in small amount at a time (no water to be given if nausea or vomiting or loss of consciousness). In case of repeated fainting or cramps or continued chest pain, shift the person to a hospital.

Disorder	Symptoms	First aid care
<b>Heat stroke</b>	<p>The body gets extremely hot; the skin becomes very dry.</p> <p>Fast pulse rate, unconsciousness, confused state of mind, convulsions.</p> <p>Possibility of death if not treated urgently.</p>	<p>Heat stroke is a critical emergency.</p> <p>Make the person lie down in a cool place. Bathe with cold water or wipe with a towel soaked in cold water or wrap in a wet blanket and see that the person is under a fan.</p> <p>Call for an ambulance immediately and shift the person to a hospital.</p>

Source - Training Manual for Medical Officers for Prevention and Management of Heat-Related Illnesses, National Programme on Climate Change & Human Health, National Centre for Disease Control, India

<p><b>Heatstroke is a medical emergency.</b></p> <p><b>The following symptoms indicate that the situation is critical and should be treated as an emergency.</b></p>	
In adults	In children
<p>Body temperature rising beyond 104<sup>0</sup>F</p> <p>Severe headache</p> <p>Confusion, irritability</p> <p>Reddened, dry, warm skin</p> <p>Fatigue, weakness, dizziness</p> <p>Nausea, vomiting</p> <p>Rapid breathing, palpitations</p> <p>Unconsciousness</p>	<p>Loss of appetite</p> <p>Excessive irritability</p> <p>Decreased urination</p> <p>Dry, weary eyes</p> <p>Dryness of mouth</p> <p>Listlessness, restlessness</p> <p>Convulsions</p> <p>Bleeding</p>

Source: Public Health Advisory: Extreme Heat/Heatwave National Programme on Climate Change & Human Health, National Centre for Disease Control, India

## What precautions are necessary to avoid the impact of extreme temperatures on health?

### Measures to maintain adequate hydration

- Adequate intake of water, lemonade, oral rehydration solution, or liquid diet. It is necessary to drink 8 to 10 glasses of water every day.
- Drink homemade salty drinks ( e.g., lassi, buttermilk, sharbat).
- Carry potable water while traveling.
- Eat fresh fruits like cucumber, watermelon, musk melon, etc.

### Measures to keep the body cool

- Move from a sunny place to a shaded, cool place.
- Cover the head with a cap or a handkerchief.
- Take a shower, intermittently do wet sponging, or cover the body with a wet cloth.
- Wear white or light-colored loose garments made of cotton.
- Using a fan or cooler, maintain a cool atmosphere at home or the workplace.
- Use an umbrella, a handkerchief, or a cap for protection whenever walking in the sun is inevitable.

### Avoid the following

- Moving around, doing manual work, or playing outdoor games in the scorching heat. (Prefer early mornings or evenings for such activities.)
- Consumption of fruits that are already cut and kept uncovered, as well as tea, coffee, soft drinks mixed with soda, and alcohol.
- Leaving small kids or old persons in a car parked in the sun.

## What is a heatwave?

There are different ways of determining heat waves. According to the definition by the Indian Meteorological Department, when the maximum temperature is more than 40°Celsius in the plains, more than 37°Celsius in the coastal areas, and more than 30°Celsius in hilly regions, a heat wave is considered to prevail. It also considers whether such maximum temperature exceeds the region's average temperature by at least 4.5°Celsius for a minimum of two days. (When the maximum temperature of a region exceeds the normal average temperature by more than 6.4°Celsius, it is considered an occurrence of an intense heat wave.) If the maximum temperature is more than 45°Celsius, it is generally called a heat wave without considering the difference between the maximum and average temperatures. (If the maximum temperature is 47°Celsius or even more, it is called an intense heat wave.) The meteorological department disseminates the intimation or warning of a heat wave through television, newspapers, and other media of communication by using the following color code so that the administration and the citizens can take appropriate precautions.

Temperature more than 40°Celsius	Temperature more than 45°Celsius	Temperature more than 47°Celsius
Yellow alert	Orange alert	Red alert
Heat Alert	Severe heat alert	Extreme heat alert

In order to understand the severity of a heatwave from a health perspective, it is essential to consider temperature and humidity together instead of focusing exclusively on temperature. It is important to incorporate this consideration in heat wave warnings.

## **What are Heat islands in urban areas?**

Urban areas typically experience higher temperatures than surrounding rural areas. This is because cities tend to have more pollution due to vehicles and factories, which trap heat in the atmosphere. Construction material such as cement, glass, metals, and plastic surfaces absorb the heat during the day and radiates it in the evening. Cities abound with this kind of construction, while the trees and greenery are scarce. Therefore, the temperature of cities is higher than that of the surrounding rural areas, especially in the evening and at night. Such areas are known as the 'heat islands'. Such heat islands are prevalent in various parts of cities and can vary in intensity. Over the last several years, the number of heat waves or intense heat waves has increased in different regions of India. The previous records of high temperature are getting outstripped. There are predictions of an increase in the number, duration, and intensity of heat waves due to global warming. Some regions of India are already experiencing life-threatening heat waves. In the future, larger areas are likely to be impacted. Urban areas are more vulnerable to a greater risk owing to the heat islands and high population density.



## **What strategies are implemented at the administrative level to reduce the impact of extreme heat on human health?**

From the public health perspective, the impact of extreme heat is not uniform across places. The impact on health mainly depends on three main factors: the extent of exposure to heat of a particular region or a particular group of people, susceptibility of an individual to health disorders induced by heat, and resourcefulness (adaptive capacity) to protection from the impacts of heat. While developing strategies to minimize the impact of heat on human health, it is essential to think about the needs of various groups of people and the available resources to fulfill them. The Government of India annually formulates heat action plans for specific cities and states. These include intimations/warnings of heat waves, efforts to create awareness, administration measures, and preparedness of health facilities. It is important to devise heat action plans based on an assessment of risks faced by various groups and their specific needs. This responsibility primarily lies with local administration, and active community participation can make this process more meaningful.



Alongside emergency responses, the availability of amenities for protection from extreme heat has to be ensured by long-term policy making and its effective implementation. This includes constructing residences with adequate ventilation, using heat-resistant paints and construction materials, providing amenities like fans and coolers, ensuring essential facilities like water and electricity, town planning to prevent heat islands, and ensuring that health services are readily accessible.

A single agency cannot accomplish this. Considering the stupendous scope of the task ahead, the initiative and cooperation of all the concerned agencies like local governing bodies, healthcare and other administrative systems, and social organizations, as well as the participation of the civil society and people, are essential.



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Because of global climate change, intense heat could be a distressing issue in the future. Public awareness, administrative precautions, and appropriate public policies can help reduce health impacts caused by extreme heat.

It is essential to disseminate scientifically accurate information about this issue to more and more people. This booklet will be helpful in doing so. Please disseminate it freely.

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