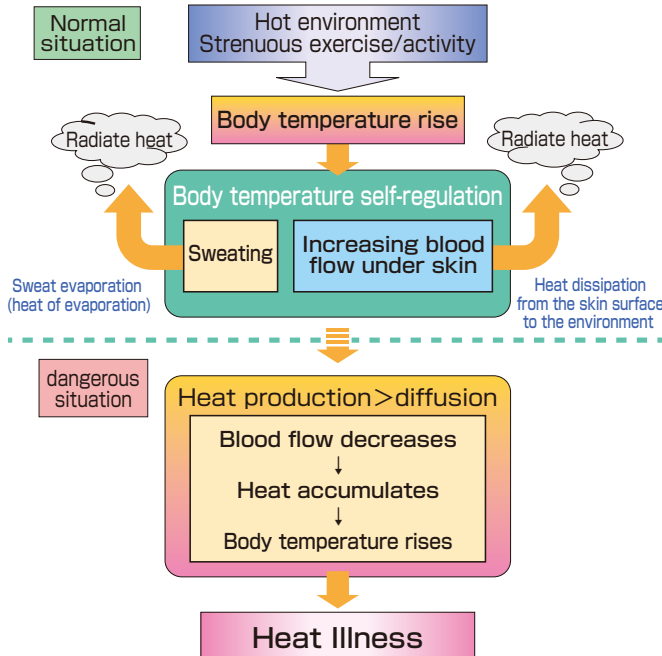




How heat illnesses occurs

Heat illness is caused by extremely high body temperature resulting in damage to internal organs. If you feel unwell after spending time in the heat, consider the possibility of heat illness, regardless of the symptoms.



■What causes heat illness?

The human body regulates heat production and diffusion to keep the body temperature within normal range. It cools itself by expanding peripheral vessels and increasing subcutaneous blood flow, dissipating heat into the air, as well as sweating and its evaporation. If the balance between heat production and diffusion is lost, body temperature rises rapidly.

Under hot conditions, heavy sweating depletes the body of water and salt, causing dehydration. Decrease in body fluid and salt may result in heat cramps or fainting caused by the lack of blood to the muscles and the brain.

Heat illness is a result of these processes. Severe heat illness can be fatal but can be avoided with appropriate prevention and treatment.



Symptoms of heat illness

When body temperature rises in hot environments, subcutaneous blood vessels expand to increase blood flow and diffuse heat from the skin to the surrounding air.

■ Mild heat illness (Grade 1)

Dehydration and diversion of blood flow from the brain and other major organs causes fainting. Drinking water with no saline or electrolyte results in reduced blood salinity, which may cause painful heat cramps.



- Numbness
- Dizziness
- Light-headedness
- Muscle cramp
- Nausea

■ Moderate heat illness (Grade 2)

The blood flow decreases from heavy sweating, diversion of blood to the skin, and additional provision of blood to the muscles during exercise or activity. This causes lower blood pressure, which leads to further decrease in blood flow. This may result in fainting, headache, vomiting, abdominal pain, diarrhea, hypouresis, and other systemic symptoms. The increase in body temperature is less than that of severe heat illness, and remains $< 40^{\circ}\text{C}$. The patient may experience slight confusion, but loss of consciousness does not occur.



- Headache
- Nausea
- Heat exhaustion
- Fatigue



- Unconsciousness
- Convulsions
- Hot dry skin
- Confusion
- Incoherency
- Inability to walk straight
- Inability to run

■ Severe heat illness (Grade 3)

If dehydration continues, the body temperature increases up to $>40^{\circ}\text{C}$, causing damage to the brain and other major organs, and may lead to unconsciousness. This is heat stroke. The level of consciousness is important in the diagnosis; other symptoms such as slow response, inability to state one's name/location or the date, and general incoherency all indicate heat stroke as well.



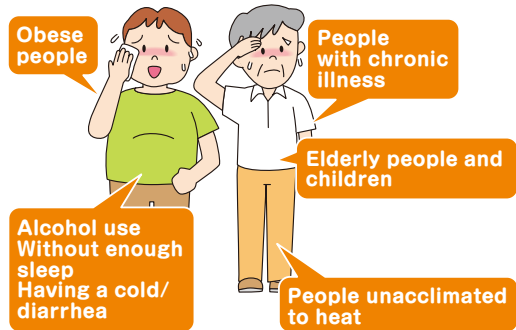
Risk factors of heat illness

■ People vulnerable to heat

The following are examples of people who are at high risk of heat illness.

- Elderly people
- Children
- People with dehydration (diarrhea or infections)
- People with heart disease, diabetes, psychoneurotic disorders, skin diseases, etc.
- People taking medication for heart disease, high blood pressure and others
- People who have hangovers
- People from cool regions who are unaccustomed to heat
- People in wheelchairs (they are closer to the hot ground)

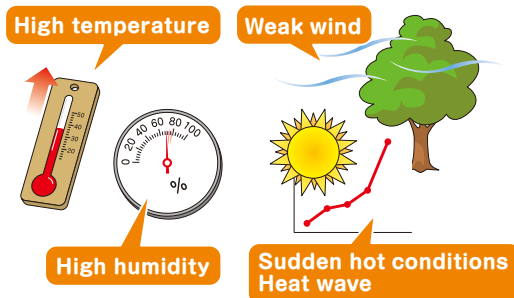
People vulnerable to heat illness



■ Environmental risk factors

In hot, humid environments with weak wind and radiant heat sources, heat discharge from the body decreases, and sweat evaporation decreases, thereby increasing the risk of heat illness. Construction sites, playgrounds, gymnasiums, bathrooms, poorly ventilated buildings, and top-floor apartments are high-risk places for heat illness.

Pay attention to the risk of heat illness in these conditions





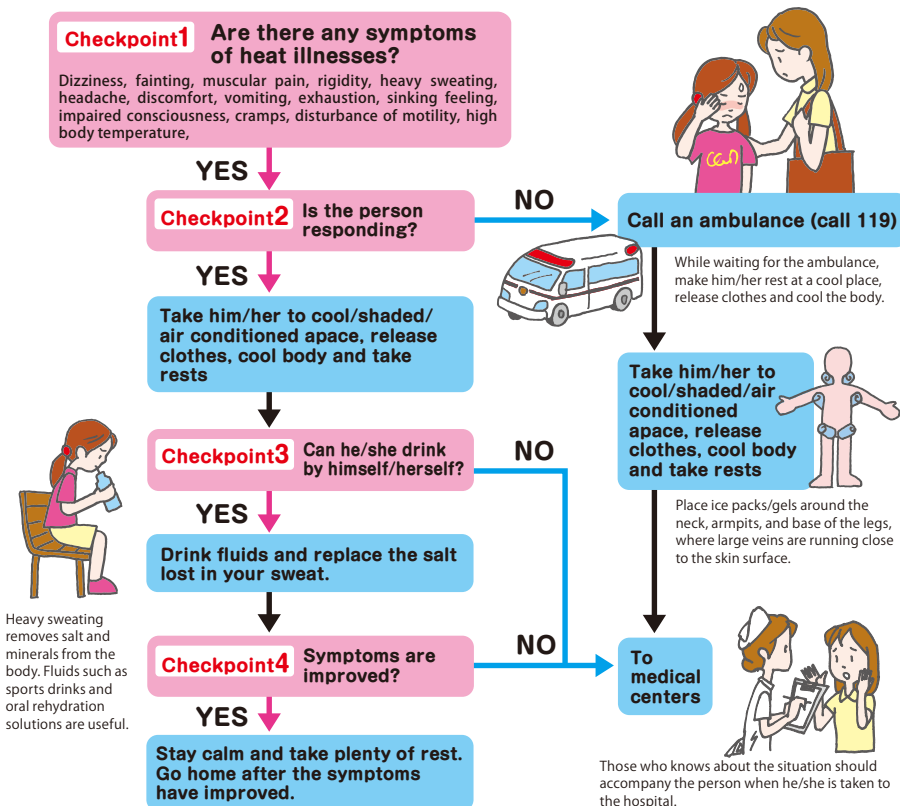
First aid for heat illness

If you feel unwell after spending time in the heat, consider the possibility of heat illness, regardless of what kind of symptoms you have. Move to a cool place, and drink plenty of fluids (electrolyte-replenishing sports drink, oral rehydration solution, or saline solution if possible).

If you suspect someone has heat illness, move the person to a cool place, loosen his/her clothes, and cool the body as soon as possible. Sprinkle water or put wet towels on the person and cool with a fan. Make the person drink some fluids. However, if the person is unconscious or unable to drink, take him/her to a hospital immediately.

First aid for Heat illness.

If someone around you has heatstroke...
Stay calm, assess the situation and respond as appropriate. First response is critical.

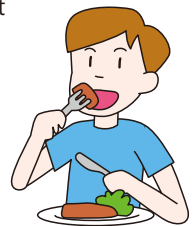




Prevent heat illness

These are ways to reduce the risk of heat illness:

- 1) Avoid heat stress
Shield yourself from the sun with clothes, a hat, an umbrella, and any other accessories. Walk in the shade wherever possible.
- 2) Try to keep the air flow around you
Use a handheld fan.
- 3) Let sweat evaporate
Wear breathable clothes.
- 4) Try to adjust your schedule
Schedule outdoor activities for cooler hours of the day.
- 5) Be careful of acute heat exposure
Special care is needed in the early summer and right after the rainy season. Take frequent breaks for the first three days after being exposed to hot climates.
- 6) Find cool places to take a break
Look for air-conditioned facilities, shops, and other places.
- 7) Use rest areas effectively
Use shade and fans in air-conditioned places.
- 8) Prevent dehydration
Drink plenty of fluids. Take saline to replace salt lost in sweat. Drink a glucose-electrolyte solution with 0.1–0.2% sodium concentration. Dark-colored urine is a sign of dehydration.
- 9) Avoid overexertion
Consider skipping outdoor activities in hot environments. Do not try to keep up with others in hot environments.
- 10) Stay healthy
Eat three meals a day. Take at least 6 h of sleep at night. Insomnia, hangovers, fevers, and diarrhea can weaken resilience to heat stress. Some medication may also increase the risk of heat illness, so seek your physician about the side effects.
- 11) Acclimatize to heat
Take short exercises over a couple of days to acclimatize yourself to hot conditions.
- 12) Keep an eye on those who have a higher risk of heat illness
Pay special attention to new staff and visitors, especially those from cool, dry regions. Pay special attention to elderly people, children, obese people with sedentary lifestyle, and others at risk.





Checklist before work/activity

Pre-work/activity risk checklist – red flags

The following are risk factors of heat illness. Check before your work/activity and take preventive measures.

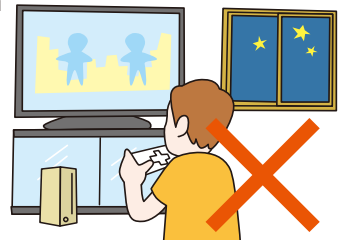
- Tasks involving overexertion
- Incomplete acclimatization
(exposure to heat for less than three days)
- History of heat illness
- Obesity
- Using medication for chronic conditions,
hypertension, and similar conditions
- Lack of sleep
- Excessive alcohol intake
- Hangover
- No breakfast
- having cold, diarrhea,
or other conditions
- Dehydration

Using medication



Dehydration

Lack of sleep

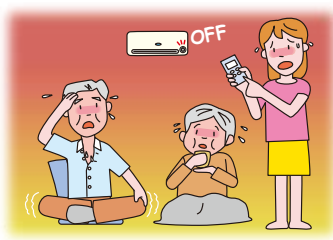




Checklist for elderly people

Checklist for elderly people

- Hydrate frequently even if you are not thirsty.
- Check indoor temperatures even if it doesn't feel hot.
- Exercise for acclimatization.



Checklist for caregivers

- General wellbeing : liveliness, appetite, and dryness of the mouth/armpits
- Metrics : weight, blood pressure, heartbeat, and body temperature
- Environment : daily schedule, indoor temperature/humidity, ventilation, and shade

■ Elderly people are insensitive to heat

Studies have shown that summer temperatures in residences of people aged ≥ 70 years are 2°C higher than in others, with levels often exceeding $31\text{--}32^{\circ}\text{C}$ and almost a 5% higher humidity. This may be because they dislike artificial cooling or want to save electricity. Skin sensor functionality decrease with aging, and delays the regulation of body temperature.

■ Elderly people are more vulnerable to heat

In elderly people, temperature regulation based on subcutaneous blood flow and sweating is less efficient than that in younger people. As a result, elderly people may not be able to effectively diffuse heat, and their core body temperature may easily rise.



Checklist for children

Ways to prevent heat illness in children

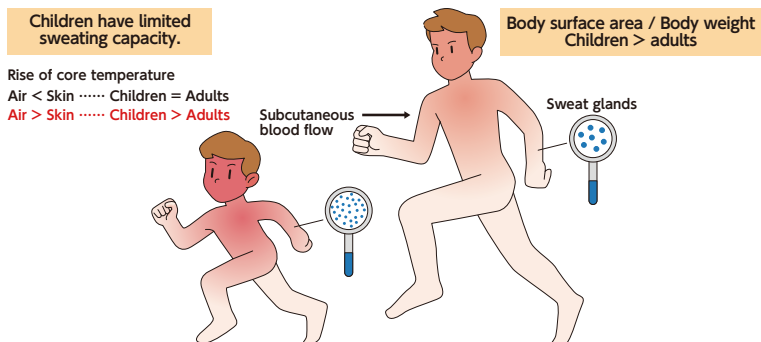
- 1. Keep an eye on their facial color and sweating**
Facial redness and/or heavy sweating are signs of increased core body temperature. Move the child to a cooler place and allow to rest.
- 2. Make sure they drink fluids often**
Make sure they drink fluids as soon as they feel thirsty.
- 3. Make sure to let them acclimatize to heat**
Let them take outdoor activities and promote heat acclimatization.
- 4. Choose appropriate clothing**
Children lack the necessary knowledge to choose clothing appropriate for the environment. Parents and other adults should ensure appropriate clothing to enhance heat diffusion.

■ Children easily get heat

Children in hot environments have a much higher subcutaneous blood flow to diffuse the heat than that in adults, since their sweating capacity is not fully developed. Therefore, children's body temperature can rise and fall easily.

■ When children are in hot environments

When the environment is cooler than the skin temperature, subcutaneous blood flow increases to cool the body. However, in hotter conditions (where sweat evaporation is the only effective method), not only are children unable to diffuse heat, they actually absorb it from their surrounding environment. This results in a rapid rise in body temperature, leading to heat illness.





Checklist for sports

Risk factors of heat illness during sports are related to the environment, one's condition, and exercise intensity. Attention should be paid to the points outlined below:

Environmental conditions

Check the weather, and avoid exercising in hot daytime conditions whenever possible. Wet-bulb globe temperature (WBGT) – an index representing temperature, humidity, radiation heat, and wind – is used for the evaluation of environmental conditions.

Adjust exercise intensity and take breaks according to environmental conditions

- When the WBGT is $> 25^{\circ}\text{C}$, take a break at least every 30 min.
- When the WBGT is $> 28^{\circ}\text{C}$, avoid strenuous exercise, such as long-distance running, and take frequent breaks.
- When the WBGT $> 31^{\circ}\text{C}$, outdoor exercise should be avoided.
- Make sure to rest if you feel unwell.

Take water and salt frequently

- Make sure to drink plenty of fluids.
- Salt is lost from the body through sweat. Sports drinks and saline solution of 0.1–0.2% concentration are adequate for fluid replacement.
- Post-exercise weight loss should be maintained within 2% with fluid replacement.

Acclimatize to heat

- People who are not acclimatized to heat are at risk of heat illness. If the weather suddenly turns hot, engage in only short periods of light exercise until you acclimatize.

Take care of people at high risk

- Elderly people, infants, and obese people are at higher risk of heat illness;
- People with diarrhea, fever, fatigue, or inadequate sleep are also vulnerable to heat illness and should avoid strenuous exercise in hot environments.

Wear appropriate clothing

- Wear light clothes made of hygroscopic and breathable materials, and a hat to block direct sunlight.



Tips to prevent heat illnesses during summer events

Reducing the risk of heat illness during outdoor events are important. Organizers should conduct the following measures:

□ Prevent waiting lines under hot conditions

- Guide people to the shade.
- Use numbered tickets with clearly displayed return times so that people do not have to spend long periods waiting in line.
- Allow seat reservations to prevent the need for waiting in line.

□ Avoid congestion at event openings

- Provide enough wide-entrance gates.
- Plan the event program to prevent congestion at entrance gates.

□ Avoid congestion at event closures

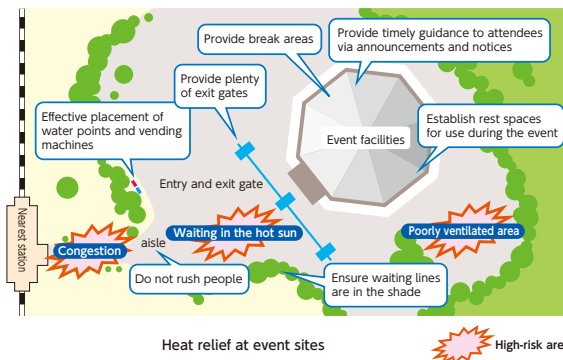
- Provide enough exit gates.
- Set a one-way system from exit gates to transportation facilities.
- Do not rush people.

□ Ease access to necessary facilities

- Clearly show where to access drinking water, vending machines, concession stands, etc.
- Clearly show where medical aid stations are.

□ Prepare adequate resting places and beverages

- Prepare resting places for attendees.
- Monitor the location waiting lines and provide water facilities/vending machines.
- Ensure that vending machines are appropriately maintained.





Risk assessment using WBGT

Precautions in line with WBGT risk ranks

WBGT	Risk of Heat illness	Activity guide in daily life	Guide to how much exercise can be safely performed
$\geq 31\text{ }^{\circ}\text{C}$		Risk of occurrence is high in elderly people even at rest. Avoid staying outdoors as much as possible, and move to a cool place.	Danger (exercise should be avoided). The environmental temperature is higher than the skin temperature, so the body heat cannot escape. Except in special cases, all exercises should be avoided.
28 - 31 $^{\circ}\text{C}$	May occur during any daily activities	Avoid staying under the sun. Keep an eye on the rise of indoor temperature.	Severe warning (heavy exercise should be avoided) Activities that require heavy exercise should be avoided. When exercising, frequent breaks and plenty of fluids should be provided. People who are at high risk should avoid exercise.
25 - 28 $^{\circ}\text{C}$	May occur during moderate activities	Take breaks regularly during exercise or strenuous activity	Warning (rests should be provided often) Frequent breaks and plenty of fluids should be provided. Breaks should be provided every 30 min for activities requiring heavy exercise.
21 - 25 $^{\circ}\text{C}$	May occur during heavy activities	Risk of occurrence is low in general. Caution is advised during heavy exercise or strenuous work.	Caution is advised since there is still a risk of heat illness. Drinking plenty of water during exercise is advised.