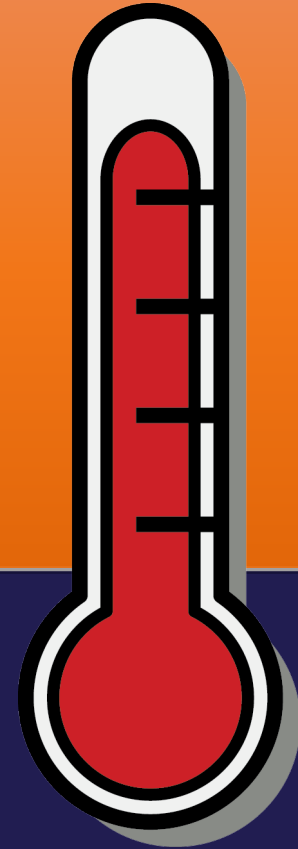




Heat Stress

Awareness and Prevention



What is Heat Stress?



Occupational heat stress is the net load to which a **worker** is exposed from the combined contributions of **metabolic heat, environmental factors,** and **clothing** worn which results in an increase in heat storage in the body.

Heat stress can result in a variety of heat-related **illnesses**, such as **heat stroke, heat syncope (fainting), heat exhaustion, heat cramps** or **heat rashes**.



Regulations



Section 5(a)(1) of the OSH Act

- often referred to as the General Duty Clause, “Each employer shall furnish to each of his (sic) employees employment and a place of employment which are free from recognized hazards that are causing or are likely to cause death or serious physical harm to his employees”

Section 5(a)(2) of the OSH Act

- requires employers to "comply with occupational safety and health standards promulgated under this Act".



Heat Stress

The Physiology of Heat Stress



Physiology of Heat Stress



The Human Body is an amazing machine designed to accommodate rigorous abuse.



We have built in mechanisms that attempt to prevent and repair injuries.

Physiology of Heat Stress



Heat from

🔥 Environmental Factors

🔥 Physical Activity

elevates the body's *core temperature* and causes physiological responses as the body attempts to prevent heat injury or illness through *thermoregulation*.



Physiology of Heat Stress



Core Temperature

: the temperature of the deep tissues of the body. (Organs in the cranial, thoracic, and abdominal cavities)

Surface Temperature

: the temperature of the skin, subcutaneous tissue, and fat. (Commonly referred to as the shell or periphery)

Thermoregulation

: the maintenance or regulation of temperature specifically : the maintenance of a particular temperature of the living body.

Warm Ambient Temperature



Cool Ambient Temperature

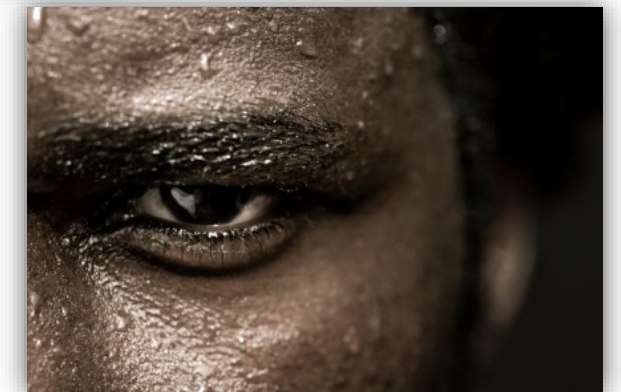


Physiology of Heat Stress



The Body's Response to Heat

- 🔥 The body tries to maintain a constant internal temperature.
- 🔥 When the internal temperature rises, the body attempts to get rid of excess heat by:
 - 🔥 Increasing blood flow to skin surface
 - 🔥 Releasing sweat onto skin surface

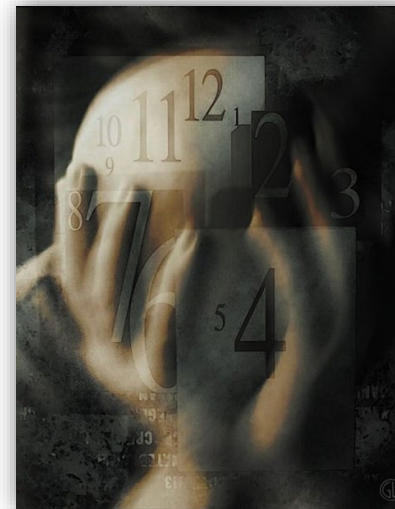


Physiology of Heat Stress



Effects of the Body's Response

- 🔥 Reduced blood Flow to Brain
 - 🔥 Reduced Mental Alertness and Comprehension
- 🔥 Reduced Blood Flow to Active Muscles
 - 🔥 Fatigue
 - 🔥 Loss of Strength
- 🔥 Increased Sweating
 - 🔥 Dehydration Rate is Accelerated
 - 🔥 Slipperiness
 - 🔥 Skin Irritation



These effects can lead to heat related illness.



Heat Stress

Contributing Factors of Heat Stress

Dehydration: A Risk Factor for Heat-Related Illness

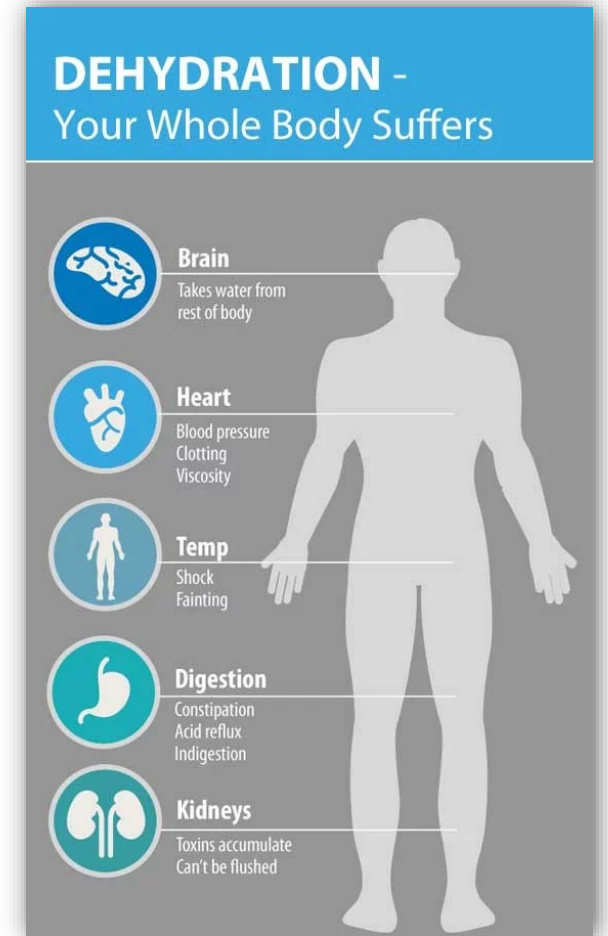


Overview

- Dehydration occurs when you use or lose more fluid than you take in, and your body doesn't have enough water and other fluids to carry out its normal functions. If you don't replace lost fluids, you will get dehydrated.
- When it's hot and humid, your risk of dehydration and heat illness increases. That's because when the air is humid, sweat can't evaporate and cool you as quickly as it normally does, and this can lead to an increased body temperature and the need for more fluids.
- You can usually reverse mild to moderate dehydration by drinking more fluids, but severe dehydration needs immediate medical treatment.
- Thirst isn't always a reliable early indicator of the body's need for water. Many people, particularly older adults, don't feel thirsty until they're already dehydrated. That's why it's important to increase water intake during hot weather or when you're ill.

Symptoms

- Extreme thirst
- Less frequent urination
- Dark-colored urine
- Fatigue
- Dizziness
- Confusion
- Loss of Appetite
- Dry Skin
- Dry Mouth
- Weakness
- Chills
- Head Rushes



Signs of Dehydration: Urine Hydration Chart



URINE COLOR	HYDRATION LEVEL	INFO
	GOOD FULLY HYDRATED	YOU ARE WELL HYDRATED
	GOOD FULLY HYDRATED	YOU ARE WELL HYDRATED
	GOOD HYDRATED	START DRINKING TO REMAIN WELL HYDRATED
	FAIR LESS HYDRATED	YOU HAVE STARTED THE DEHYDRATION PROCESS AND NEED TO DRINK WATER TO REHYDRATE PERFORMANCE LEVEL HAS DECREASED
	DEHYDRATED DRINK WATER	NOT CRITICAL - DRINK NOW YOU ARE DEHYDRATED AND AT RISK FOR CRAMPS AND OTHER HEAT RELATED SYMPTOMS
	DEHYDRATED DRINK WATER	DRINK NOW - YOU ARE DEHYDRATED AND AT RISK FOR MORE SERIOUS HEAT RELATED SYMPTOMS
	VERY DEHYDRATED REPLACE ELECTROLYTES	DRINK NOW - YOU ARE VERY DEHYDRATED AND AT RISK FOR MORE SERIOUS HEAT RELATED SYMPTOMS
	SEVERE DEHYDRATION REPLACE ELECTROLYTES	DRINK NOW - YOU ARE IN NEED OF RAPID REHYDRATION TO REPLACE ELECTROLYTES AND AT RISK FOR SEVERE ILLNESS

Dehydration: Risk Factor for Heat-Related Illness

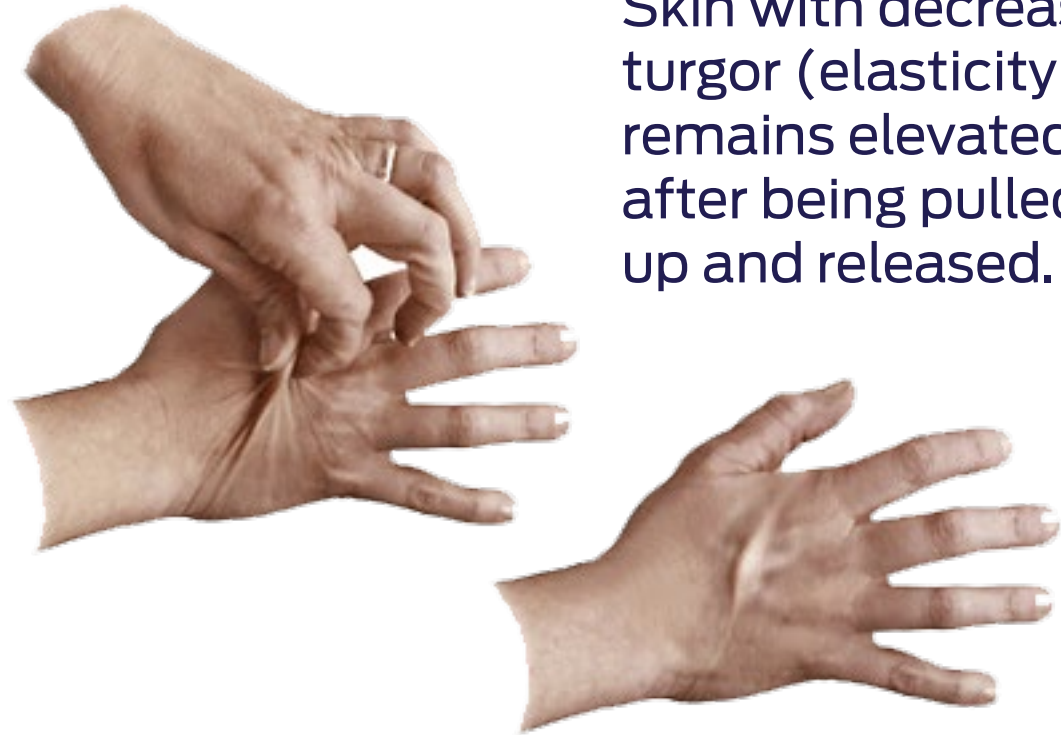


Signs of Dehydration

Pinch the skin on the back of your hand and pull up gently.

The skin should return to its normal flat state consistently and quickly.

If it doesn't...you are dehydrated.



Skin with decreased turgor (elasticity) remains elevated after being pulled up and released.

Contributing Factors for Heat-Related Illness



Many prescription and OTC medicines warn of dehydration.



Contributing Factors for Heat-Related Illness



Avoid alcohol before
or during working
in the heat.
Alcohol dehydrates
the body.



PPE: A Risk Factor for Heat-Related Illness



PPE can:

- 🔥 Reduce the body's normal way of getting rid of heat by sweat evaporation.
- 🔥 Hold excess heat and moisture inside PPE, making the worker's body even hotter.
- 🔥 Increase the physical effort to perform duties while carrying the extra weight of the PPE.



Contributing Factors for Heat-Related Illness



- Age-
Elderly and Children Under 5
- Weight
- Physical fitness
- Pregnancy
- Metabolism
- Medical conditions-
hypertension, diabetes





Heat Stress



Manifestations of Heat Stress

Heat Related Illnesses



Heat-related illnesses can vary in symptoms and severity.

SEVERITY

Less Severe

More Severe



Heat Rash

Heat Cramps

Heat Syncope

Heat Fatigue/
Exhaustion

Heat Stroke

Discomfort

Death

Heat Related Illnesses



Heat Rash

- 🔥 Heat rash, also called “prickly heat” is a skin condition that can affect skin in hot weather.
- 🔥 The rash usually occurs when your sweat ducts become blocked and perspiration is trapped under your skin. Heat rash often occurs in the summer or in humid climates.
- 🔥 Adults can experience heat rash when they are dressed too warmly or when they stay outside too long in hot and humid weather.
- 🔥 A common sign of heat rash is a cluster of red bumps that resemble pimples on the skin.
- 🔥 The most common places for heat rash to occur are the face, neck, under the breasts, and the groin. It can also appear in skin folds and in areas of the body that rub against clothing such as the inner thighs, back, chest, and stomach. These are all places that tend to sweat more often.
- 🔥 Severe heat rashes may blister and become infected if not treated properly.

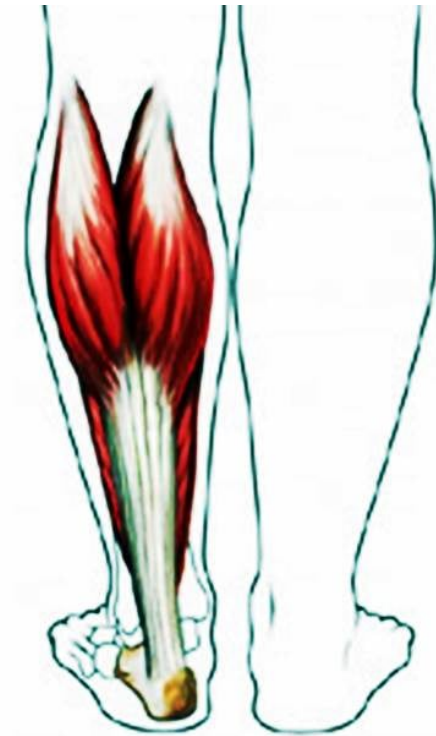


Heat Related Illnesses



Heat Cramps

- ⌚ Painful, brief muscle cramps (usually involving the legs, chest, or abdomen) that occur during or after exercise or work in a hot environment. Muscles may spasm or jerk involuntarily. Cramping may also be delayed and occur a few hours later.
- ⌚ Heat cramps are thought to be caused by a deficiency in electrolytes. Electrolyte dilution can arise from performing hard work in hot environments, heavy sweating, and excessive water intake.



Heat Related Illnesses



Heat Syncope (Fainting)

- ⚡ Sometimes called Heat Collapse.
- ⚡ Heat syncope is fainting or dizziness as a result of overheating (syncope is the medical term for fainting). It is a type of heat illness. The basic symptom of heat syncope is fainting, with or without mental confusion.
- ⚡ Heat syncope is caused by peripheral vessel dilation, resulting in diminished blood flow to the heart & brain, and dehydration.
- ⚡ Heat syncope occurs in a warm environment when blood pressure is lowered as the body dilates (widens) arterioles (small blood vessels) in the skin to radiate heat.
- ⚡ This condition occurs within five days of heat acclimatization, before the blood volume expands. The result is less blood to the brain, causing light-headedness and fainting when a person stands up quickly or stands for a long period of time.
- ⚡ Those who perform strenuous work outside in warm climates are at particular risk.



Heat Related Illnesses



Heat Fatigue/Exhaustion

⚡ Heat exhaustion is a severe form of heat illness. It is a medical emergency. Heat exhaustion is caused by the loss of water and electrolytes through sweating. Someone suffering from heat exhaustion may exhibit impaired performance of skilled sensorimotor tasks or mentally & physically challenging jobs.

⚡ **Common causes of heat exhaustion include:**

- ⚡ Hot, sunny, humid weather
- ⚡ Physical exertion, especially in hot, humid weather
- ⚡ Due to impaired thermoregulation, elderly people can get serious heat illness even at rest, if the weather outside is hot and humid, and they are not getting enough cool air.
- ⚡ Some drugs, such as diuretics, antihistamines, beta-blockers, alcohol, ecstasy, and amphetamines can cause an increase in the risk of heat exhaustion.

⚡ **Especially during physical exertion, risk factors for heat exhaustion include:**

- ⚡ Wearing dark, padded, or insulated clothing; hats; and/or helmets (for example, turnout gear)
- ⚡ Having a higher percentage of body fat
- ⚡ Dehydration
- ⚡ Fever
- ⚡ Some medications, like beta blockers and antipsychotic medicines

Symptoms :

- | | |
|----------------|--------------------------|
| ⚡ Nausea | ⚡ Weakness |
| ⚡ Dizziness | ⚡ High Body Temperature |
| ⚡ Irritability | ⚡ Excessive Sweating |
| ⚡ Headache | ⚡ Decreased Urine Output |
| ⚡ Thirst | ⚡ Vertigo |



Heat Related Illnesses



Heat Stroke

⌚ Heat stroke is the most serious form of heat injury and is considered a medical emergency. The medical definition of heat stroke is a core body temperature greater than 104 degrees Fahrenheit, with complications involving the central nervous system that occur after exposure to high temperatures. Onset can be sudden or gradual. Heat stroke can kill or cause damage to the brain and other internal organs.

Symptoms may include:

- ⌚ Throbbing headache
- ⌚ Confusion or altered mental state
- ⌚ Irrational behavior
- ⌚ Dizziness and light-headedness
- ⌚ Lack of sweating despite the heat *or* profuse sweating
- ⌚ Red, hot, and dry or damp skin
- ⌚ Muscle weakness or cramps
- ⌚ Nausea and vomiting
- ⌚ Rapid heartbeat, which may be either strong or weak
- ⌚ Rapid, shallow breathing
- ⌚ Behavioral changes such as disorientation, or staggering
- ⌚ Seizures
- ⌚ Unconsciousness





Heat Stress

Prevention



Prevention



Drink plenty of fluids.

Water =

1c (8oz.) every 15 minutes or
4c (32oz.) each hour

Do not use thirst as a gauge for
dehydration.

Drink plenty of fluids before,
during and after you begin work.



Prevention



**Avoid soft drinks
and caffeinated
products.**



Prevention



Wear clothing that is

- Relaxed fitting
- Light colored
- Lightweight
- Breathable



Prevention



Minimize your exposure to the sun.



Prevention



- **Eat light, cool meals.**
- **Hot and heavy meals add heat to your body.**
- **Hot meals divert blood to your digestive system that would normally help cool you off.**



Prevention



**Understand
the role of
Relative
Humidity.**

Relative Humidity (%)

°F	40	45	50	55	60	65	70	75	80	85	90	95	100
110	136												
108	130	137											
106	124	130	137										
104	119	124	131	137									
102	114	119	124	130	137								
100	109	114	118	124	129	136							
98	105	109	113	117	123	128	134						
96	101	104	108	112	116	121	126	132					
94	97	100	103	106	110	114	119	124	129	135			
92	94	96	99	101	105	108	112	116	121	126	131		
90	91	93	95	97	100	103	106	109	113	117	122	127	132
88	88	89	91	93	95	98	100	103	106	110	113	117	121
86	85	87	88	89	91	93	95	97	100	102	105	108	112
84	83	84	85	86	88	89	90	92	94	96	98	100	103
82	81	82	83	84	84	85	86	88	89	90	91	93	95
80	80	80	81	81	82	82	83	84	84	85	86	86	87

Heat Index
(Apparent
Temperature)

**With Prolonged Exposure
and/or Physical Activity**

Extreme Danger
Heat stroke or sunstroke highly likely
Danger
Sunstroke, muscle cramps, and/or heat exhaustion likely
Extreme Caution
Sunstroke, muscle cramps, and/or heat exhaustion possible
Caution
Fatigue possible

Prevention



- Know the hazards of heat stress.
- Be aware of your working environment.
- Watch for danger.
- Be Prepared.
 - Training in First-Aid Procedures.
 - Have an action plan in place.



Prevention



Employer Responsibilities

When the heat index is expected to be dangerous, employers must protect employees. NIOSH recommends that employers establish a heat-related illness prevention program that includes the following measures:

- Training for supervisors and workers to prevent, recognize, and treat heat-related illness
- Implementing a heat acclimatization program for workers
- Providing for and encouraging proper hydration with proper amounts and types of fluids
- Establishing work/rest schedules appropriate for the current heat stress conditions (an industrial hygienist may need to be consulted)
- Ensuring access to shade or cool areas
- Monitoring workers during hot conditions
- Providing prompt medical attention to workers who show signs of heat-related illness
- Evaluating work practices continually to reduce exertion and environmental heat stress
- Monitoring weather reports daily and rescheduling jobs with high heat exposure to cooler times of the day

Prevention



Employee Responsibilities

Employees are urged to protect themselves. To protect yourself as an employee, do the following:

- **Drink water or other liquids frequently enough to never become thirsty (about 1 cup every 15–20 minutes). Hydration is the most important tool in preventing heat-related illness, and workers should try to be well-hydrated *before* arriving at work.**
- **Eat during lunch and other rest breaks. Food helps replace lost electrolytes.**
- **Wear light-colored, loose-fitting, breathable clothing such as cotton.**
- **Wear a wide-brimmed hat when possible.**
- **Take breaks in the shade or a cool area when possible.**
- **Be aware that protective clothing or personal protective equipment may increase the risk of heat stress.**
- **Monitor their physical condition and that of coworkers.**
- **Tell their supervisor if they have symptoms of heat-related illness.**
- **Talk with their doctor about medications they are taking and how the medications may affect their tolerance of heat.**

Prevention



Pure Water vs. Electrolyte Drinks

- **Electrolytes - minerals (magnesium, potassium, sodium, and calcium) that are lost through perspiration or other forms of dehydration, particularly in heat stress situations.**
- **Water absorbs slowly into the body**
- **Studies show that some electrolyte drinks help the body to absorb water 98% faster than water alone.**





Question
Everything.

~Albert Einstein

