

Limiting Heat Burden While Wearing Personal Protective Equipment (PPE)

Developed for Healthcare Workers and Site Coordinators Providing Care
in West African Countries Affected by the Ebola Outbreak

October 17, 2014

Purpose

- Working in the harsh conditions in West Africa and other risk factors, including wearing PPE, puts healthcare workers at risk for heat-related illnesses.

Objectives

- Know what tools can help with **monitoring temperatures and humidity**.
- Understand **risk factors** for heat-related illness.
- Recognize **symptoms** of heat-related illnesses and know **first aid**.
- Learn **recommendations** for limiting the heat burden and protecting yourself from heat-related illnesses.

Harsh Conditions at the Worksite

- **Length of work shift:**
 - Shorter work shifts may not be possible where PPE supplies are limited.
 - Shift length is also affected by the large workloads and limited number of workers.
- **Limited electrical power:**
 - Air-conditioning and fans may not be available.
- **Limited access to electrolyte replacement fluids.**
- **Other illnesses:**
 - Contaminated food or water can result in severe vomiting and diarrhea, which can lead to fluid loss and dehydration, increasing the risk for developing a heat-related illness.
- **Limited or no medical oversight for healthcare workers while in the rest area.**
- **Limited number of healthcare workers:**
 - Only 2 days to adjust to working in a hot, humid environment before starting to work with patients.

Monitor Temperatures

- *Monitor temperature and humidity daily.*
- Download the OSHA Heat Safety Tool at https://www.osha.gov/SLTC/heatillness/heat_index/heat_app.html or using the heat index table.
- **Heat index** is a measure of how hot it feels when humidity is taken into account with air temperature.
- As the heat index increases, take more frequent rest breaks and drink more water and/or electrolyte replacement fluids.



Heat Index Table

		Temperature °F (°C)																
		80(27)	82(28)	84(29)	86(30)	88(31)	90(32)	92(33)	94(34)	96(36)	98(37)	100(38)	102(39)	104(40)	106(41)	108(43)	110(47)	
Relative humidity (%)	40	80(27)	81(27)	83(28)	85(29)	88(31)	91(33)	94(34)	97(36)	101(38)	105(41)	109(43)	114(46)	119(48)	124(51)	130(54)	136(58)	
	45	80(27)	82(28)	84(29)	87(31)	89(32)	93(34)	96(36)	100(38)	104(40)	109(43)	114(46)	119(48)	124(51)	130(54)	137(58)		
	50	81(27)	83(28)	85(29)	88(31)	91(33)	95(35)	99(37)	103(39)	108(42)	113(45)	118(48)	124(51)	131(55)	137(58)			
	55	81(27)	84(29)	86(30)	89(32)	93(34)	97(36)	101(38)	106(41)	112(44)	117(47)	124(51)	130(54)	137(58)				
	60	82(28)	84(29)	88(31)	91(33)	95(35)	100(38)	105(41)	110(43)	116(47)	123(51)	129(54)	137(58)					
	65	82(28)	85(29)	89(32)	93(34)	98(37)	103(39)	108(42)	114(46)	121(49)	128(53)	136(58)						
	70	83(28)	86(30)	90(32)	95(35)	100(38)	105(41)	112(44)	119(48)	126(52)	134(57)							
	75	84(29)	88(31)	92(33)	97(36)	103(39)	109(43)	116(47)	124(51)	132(56)								
	80	84(29)	89(32)	94(34)	100(38)	106(41)	113(45)	121(49)	129(54)									
	85	85(29)	90(32)	96(36)	102(39)	110(43)	117(47)	126(52)	135(57)									
	90	86(30)	91(33)	98(37)	105(41)	113(45)	122(50)	131(55)										
95	86(30)	93(34)	100(38)	108(42)	117(47)	127(53)												
100	87(31)	95(35)	103(39)	112(44)	121(49)	132(56)												

Caution

Extreme Caution

Danger

Extreme Danger

Heat index	Risk level	Protective measures
Less than 91°F (33°C)	Lower (caution)	Basic health and safety planning
91°F–103°F (33°C–39°C)	Moderate	Implement precautions and heighten awareness
103°F–115°F (39°C–46°C)	High	Additional precautions to protect workers
Greater than 115°F (46°C)	Very high to extreme	Even more aggressive protective measures

PPE: A Risk Factor for Heat-related Illness

- Wearing PPE *increases* your risk for heat-related illnesses.
- PPE:
 - Reduces or eliminates exposure to hazardous chemicals, physical hazards, and disease-causing organisms such as Ebola.
 - Reduces the body's normal way of getting rid of heat by sweat evaporation.
 - Holds excess heat and moisture inside PPE, making the worker's body even hotter.
 - Increases the physical effort to perform duties while carrying the extra weight of the PPE.

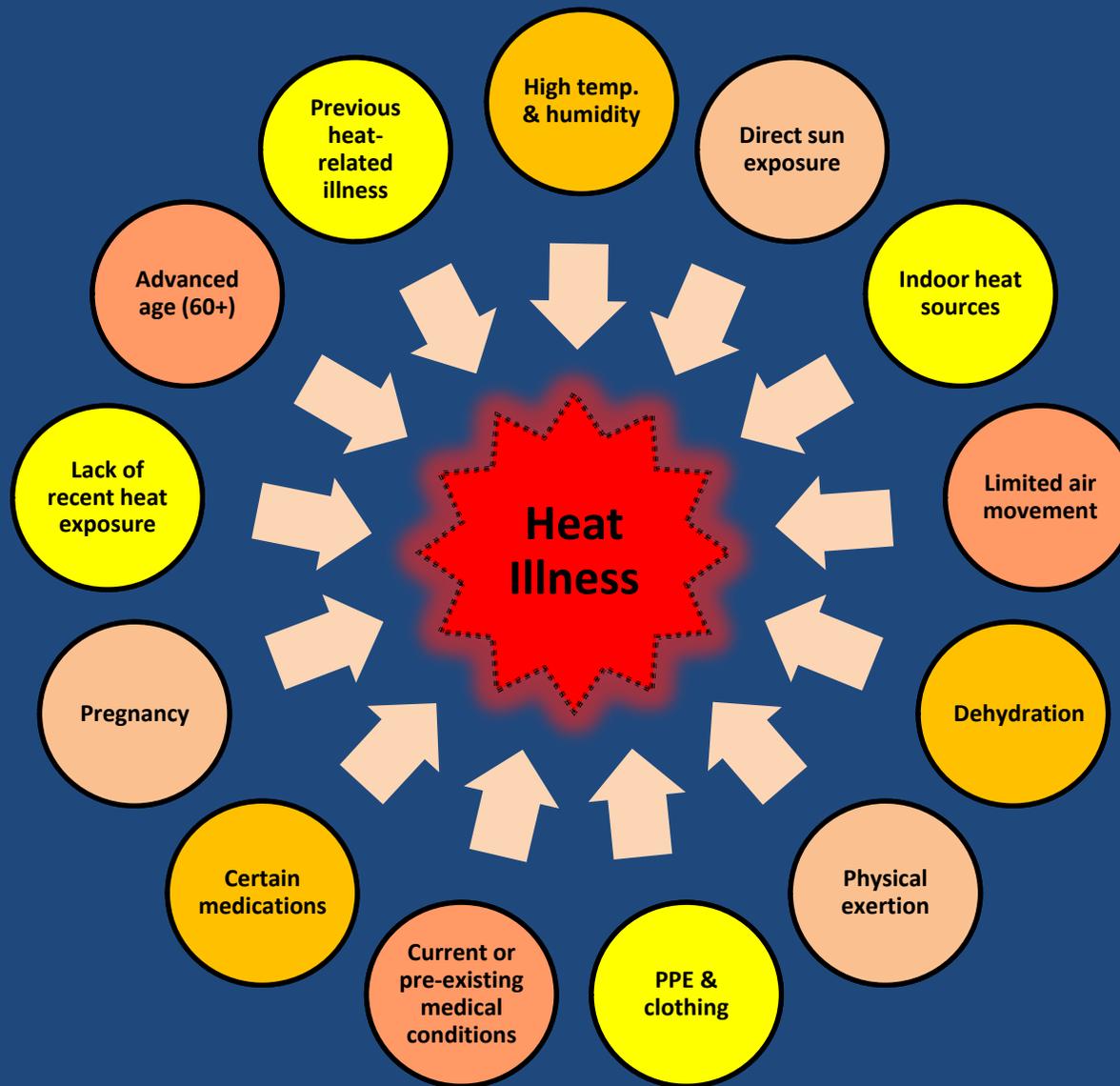


Photo courtesy of Kimberly-Clark



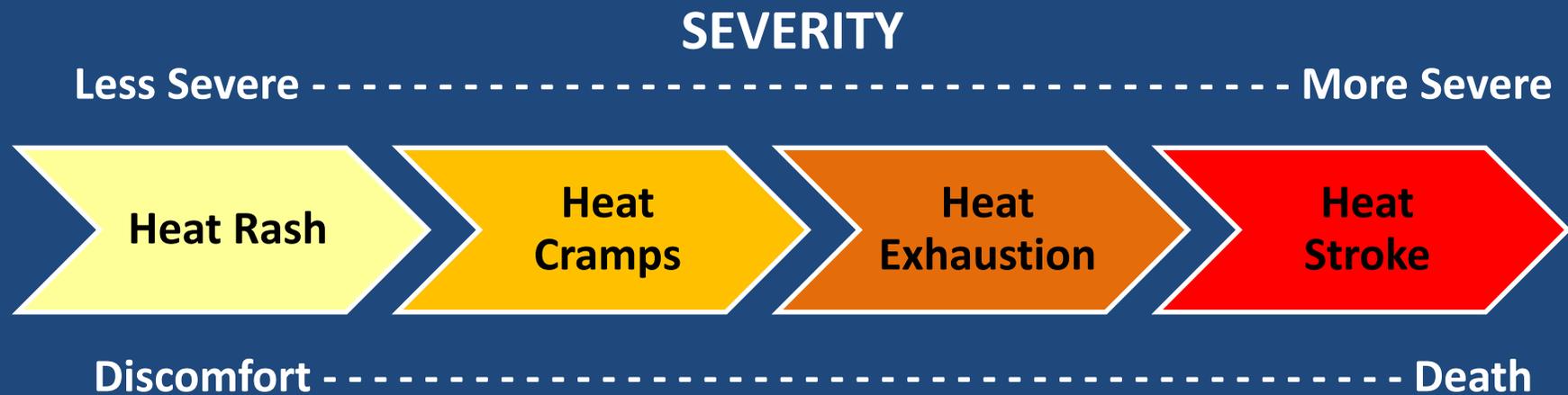
Examples of PPE you may be required to wear.

Other Risk Factors for Heat-related Illnesses



Heat-related Illnesses

- *Heat-related illnesses can vary in symptoms and severity.*



Heat Rash

✓ Symptoms

- Looks like red cluster of pimples or small blisters that usually appears on the:
 - neck
 - upper chest
 - groin
 - under the breasts
 - in elbow creases

+ First Aid

- Keep rash area dry.
- Change out of sweaty clothes into fresh dry clothes frequently.
- Apply powder to increase comfort.
- Do not use ointments and creams.

Heat Cramps

✓ Symptoms

- Muscle cramps, pain, or spasms in the abdomen, arms, or legs

+ First Aid

- Drink water and have a snack, and/or electrolyte-replacement drinks every 15 to 20 minutes.
- Do not take salt tablets.
- Get medical help if the worker:
 - has heart problems,
 - is on a low sodium diet, or
 - if cramps do not subside within one hour.

Heat Syncope (Fainting)

✓ Symptoms

- Fainting
- Dizziness
- Light-headedness during prolonged standing or suddenly rising from a sitting or lying position

+ First Aid

- Sit or lie down in a cool place or remove worker that has fainted from hot area.
- Drink water or other cool liquids slowly.
- Use cool compresses.

Heat Exhaustion

✓ Symptoms

- Headache
- Nausea
- Dizziness
- Weakness
- Irritability
- Thirst
- Heavy sweating
- Elevated body temperature
- Decreased urine output

+ First Aid

- Get medical evaluation and treatment for the worker.
- Remove worker from hot area and give cool liquids to drink.
- Remove PPE.
- Cool the worker with cold compresses or wet head, face, and neck with cold water.
- Seat the worker in an air-conditioned area or next to a misting fan.

Rhabdomyolysis

(breakdown of skeletal muscle)

✓ Symptoms

- Muscle cramps/pain
- Abnormally dark colored urine (tea or cola-colored)
- Weakness
- Exercise intolerance

+ First Aid

- Stop activity.
- Drink water.
- Get immediate care at the nearest medical facility.
- Ask to be checked for rhabdomyolysis (blood/urine creatine kinase and myoglobin tests).

Heat Stroke

✓ Symptoms

- Confusion
- Loss of consciousness
- Hot, dry skin or profuse sweating
- Seizures
- Very high body temperature

Heat stroke may be fatal!

+ First Aid

- Get professional medical care immediately.
- Move the worker to a shaded, cool area and remove PPE.
- Cool the worker quickly with a cold water bath. Keep the head out of the water.
- Wet the skin, place cold wet cloths on skin, or soak clothing with cool water.
- Circulate the air to speed cooling.
- Do not try to give oral fluids if the worker seems sedated or has slurred speech.

Recommendations for Preventing Heat-related Illness

- Take time to acclimatize.
- Stay well hydrated.
- Watch for signs/symptoms of heat-related illnesses.
- Take time to rest and cool down.

Take Time to Acclimatize

- **Gradually increase work** time in hot environmental conditions over a 7-14 day period.
 - If not possible, implement shorter work shifts for workers until they are adjusted to the heat.
- For **workers new to the climate**, schedule no more than 20% of the usual work shift on day 1 and a no more than 20% increase on each additional day.
- For **workers with previous experience** with the job in this climate, schedule no more than a 50% of the usual work shift on day 1, 60% on day 2, 80% on day 3, and 100% on day 4.

Stay Well Hydrated

- Arrive for your shift well hydrated.
- **Drink frequently** enough that you do not feel thirsty.
- Rehydrate during **every** rest break.
- **Tell your supervisor** and **do not start your shift** if you have recently vomited or had diarrhea.
- **Do not** use caffeine, alcohol, and other stimulants.



Stay Well Hydrated (continued)

- Consider keeping a **weight scale** in the rest area.
 - Weigh yourself before putting on PPE at the beginning of your shift and after removing it (and removing sweat-soaked scrubs) on the last shift of the day.
 - Record your body weight changes.
≥ 2% body weight loss = possible decreased heat tolerance
 - Alert your supervisor if you have lost body weight during a shift.

Example: If starting weight is 150 lbs., then a 2% loss would be 3 lbs.

(150 lbs. X 0.02 = 3 lbs.)



Watch for Signs/Symptoms of Heat-related Illness

- **Avoid working alone. Designate a buddy.**
 - Ask your buddy how he feels periodically, and encourage rest and water breaks as needed.
 - Tell your buddy if you do not feel well.
 - Follow emergency procedures if someone has heat-related symptoms.



Watch for Symptoms of Heat-related Illness (continued)

- **Assign a trained person who knows first aid to monitor the rest area for symptoms of heat-related illness.**

Additional monitor duties may include:

- Doing a mental health assessment on those entering and leaving the rest area. *Asking them to answer basic questions like their name, etc.*
- Using an infrared thermometer to assess aural (ear canal) temperature.
Temperature $\geq 102.2^{\circ}\text{F}$ (39°C) means they should not return to work. Return to work only after temperature decreases to 100.4°F (38°C).
- Telling workers it is time for their break.
- Ensuring that the rest area is well stocked with water and electrolyte replacement fluids and that cooling devices work properly.



Take Time to Rest and Cool Down

- The **rest area** should include:
 - Shaded area, chairs, and cots.
 - Electric fans with misters or squirt bottles.
 - Bottled water and electrolyte replacement fluids.
 - Basic first aid equipment, bucket containing cool water to quickly cool down a person, and spare communication equipment to call for evacuation.
- Follow all **local emergency plans and procedures** if an evacuation is needed.
- Consider keeping a **change of scrubs** in the rest area to change out of sweaty scrubs.
- Arrive for your shift **well rested**.



Key Points

- Wearing PPE will increase your risk for heat-related illnesses.
- Take time to acclimatize.
- Stay well hydrated.
- Watch for symptoms of heat-related illnesses.
- Take time to rest and cool down.

Additional Resources

NIOSH Heat Stress Topic Page

<http://www.cdc.gov/niosh/topics/heatstress/>

OSHA-NIOSH INFOSHEET: Protecting Workers from Heat Illness

<http://www.cdc.gov/niosh/docs/2011-174/>

NIOSH Fast Facts: Protecting Yourself from Heat Stress

<http://www.cdc.gov/niosh/docs/2010-114/pdfs/2010-114.pdf>

The screenshot shows the CDC website interface. At the top, it says "Centers for Disease Control and Prevention" and "All CDC Topics". Below that, there's a search bar and a "Workplace Safety & Health Topics" section. The main content area is titled "HEAT STRESS" and includes an "Overview" section with text about heat stress risks, a "NIOSH Fast Facts" section with a link to a PDF, and a "Contact Us" section with phone and email information. There are also social media links for Facebook, Twitter, and YouTube.

This infographic is titled "NIOSH Fast Facts: Protecting Yourself from Heat Stress". It provides key information about heat stress, including symptoms of heat stroke and heat exhaustion, and first aid steps. The text is concise and easy to read, with a focus on practical advice for workers.

Protecting Yourself from Heat Stress

Heat stress, from exertion or hot environments, places workers at risk for illnesses such as heat stroke, heat exhaustion, or heat cramps.

Heat Stroke

A condition that occurs when the body becomes unable to control its temperature, and can cause death or permanent disability.

Symptoms

- High body temperature
- Confusion
- Loss of coordination
- Hot, dry skin or profuse sweating
- Throbbing headache
- Seizures, coma

First Aid

- Request immediate medical assistance.
- Move the worker to a cool, shaded area.
- Remove excess clothing and apply cool water to their body.

Heat Exhaustion

The body's response to an excessive loss of water and salt, usually through sweating.

Symptoms

- Rapid heart beat
- Heavy sweating
- Extreme weakness or fatigue
- Dizziness
- Nausea, vomiting
- Irritability
- Fast, shallow breathing
- Slightly elevated body temperature

First Aid

- Rest in a cool area.
- Drink plenty of water or other cool beverages.
- Take a cool shower, bath, or sponge bath.

This infographic is titled "OSHA-NIOSH INFOSHEET: Protecting Workers from Heat Illness". It provides detailed information about heat-related illnesses, including factors that increase risk to workers, symptoms of heat exhaustion, and first aid steps. The text is more comprehensive than the fast facts version, providing a deeper understanding of the risks and how to prevent them.

Protecting Workers from Heat Illness

All the time, workers may be required to work in hot environments for long periods. While the human body is unable to maintain a normal temperature, heat-related illnesses can occur and may result in death. This fact sheet provides information to employers on measures they should take to prevent heat-related illnesses and death.

Factors That Increase Risk to Workers

- High temperature and humidity
- Direct sun exposure (with no shade)
- Indoor exposure to other sources of radiant heat (ovens, furnaces)
- Limited air movement (no breeze)
- Low fluid consumption
- Physical exertion
- Heavy personal protective clothing and equipment
- Poor physical condition or health problems
- Some medications, for example, different kinds of blood pressure pills or antihistamines
- Pregnancy
- Lack of recent exposure to hot working conditions
- Previous heat-related illness
- Advanced age (65+)

Health Problems Caused by Heat Environments

Heat stroke is the most serious heat-related health problem. Heat stroke occurs when the body's temperature regulating system fails and body temperature rises to critical levels. Heat stroke is a medical emergency that may rapidly result in death!

Symptoms of heat stroke include:

- Confusion
- Loss of consciousness
- Seizures
- Very high body temperature
- Hot, dry skin or profuse sweating

If a worker shows signs of possible heat stroke:

- Heat stroke is a life-threatening emergency! While first aid measures are being implemented, call 911 and get emergency medical help.

Make sure that someone stays with the worker until help arrives.

- Move the worker to a shaded, cool area and remove outer clothing.
- Wet the worker with cool water and circulate the air to speed cooling.
- Place cold wet cloths or ice all over the body or soak the worker's clothing with cold water.

Heat Exhaustion is the next most serious heat-related health problem.

Symptoms of heat exhaustion:

- Headache
- Nausea
- Dizziness
- Weakness
- Irritability
- Thirst
- Heavy sweating
- Elevated body temperature
- Decreased urine output

If a worker shows signs of possible heat exhaustion:

- Workers with signs or symptoms of heat exhaustion should be taken to a clinic or emergency room for medical evaluation and treatment.
- If medical care is not available, call 911 immediately.
- Make sure that someone stays with the worker until help arrives.
- Workers should be removed from the hot area and given liquids to drink.
- Remove unnecessary clothing including shoes and socks.
- Cool the worker with cold compresses to the head, neck, and face or have the worker splash his or her head, face and neck with cold water.