

# 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](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.

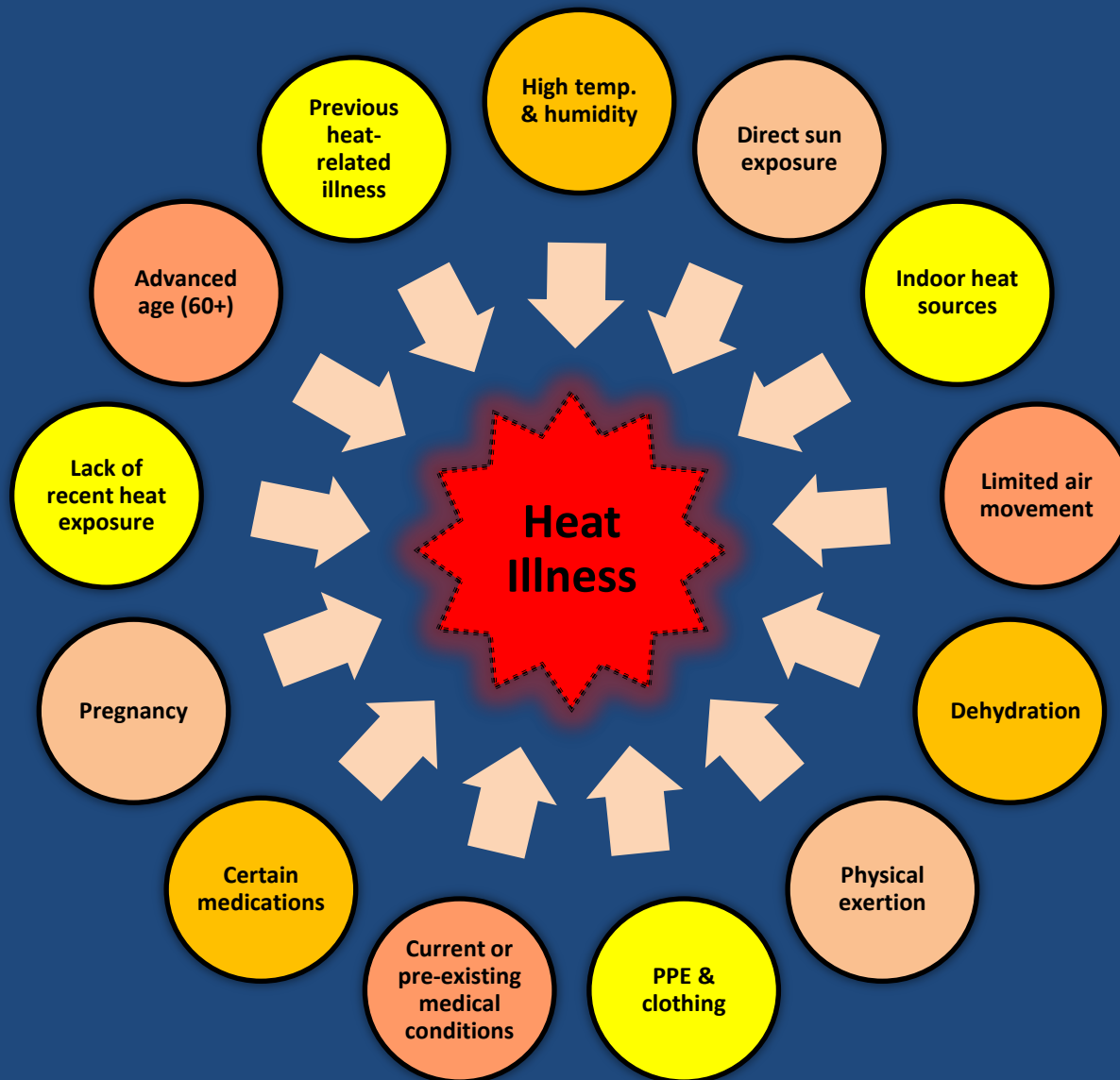


Photo courtesy of Kimberly-Clark



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.*

## SEVERITY

Less Severe ----- More Severe



Discomfort ----- Death

# 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  $\geq 102.2^{\circ}\text{F}$  ( $39^{\circ}\text{C}$ ) means they should not return to work. Return to work only after temperature decreases to  $100.4^{\circ}\text{F}$  ( $38^{\circ}\text{C}$ ).*
- 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/>

The screenshot shows the CDC website's 'Workplace Safety & Health Topics' section for 'HEAT STRESS'. It includes a navigation menu on the left with categories like 'Workplace Safety and Health Topics', 'Industries & Occupations', and 'Hazards & Exposures'. The main content area features an 'Overview' section with a video thumbnail and text about heat stress risks. There are also 'NIOSH Fast Facts' and 'Infographic: Protect your workers from HEAT STRESS' links. A sidebar on the right contains social media options and contact information for NIOSH.

## OSHA-NIOSH INFOSHEET: Protecting Workers from Heat Illness

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

This infographic provides key information about heat stress. It defines heat stress as heat from exertion or hot environments that puts workers at risk for illnesses like heat stroke. It lists symptoms of heat stroke (high body temperature, confusion, loss of coordination, hot/dry skin, profuse sweating, throbbing headache, seizures, coma) and first aid steps (request medical assistance, move to a cool area, remove clothing, apply cool water). It also defines heat exhaustion as a condition where the body cannot control its temperature, listing symptoms like rapid heart rate, heavy sweating, weakness, dizziness, nausea, vomiting, irritability, fast/shallow breathing, and slightly elevated body temperature. First aid for heat exhaustion includes resting in a cool area, drinking water, and taking a cool shower or bath.

This infographic details factors that increase risk to workers, such as high temperature/humidity, direct sun exposure, and poor physical condition. It lists symptoms of heat exhaustion (headache, nausea, dizziness, weakness, thirst, heavy sweating, elevated body temperature, decreased urine output) and heat stroke (rapid heart rate, confusion, loss of consciousness, seizures, very high body temperature, hot/dry skin, profuse sweating). It provides first aid instructions for both conditions, including seeking medical help and cooling the worker.

## NIOSH Fast Facts: Protecting Yourself from Heat Stress

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