

# Occupational Exposure to Heat Stress and Hot Environments

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## Abstract

Workers who are exposed to extreme heat or work in hot environments, or even those engaged in strenuous physical activities may be at risk for heat stress. Exposure to extreme heat can result in occupational illnesses, including heat stroke, heat exhaustion, heat cramps, or heat rash. Heat can also increase workers' risk of injuries, as it may result in sweaty palms, fogged-up safety glasses, burns, dizziness, and may reduce brain function responsible for reasoning ability, creating additional hazards. The NIOSH Education and Information Division (EID) develops heat-related guidance and educational materials in collaboration with scientists internal and external to NIOSH.

In 2016, NIOSH published an updated *Criteria for a Recommended Standard: Occupational Exposure to Heat and Hot Environments*.<sup>1</sup> This document provides technical guidance for managing heat stress in workplaces, and targets safety and health professionals. In addition, NIOSH has created products in many different formats for varying occupational safety and health (OSH) audiences (e.g., workers, employers, safety and health professionals) to ensure the information is translated and disseminated as widely as possible. Future efforts include the development of heat stress training for outdoor workers.

## Introduction

According to data from the U.S. Bureau of Labor Statistics, there were 220 fatal occupational injuries due to exposure to environmental heat from 2011 to 2016.<sup>2</sup> Heat-related illnesses (HRIs) can vary in severity, with heat stroke often leading to death.

### Who works in hot environments?

In 2011, the Bureau of Labor stated that 2 out of every 1000 workers are at risk for heat stress, with some occupations at greater risk.<sup>3</sup>

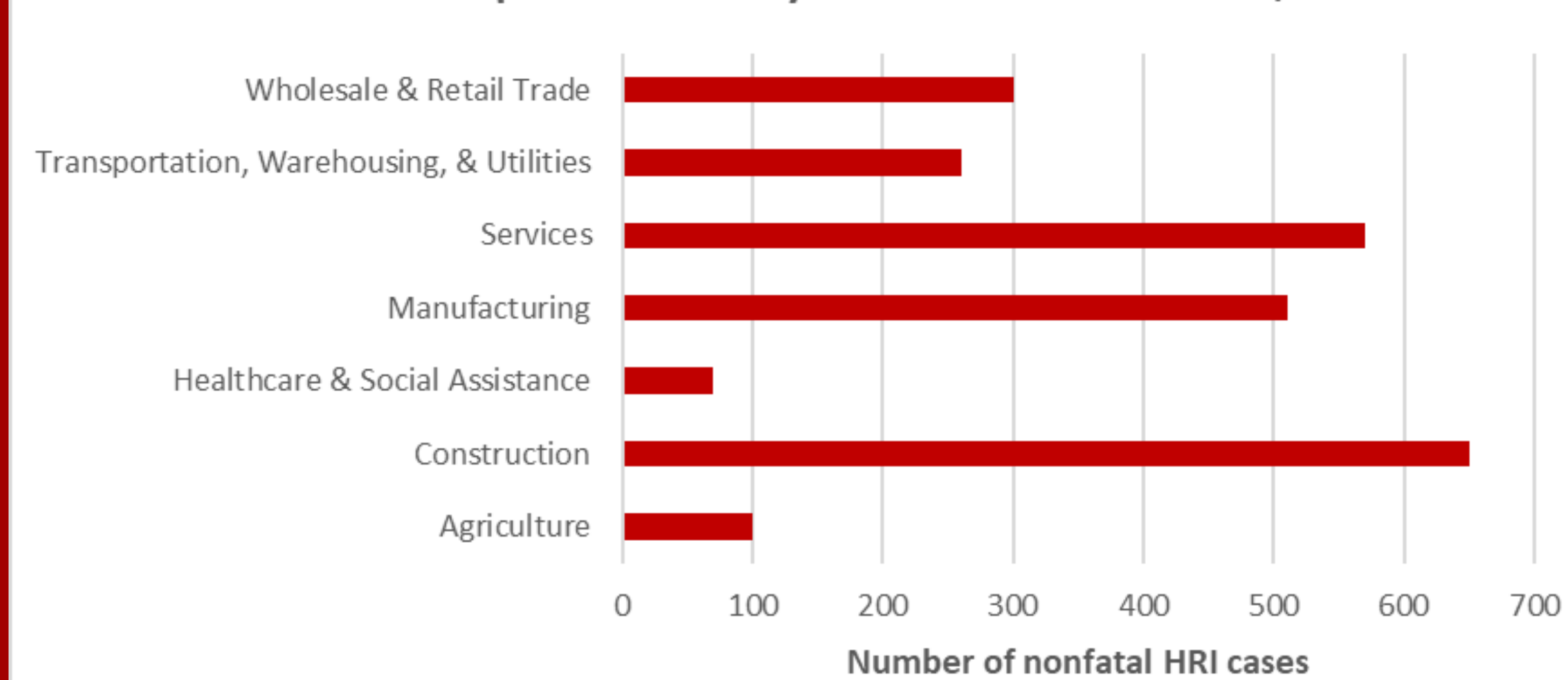
#### Outdoor Workers

- Construction
- Roofers
- Farmers/Agricultural
- Lawn care/Landscapers
- Foresters
- Police

#### Indoor Workers

- Firefighters
- Factory/Foundry
- Bakery
- Anyone in hot, confined spaces

Nonfatal Occupational HRI by Sectors - United States, 2017



Source: U.S. Bureau of Labor Statistics, U.S. Department of Labor, November 15, 2018.

## Risk Factors



A brief overview of select risk factors is provided below.

### Not Enough Fluids

- Sweat production rates of about 1 L/hr are common in industrial work.
- Heavy sweating could result in a 2-3% deficit in body weight at end of shift.

### PPE and Clothing

- Alters the rate and amount of heat exchange between skin and air.
- The thicker and greater the air and vapor impermeability, the greater its interference with heat exchange.
- Hot microenvironments created from increased metabolic heat production during exertion and trapped inside clothing or PPE.

### Physical Condition (e.g. obesity)

- Predisposes individuals to heat disorders.
- Extra weight calls for a greater expenditure of energy.
- Fat provides additional insulation.
- Lower physical fitness, decreased maximum work capacity and cardiovascular capacity.

### Lack of Recent Exposure (i.e., unacclimatized)

- Readily show signs of heat stress.
- Difficulty replacing water lost in sweat.
- Failure to replace the water lost will slow or prevent acclimatization.

## NIOSH Recommendations

### Engineering Controls

- Increase air velocity
- Use reflective or heat-absorbing shielding or barriers
- Reduce steam leaks, wet floors, or humidity

### Work Practice Recommendations

- Limit time in heat and/or increase rest time in a cool environment
- Increase the number of workers per task
- Implement a buddy system
- Require workers to conduct self-monitoring
- Implement a heat alert program when a heat wave is likely

### Training

#### Workers and Supervisors:

- Recognize symptoms of HRI
- First aid
- HRI risk factors
- Importance of acclimatization
- Importance of reporting HRI symptoms

#### Additional Training for Supervisors:

- Implementation of an acclimatization plan
- Procedures for when HRI symptoms are present
- Monitoring weather reports and responding to advisories
- Monitoring and encouraging adequate hydration and rest breaks

### Acclimatization Plan



### Hydration

#### Employers should provide appropriate hydration

- Water should be cool and near the work area
- Provide individual drinking cups
- Encourage workers to hydrate

#### Workers should drink an appropriate amount

If you are:	Drink:
In the heat < 2 hours and involved in moderate work activities	1 cup (8 oz.) of water every 15-20 minutes
Experiencing prolonged sweating lasting several hours	Sports drinks containing balanced electrolytes

### Rest Breaks

#### Ensure and encourage rest breaks

- Permit breaks when a workers feels discomfort
- Assign new workers lighter work and longer, more frequent breaks
- Shorten work and increase rest periods:
  - As temperature, humidity, and sunshine increase
  - When there is no air movement
  - If protective clothing or PPE is worn
  - For heavier work

## Disseminating to OSH Audiences



### Past Publications

Dissemination efforts of heat-related guidance have been ongoing. Technical guidance has been translated and disseminated to target audiences that have included: safety and health professionals, medical professionals, employers, and workers.

Heat stress-related publications and products have ranged from fact cards and smartphone heat app for outdoor workers, and information for emergency responders during the Ebola response in Africa and hurricane responses in the U.S.

### Future Projects

Stakeholders have shown ongoing interest in having training modules made available based on the information found in the NIOSH Criteria Document. In the next year, there are plans to develop online heat stress training for outdoor workers and evaluating the training among different sectors.

Along with developing online heat stress training, the NIOSH Small Business Assistance Program is interested in developing tools that could be of use to small businesses. Small businesses are often found in occupational sectors (e.g., construction, agriculture, services, etc.) that experience a high heat burden, in addition to having OSH-related challenges specific to their small size and lack of resources.

## References

<sup>1</sup> NIOSH [2016]. NIOSH criteria for a recommended standard: occupational exposure to heat and hot environments. By Jacklitsch B, Williams WJ, Musolin K, Coca A, Kim J-H, Turner N. Cincinnati, OH: US Department of Health and Human Services, CDC, NIOSH, DHHS (NIOSH) Publication 2016-106. <https://www.cdc.gov/niosh/docs/2016-106/>

<sup>2</sup> U.S. Bureau of Labor Statistics [November 15, 2018], U.S. Department of Labor.

<sup>3</sup> U.S. Department of Labor [2011]. Occupational outlook handbook, 2010-2011. New York: Skyhorse Publishing.

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