



## Risk Research Bulletin

# Reducing Heat Illness in College and High School Sports

Heat-related illness is preventable, yet it's a leading cause of death and injury among college and high school athletes. All athletes are susceptible to the risks of exercising in a hot environment, but particularly those in high-exertion sports such as football, where studies show the majority of heat-related illnesses occur.

A review of United Educators (UE) claims arising from heat-related illnesses in athletes reveals that the primary cause of liability is poor planning for reduction of and response to this risk.

Professional football provides a model for high school and college athletics. Since the NFL overhauled its practices around heat-related illnesses following the death of Korey Stringer in 2001, not a single player has died from heat exertion. By implementing heat-illness reduction programs, institutions can decrease or eliminate risk and enhance the overall safety of their athletic practices and competitions. Use this publication to help inform or assess your institution's heat-illness reduction practices.

## What Is Heat Illness?

Typical exercise-related heat illnesses consist of three separate but related conditions:

**Exertional heat stroke (EHS)** is the most severe of these conditions and can cause death if not quickly recognized and aggressively treated. EHS is defined as a high body temperature (above 104 degrees Fahrenheit) in addition to central nervous system dysfunction (e.g., collapse, aggressiveness, irritability, confusion, altered consciousness). As a medical emergency, EHS can progress to a whole-body inflammatory response and multi-organ system failure. The risk of mortality or long-term complications increases the longer the individual's temperature remains above 104 degrees F.

**Heat exhaustion** is the inability to exercise effectively in the heat, secondary to a combination of factors including cardiovascular insufficiency, hypotension, hypoglycemia (low blood sugar), energy depletion, and central fatigue. This condition is usually associated with an elevated but safe body temperature (between 98.6 and 104 degrees Fahrenheit), as well as heavy sweating and potentially signs of dehydration.

**Exercise-associated muscle cramps** are sudden, painful, involuntary muscle spasms that occur during or soon after exercise.

See [Appendix B: Heat Illness Response Guide](#) for on-site treatment suggestions.

## Components of a Heat-Illness Reduction Program

To reduce heat-related illnesses, institutions should consider implementing these practices:



Conduct pre-participation screening of athletes



Train on recognizing symptoms, acclimatization, and hydration



Ensure access to a heat stress monitor, thermometer, and cold water immersion tub



Have an emergency action plan



## Conduct Pre-Participation Screening

College and high school student athletes should undergo a pre-participation physical exam (PPE), which is required by the NCAA and most high school athletic associations. State-licensed health care providers usually conduct PPEs. Having an athlete's primary physician perform the PPE offers patient familiarity.

Institutions can target the following issues through screening questions:

- Recent history of cramping or heat illness
- Weight changes during activity
- Medication and supplement use
- Fluid intake
- Training activities and locations for the previous month to evaluate acclimatization and fitness status
- Sickle cell trait
- Medical conditions that may indicate susceptibility to heat illness, such as diabetes, use of certain medications, excess body fat, and recent illness, including heat illness.

A medical provider must complete the screening questions and determine whether the student is able to participate, with or without restrictions.

The [American Academy of Pediatrics' sample PPE](#) applies to all levels of sport. After the initial medical evaluation, colleges and high schools should request an annual updated history through a health status questionnaire completed by the student or a parent (for minors). Here are sample questionnaires for [college](#) and [high school](#) athletes.

In addition to the PPE and annual health status questionnaires, institutions should maintain ongoing records of an athlete's:

- Reports of athletic injuries and illnesses
- Treatment or rehabilitation and subsequent clearance to play



- Signed annual release specifying to whom and under what circumstances medical information may be released

Review your medical screening forms and records retention practices with legal counsel to ensure compliance with state regulations.

### Sickle Cell Trait Screening

Sickle cell trait is a hereditary blood disorder that can increase the risk of exercise-related injuries and deaths, particularly during conditions of intense heat and dehydration. Significantly, sickle cell trait was a known or suspected factor in many of UE's claims arising from student athlete deaths from heat illness.

The National Federation of State High School Associations (NFHS) recommends that high schools include a question about the athlete's sickle cell status in the PPE. The NCAA goes further, requiring colleges to screen incoming student athletes for the sickle cell trait. For athletes with the trait, or when an athlete declines testing or does not provide test results, institutions should require that athlete and a parent or guardian (if the athlete is a minor) [sign a waiver](#) as a condition of participation. Consult with counsel in drafting the waiver and before offering one. Schools that offer a waiver should ensure athletes and their parents or guardians are educated about the dangers of sickle cell trait.

## Accommodating Students With Impairments

The PPE is not intended to exclude students from sports. Failure to offer accommodations to students with a problematic PPE may be viewed as discrimination under federal and state disability laws. Schools should establish policies addressing the standards for medical clearance, the risks of athletic participation, and how to decide whether to exclude a student for medical reasons. Exclude students only when a physical or mental impairment presents a significant risk of substantial harm to the health or safety of the student or other participants that reasonable accommodations cannot eliminate or reduce.

Review your athletic participation and exclusion policies with legal counsel to ensure compliance with disability law. Not all physical or mental impairments constitute a protected disability. The requirements of federal and state disabilities laws vary depending on whether the institution is K–12 or postsecondary, public or private, or a recipient of federal funds. To determine whether an impairment is protected by law, consult with legal counsel.

## Use Informed Consent Forms

Written notices informing students of the risks of athletic participation and releasing the school from associated liability are often required for athletic participation. These informed consent forms are particularly important for students with increased risk of heat illness, such as those with sickle cell or diabetes. While the legal enforceability of these documents varies from state to state, institutions should still consider using them. To be effective, informed consent forms should describe the athlete's condition and the specific risks involved in playing with the condition, including heat-illness injury and death. Consult legal counsel when drafting these documents.

## Train on Symptoms, Acclimatization, and Hydration

Heat-illness prevention starts at the top. Athletic directors and coaches must emphasize that prevention and treatment of heat illness are more important than winning. Athletes should also learn that self-care is neither a punishable offense nor a sign of weakness. In several UE claims, athletes experiencing heat-illness symptoms continued without rest or hydration until they collapsed, and in some cases died.

Provide heat-illness education for coaches, staff, and athletes before each season. Whether the training is online or in person, use interactive scenarios featuring athletes experiencing symptoms so learners can better identify heat illness. Training should address prevention methods, such as acclimatization and hydration, symptoms, and response protocols.

See the Resources section for suggested heat illness [training resources](#).



## Acclimatization

The importance of acclimating athletes to weather conditions, workouts, and new equipment cannot be overstated. Studies show that heat illness occurs with increased frequency during the first 7 to 14 days of practice.

Staff and student training should address these requirements:

- Limit duration and intensity of play for the first two weeks of training, also known as the acclimatization period
- Gradually increase each athlete's exposure to play and environment
- Use limited protective equipment during the acclimatization period to prevent overheating
- Avoid maximum exertion until acclimatization is complete<sup>1</sup>

## Hydration

Both dehydration and overhydration can lead to heat illness. Athletes should hydrate in amounts that approximate the fluids lost during play.

Educate athletes and athletics staff about the signs of dehydration and actions for keeping hydrated. For example, teach athletes to:

- Drink every 15 to 20 minutes throughout practices and competitions
- Report dark urine, rapid weight loss, or rapid weight gain during practice or competition to athletic staff<sup>2</sup>

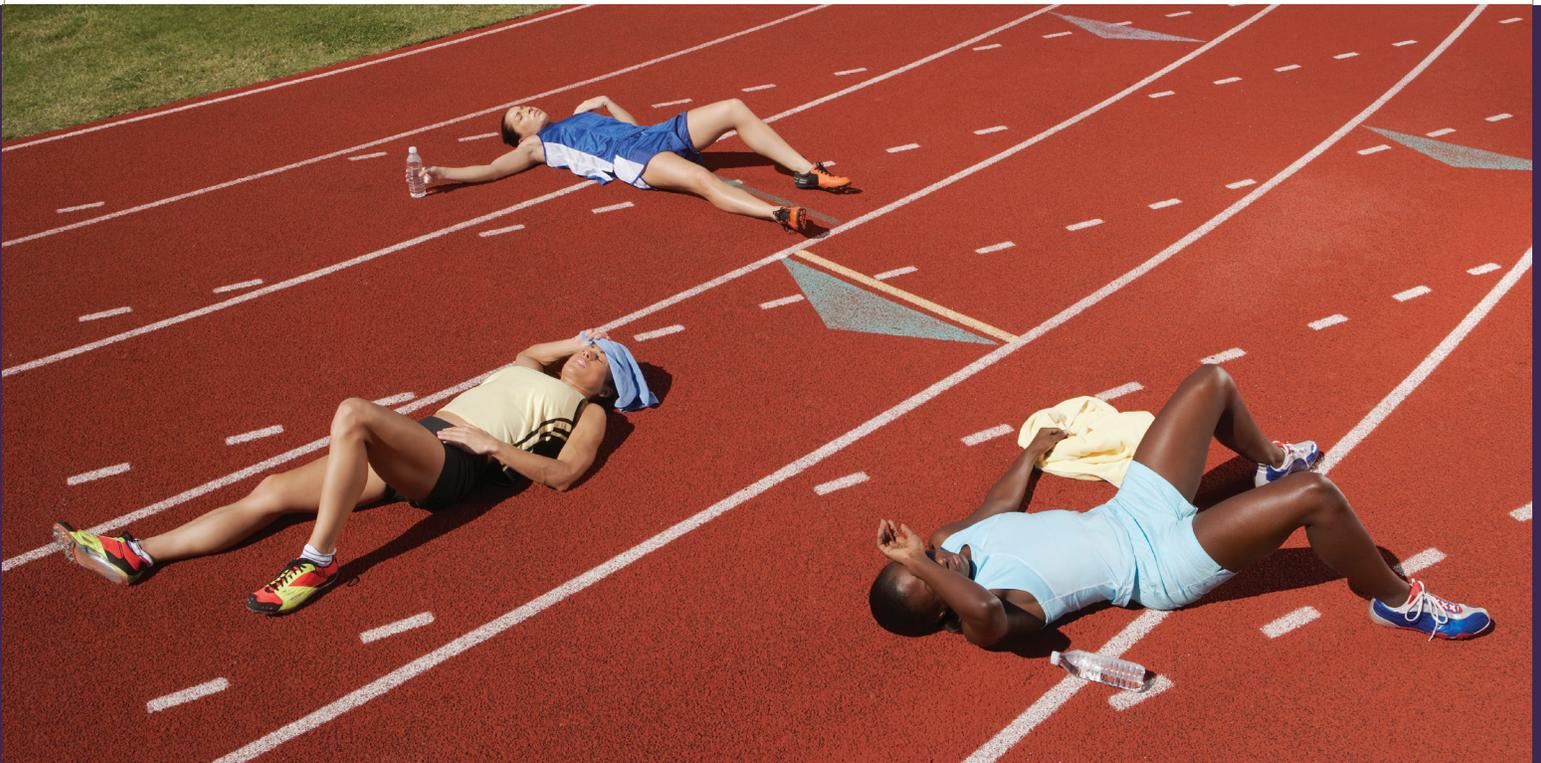
During days of increased heat stress or incomplete athlete acclimatization, consider recording athletes' weights before and after practices and competitions to monitor for sudden loss of fluids. Athletes who lose 5 percent of their body weight or more should be evaluated medically and rehydrated. Losses above 2 to 3 percent can start to impact health and increase body temperature.

Athlete weight gains above 2 percent can also be dangerous, as they may lead to hyponatremia (water intoxication). Though less common than dehydration, water intoxication can be fatal. Athletes who gain 2 percent of their body weight or more during practice or play should also receive medical evaluation and treatment.<sup>3</sup>

<sup>1</sup> Casa, Csillan. Preseason Heat-Acclimatization Guidelines for Secondary School Athletics. *Journal of Athletic Training* (2009)

<sup>2</sup> Id.

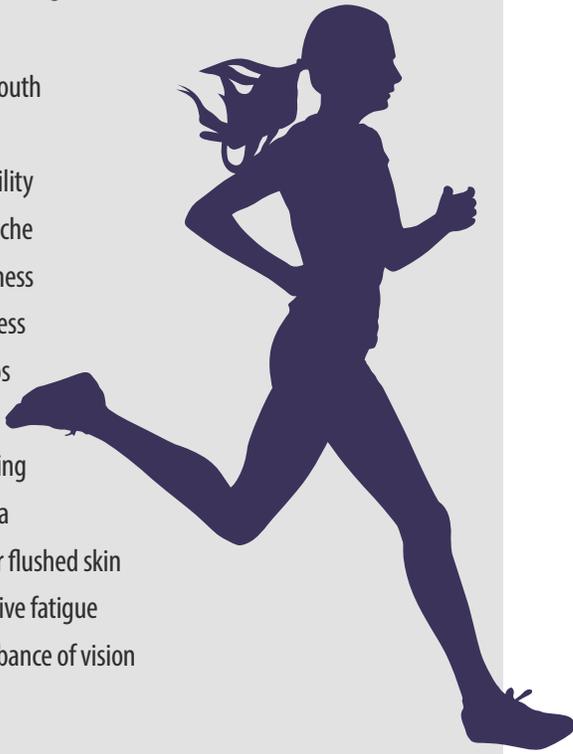
<sup>3</sup> McDermott, Anderson, Armstrong, Casa, et al. National Athletic Trainers' Association Position Statement: Fluid Replacement for the Physically Active. *Journal of Athletic Training* (2017)



## Heat Illness Symptoms

Train all athletic staff and student athletes to identify these signs of heat illness:

- ✓ Dry mouth
- ✓ Thirst
- ✓ Irritability
- ✓ Headache
- ✓ Weakness
- ✓ Dizziness
- ✓ Cramps
- ✓ Chills
- ✓ Vomiting
- ✓ Nausea
- ✓ Pale or flushed skin
- ✓ Excessive fatigue
- ✓ Disturbance of vision



though more expensive units can email coaches when environmental conditions exceed preset limits. Most schools require only one monitor.

Some states now require high schools to take WBGT readings before athletic practice or competition. The NCAA suggests taking greater caution during athletic activity if the WBGT is higher than 82 degrees Fahrenheit. Use regional WBGT recommendations to reduce the number of exertional heat illnesses, and monitor the WBGT at practices and competitions to determine when enhanced protective measures are necessary.

### Thermometer

Student athletes experiencing exertional heat stroke symptoms should receive emergency medical care if their core temperature exceeds 104 degrees Fahrenheit. The only valid measurement of core temperature for individuals exercising in hot environments is by rectal thermometer. Choose a thermometer with a flexible arm that allows for continuous temperature monitoring while immersed. Rectal thermometers with flexible arms are readily available and inexpensive. Only trained medical staff, such as on-site trainers or responding EMTs, should take a rectal temperature.

### Cold Water Immersion Tub

**Cold water immersion** tubs have a 100 percent survival rate when used within 15 minutes of exertional heat stroke onset,<sup>4</sup> but immersion tubs are only effective when used. In one UE claim, an institution stored their cold water immersion tub in the rear of a crowded closet. When an athlete collapsed from heat illness, coaches could not find the tub. Keep immersion tubs easily accessible and train all coaches and staff on their location and use.

When an athlete experiences exertional heat stroke, staff must quickly locate the tub and fill it with ice and water. If water and ice are not available on-site, bring coolers of ice and water bottles to practice and competition locations. Practice filling the tub to determine how much water it requires and how long it takes to fill and cool the tub of water.

Immersion tubs can cost \$150 to \$5,000. Less expensive options include insulated plastic tubs, often called stock

## Ensure Access to a Heat Stress Monitor, Thermometer, and Cold Water Immersion Tub

Making the appropriate equipment available and training athletic staff in its proper use can save athletes' lives. Specifically, institutions are best positioned to respond to a heat illness emergency by ensuring a heat stress monitor, thermometer, and cold water immersion tub are accessible at all practices and games—especially for football, in hotter climates, and during the first two weeks of training when rates of heat illness are highest.

### Heat Stress Monitor

Heat stress monitors detect environmental risks to players by measuring the wet-bulb globe temperature (WBGT), a measurement of heat intensity created by evaluating sun exposure, air temperature, humidity, and wind speed. Heat stress monitors can cost as little as \$100,

<sup>4</sup> Korey Stringer Institute Heat Stroke Treatment

tanks. Portable options are also available for traveling teams. Higher-end immersion tubs are self-cooling.

A second cooling method is the tarp-assisted cooling with oscillation, or TACO, method. Although less effective, the TACO method provides a suitable alternative when full immersion is not possible. Several people hold the sides of the tarp while it is filled with ice water. After the athlete is placed in the tarp, they oscillate the water over the athlete by moving the sides. As with immersion, practice the **technique**.

## Have an Emergency Action Plan

A well-crafted emergency action plan should guide personnel through providing help and preventing further injury due to heat illness. For more guidance on appropriate responses to different types of heat illness, see *Appendix B: Heat Illness Response Guide*. When drafting the plan, seek input from medical personnel, athletic staff, senior administrators, and local emergency medical services. Also, review and practice the plan with your athletics staff at least annually, to ensure their familiarity with it and to identify areas for improvement. For example, athletics personnel, including conditioning and fitness staff, should know their responsibilities in the event of a heat illness emergency, including the location of all communications and emergency equipment.

## Emergency Medical Technicians

Emergency medical technicians (EMTs) without heat illness training may want to stop cold water immersion to initiate transport. Even when athletic trainers know that cold water immersion should not be interrupted, most jurisdictions give EMTs the legal authority to control treatment once they arrive. To help prevent incorrect emergency treatment, invite local emergency management personnel to participate in the annual emergency action plan review and practices. Train participants on the importance of immediate and continuous cold water immersion to counteract the effects of exertional heat stroke.



Post emergency action plans prominently at all practice sites and include:

- Key signs of heat illness
- Responsibilities of identified personnel and a chain of command
- Contact information for emergency medical service providers
- Venue-specific information, including the address, access points, and location of on-site emergency equipment

## Put Safety in the Game Plan

By implementing the actions discussed, colleges and high schools can better prevent and respond to heat-related illnesses at their athletic practices and games.

*By Melanie Bennett, risk management counsel*

*United Educators would like to thank Rebecca Stearns from the Korey Stringer Institute for reviewing and providing helpful comments prior to publication.*

# APPENDIX A: HEAT ILLNESS SCENARIOS

The following scenarios from United Educators (UE) member institutions exemplify the types of problems that can arise.

## I. Lack of Acclimatization and Dehydration

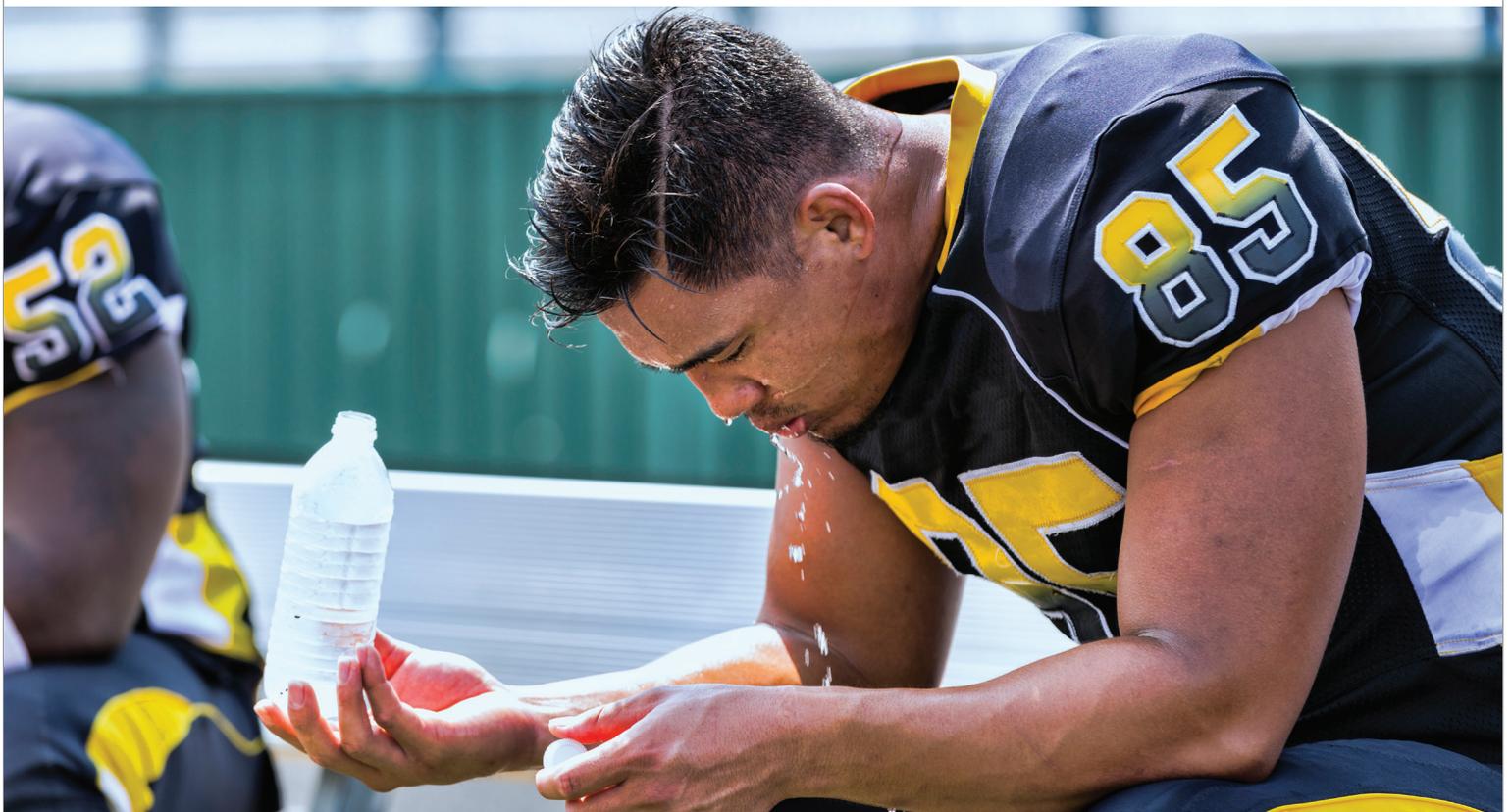
- A college basketball player attending his first practice reported feeling sick. The coach instructed the athlete to continue practice and complete sprints around the court. During the sprints, the athlete collapsed due to exertional heat stroke. Although immediate medical treatment saved the student's life, he is permanently injured from the heat stroke. The claim settled for six figures.
- During the first week of college football practice, after practicing all day in heat over 100 degrees, the team captain told his trainer that he felt bad. The trainer noted the symptoms of heat illness and brought him to the hospital, where he later died.

## II. Failure to Perform a Pre-Participation Exam

- After a three-hour high school football practice in full equipment, a player collapsed in the shower and died from a genetic predisposition exacerbated by heat illness. His parents sued, alleging that the school should not have allowed the athlete to play due to his genetic condition. Upon investigation, the school learned that athletes regularly played without completing the PPEs that would reveal such conditions.

## III. Failure to Provide Timely Treatment

- A 17-year-old student attending high school football practice reported dizziness and nausea to his coach. After taking a rest break, he reported dark urine. The coach said to finish practice but skip evening training. After practice, the student continued to vomit hourly. Later he visited the infirmary and received treatment for heat illness. The delayed treatment resulted in permanent injury to the athlete. The athlete's parents sued the school, alleging that the coach failed to recognize and treat symptoms of exertional heat illness. The claim settled for six figures.
- On a 100-degree day, a student running with the high school track team collapsed during the first practice of the season and died. Although water was regularly available along the track, the student chose not to drink any. After the athlete collapsed, it took more than 15 minutes for coaches to find him and administer treatment.



# APPENDIX B: HEAT ILLNESS RESPONSE GUIDE

When athletes experience symptoms of heat illness, coaching and medical staff should work together to provide immediate on-site treatment. Consider these suggestions.

## Exercise-Associated Muscle Cramps

Instruct athletes experiencing cramps to:

- Rest to cool down
- Consume salty foods or a concentrated, salty liquid (e.g., broth, electrolyte beverage with salt added, pickle juice)
- Practice gentle, range-of-motion stretching and massage of the affected muscle group
- Avoid strenuous activity for several hours or longer after heat cramps go away
- Get medical treatment if cramps do not quickly improve with treatment



Once athletes complete treatment and are symptom-free, have medical staff assess whether they can perform at required levels of play. Review what caused the cramps and whether to make any change to practice to prevent further illness.

## Heat Exhaustion

When athletes experience heat exhaustion:

- Move the athlete to a cool space or provide cold ice towels (towels engineered to quickly cool athletes)
- Rest the athlete on their back with legs elevated higher than heart level
- Loosen and remove unnecessary clothing and equipment
- Instruct the athlete to drink cool fluids



Athletes who complete heat exhaustion treatment should rest for the remainder of the day. Participation should only resume after a medical provider rules out underlying illness and gives written clearance to engage in activity. Athletic staff should review acclimatization issues and fitness level prior to the athlete's return.

## Exertional Heat Stroke (EHS)

When athletes experience heatstroke:

- Cool first, transport second
- Immerse entire body in ice and water
- Continuously stir water and ice around body
- Rotate soaked towels on any extremities that may not be in the water
- Monitor rectal temperature at least every five minutes. Cool until rectal temperature is 102 degrees Fahrenheit or below



EHS victims need to be cooled within 30 minutes of onset. After the athlete is cooled, medical professionals should transport the athlete to the hospital for further emergency treatment and follow-up.

Require athletes who experience EHS to receive written clearance from a physician before returning to play. Suspend their participation for a minimum of one week after release from medical care. Under a qualified medical professional's supervision, the athlete can then begin a gradual return-to-play acclimatization schedule created by the athlete's physician.

## Resources

Boden, Breit, Williams, and Mueller. Fatalities in High School and College Football Players. *The American Journal of Sports Medicine* (2013)

Rates of exertional heat illness among high school athletes are higher in football than all other sports combined, averaging four incidents of heat illness per 100,000 exposures. College football players are 3.8 times more likely than high school players to die from heat illness.

National Athletic Trainers' Association Position Statement: Exertional Heat Illnesses, *Journal of Athletic Training* (2015)

American College of Sports Medicine

NCAA Sports Medicine Handbook (2014–2015) p. 40

NFHS Sports Medicine Handbook (2011)

NCAA Sickle Cell Trait Testing – What You Need to Know

Grundstein, Williams, *Regional Heat Safety Thresholds for Athletics in the Contiguous United States*

Kerr, Casa, Marshall, and Comstock, *Epidemiology of Exertional Heat Illness Among U.S. High School Athletes*

Korey Stringer Institute

National Athletic Trainers' Association Inter-Association Task Force on Exertional Heat Illness Consensus Statement

National Center for Catastrophic Sports Injury Research, All Sport Catastrophic Injuries Reports

National Federation of State High Schools, *Dangers of Heat Illness Reduced by Following Proper Guidelines*

National Institute of Health, *Exertional Heat Illness in American Football Players: When Is the Risk Greatest?*

### Cold Water Immersion Policy

New Jersey State Interscholastic Athletic Association

### TACO Cooling Method

Cooling Effectiveness of Modified Cold Water Immersion Method Following Exercise-Induced Hyperthermia

University of Tennessee Chattanooga Training Video

### Training

National Federation of State High School Associations

UE Youth Athletics Learning Program and Heat Illness Course



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