THSCA
TEXAS HIGH SCHOOL COACHES ASSOCIATION & COACHES EDUCATION FOUNDATION

A RESOURCE FOR COACHES BY:

dell children's
Ascension

HEAT ILLNESS PREVENTION PLAYBOOK

A NOTE FROM THSCA EXECUTIVE DIRECTOR

JOE MARTIN

Dear Coaches and Athletic Trainers,

As we embark on the 2024-25 school year, I want to commend each of you for the incredible work you have already done to prepare for the season. Our top priority is the safety of our student-athletes, especially during these critical early months of practice..

Our mission, “Helping Coaches Help Kids,” is the driving force behind everything we do. Now that practices are underway, we want to continue supporting your efforts by providing you with the most up-to-date information and resources on athlete safety. This “Heat Awareness Toolkit” is designed to equip you with the latest guidelines, protocols, and tools to maintain a healthy and safe environment for your athletes.

In collaboration with the UIL staff and Dell Ascension Hospital, we have developed this toolkit specifically for coaches and athletic trainers. It includes:

- **Guidelines and Protocols:** Updated instructions on monitoring and managing practice conditions using the Wet-Bulb Globe Temperature (WBGT) index, as recommended by the UIL.
- **Emergency Management Tools:** Essential resources from Dell Ascension to help identify and manage potential heat-related issues.
- **Best Practices:** THSCA’s contributions of best practices to support informed decisions for both practice and game time.

Our goal throughout this school year is to continue working with experts to provide you with the knowledge and tools needed to keep our athletes safe while maintaining a competitive environment. We believe that by prioritizing safety, we can ensure a successful and rewarding season for all.

Thank you for your unwavering commitment to our student-athletes. Let’s continue to work together to make this school year one of safety, success, and achievement.

Joe Martin
Executive Director
Texas High School Coaches Association

HEAT ILLNESS PREVENTION PLAYBOOK

MISSION STATEMENT:

Dell Children’s Medical Center is proud to collaborate with the Texas High School Coaches Association on the official Heat Illness Playbook exemplifying the importance of accessible and comprehensive Health, Wellness, and Safety resources for the communities we are proud to serve in Texas.

Similar to the world of sports, in an ever changing environmental climate here, the Heat Illness Playbook will educate, inform, and prepare the Coaches, Athletic Trainers, Administrators, and Families on the leading evidence-based approaches for preventing and triaging athlete care in the event Heat Illness occurs on or off the field.

This Playbook cover the following in relation to Identification, Treatment, Prevention, and Management of the following Heat Related Illnesses:

- Heat Cramps
- Heat Syncope
- Heat Exhaustion
- Heat Stroke
- Exertional Rhabdomyolysis
- Sickle Cell
- Hydration Assessment and Re-Supplementation: What to Drink Before, During, and After Physical Activity
- Determining Heat Safety Conditions for Outdoor Practice
- Websites for Education & Resources: Rules, Regulations for Outdoor Sports Activities

Our commitment to the Health, Safety, and Wellbeing of Student Athletes throughout the state of Texas will not waver. Dell Children’s will continue to prove ready, resilient, and reliable in leading the way in Student Athlete Care.

Adam Messer, MPH
President and CEO
Dell Children’s Medical Center

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HEAT CRAMPS

Heat cramps are a type of heat-related illness characterized by muscular pain and spasms due to heavy exertion.[1] Normally heat cramps are easy to diagnose because the athlete will have visible and involuntary cramps or spasms on large muscle groups as well as excessive/heavy sweating.

The first treatment option for heat cramps is to cease all activity and work on cooling the body down. This can be done by finding a shaded area to rest, applying cold towels or ice to neck, back, and armpits.[1] Athletes should also drink small amounts of cold water and replenish electrolytes with something such as a sports drink, salt tablet, electrolyte pills, or pickle juice. Gentle stretching or rolling out of affected muscle groups will also help. Strenuous activity should be avoided for the next 24 hours and if cramping becomes more severe or lasts more than [1] hour, seek medical attention.

Heat cramps can be prevented by avoiding strenuous activity during extreme heat or properly acclimating athletes to heat over the period of several days so that their body can adjust. It is important to have frequent water breaks during strenuous activity in the heat and accessible ways for athletes to cool down or replenish such as: cold towels, ice bath, salt or sports drinks, and shaded areas.

Emergency Action Plan (EAP): Once athlete has shown signs of heat cramps

Step 1: Move athlete to cool, shaded area

Step 2: Apply ice or cold towels to neck, back, and armpits

Step 3: Supply with salt tablet/pickle juice/sports drink

Step 4: Supply with cold water

Step 5: Gently stretch or roll out affected area

HEAT SYNCOPE

Heat syncope is a temporary episode of fainting or dizziness that occurs when the body overheats. This is typically due to prolonged exposure to the heat or standing for extended periods in a hot environment and occurs in individuals who are unfit or unacclimatized to the heat, especially when wearing a uniform or insulated clothing eventually leads to maximal skin vasodilation. Heat syncope usually occurs during the first 5 days of unaccustomed heat exposure (preseason), before the blood volume expands and cardiovascular adaptations are complete, and also in those with heart disease or taking diuretics. Characterized by its sudden nature, heat syncope, caused by dehydration, venous pooling of blood, reduced cardiac filling, or low blood pressure.

Recovery from heat syncope is short and usually occurs within a few hours. Prevention and preparation are crucial for mitigating the risk of heat syncope. Making sure that athletes have received a preparticipation physical prior to the start of training is beneficial, as it can help identify athletes with risks for heat illness (e.g., athletes with sickle cell trait) or history of heat illness. Furthermore, athletes should go through an acclimatization period by slowly adapting to their environment over a 7-14 day period. In the first 2-3 weeks, individuals are the most susceptible to heat illness. Athletes who are currently sick with viral infection or other illnesses such as, fever, gastroenteritis, serious skin infection, or upper respiratory tract infection, should not participate until illness has resolved. These individuals should be closely monitored upon return to activity as they are still susceptible to heat illness. Proper preparation of the body should be encouraged. Athletes should properly hydrate with water or fluids containing electrolytes, get adequate sleep, and eat nutrient dense foods within the 24-32 hour window before participation. Practices, workout sessions, or competitions in hot climates should have adequate breaks planned every 10-30 minutes depending on the heat. Athletes should have ample opportunity to hydrate with water or fluids with electrolytes. Depending on length of participation, light snacks like bananas,watermelon,

fruit snacks, and pickles should be made available during or after practice. Athletes should properly “cool down” after workouts by completing stretching or foam rolling activities. Cooling stations equipped with supplies such as water, ice, towels, and tubs for cold water immersion should be made available in the event a heat related emergency occurs. It is advantageous to have an athletic trainer or other trained medical personnel available on site to educate as well as identify, prevent, and treat heat illness.

EAP: Once athlete shows signs of heat syncope

Step 1: Remove the athlete from direct heat and into a shaded area or indoors. Lay the athlete down supine with their legs elevated above the heart to restore central blood volume.

Step 2: Monitor vital signs to determine level of heat illness

Step 3: Cool the skin with ice towels, ice packs, fans, etc., and rehydrate the athlete. Vitals should be continued to be monitored until signs and symptoms have worn off. Symptoms usually resolve within 10-20 minutes.

HEAT EXHAUSTION

Heat exhaustion is the most common heat related illness and if not properly recognized and treated, it can lead to heat stroke. Exposure to a hot environment for prolonged periods combined with strenuous exercise leads to heat exhaustion by inhibiting the body’s ability to cool itself. Signs and symptoms of heat exhaustion include excessive sweating, dizziness, cool and clammy skin, dehydration, rapid and weak pulse, and core temperature of 101° to 104°F (38.3° to 40°C) while mental status remains intact.8 Rectal temperature measurement is the most accurate method for diagnosing heat exhaustion. If any decline in mental status occurs, regardless of core temperature, it must be considered heat stroke and should be treated accordingly.

When heat exhaustion occurs, stop activity and remove the athlete from the hot environment. If necessary, remove excess clothing and equipment. Lay the athlete down with feet elevated above the heart and cool the athlete with cold towels, ice packs, or fans. Continue to hydrate the athlete and monitor their vital signs. Call 911 if there is no improvement.

Returning to activity the same day of an episode is not advised. The athlete should wait at least 24-48 hrs before returning to activity and should re-acclimate by gradually increasing intensity and volume of exercise as well as clothing and equipment. Medical clearance is recommended to rule out other conditions.

Athletes should be encouraged to wear loose-fitted, light colored clothing and should try to avoid exercising in extreme heat if at all possible. Frequent water breaks, scheduled rest and recovery periods, and close monitoring is recommended if avoidance is not possible. All coaches and staff should be aware of the risks associated with exercising in the heat, the signs and symptoms, and familiarize themselves with the EAP.

EAP: Once athlete has shown signs of heat exhaustion[8]

Step 1: Immediate reduction of heat gain by removing the athlete from exercise and reducing exposure to the hot environment.This can be done by moving the athlete into the shade, indoors, etc.

Step 2: Obtain rectal temperature and remove excess clothing that may inhibit the cooling process. The athlete should be supine with legs elevated and rehydrating orally or intravenously (if available). Cooling methods include but are not limited to: ice towels, ice packs, fans, and cooling mist. You may also use more aggressive cooling techniques such as cold showers or cold water submersion. While this is happening, monitor the patient’s vital signs. Reevaluate the athlete in 10-20 minutes. The athlete should be cooled to a core temperature of 101 degrees.

Step 3: If there is no improvement, activate EMS.

HEAT STROKE

Exertional heat stroke is the most severe heat-related illness. It is characterized by a high core body temperature greater than 105° and neuropsychiatric impairment. As the body’s thermoregulatory system becomes overwhelmed by excessive heat production, the ability to sweat decreases and moisture evaporation becomes difficult. This can occur in hot and humid environments and worsen with intense physical activity. Signs of exertional heat stroke include vomiting, red and hot dry skin, altered consciousness, and a strong, rapid pulse. Exertional heat stroke poses a significant risk of organ dysfunction and life-threatening complications which makes it a medical emergency; however, the risk of mortality significantly decreases if the core body temperature is properly lowered.

Exertional heat stroke risk factors encompass both extrinsic elements like environmental conditions and intrinsic factors such as health and fitness levels. Refer to the chart below.[8,10]

Extrinsic Risk Factors	Intrinsic Risk Factors
High ambient temperatures, high humidity, and solar radiation.	High intensity of exercise, or lack of physical conditioning.
Athletic gear and/or uniform.	Sleep deprivation
Peer or organizational pressure to perform beyond limits.	Hydration and electrolyte status
Inappropriate work-to-rest ratios based on intensity, Wet-Bulb Globe Temperature, dark clothing and equipment worn, and fitness level.	Use of diuretics or other medications such as antihistamines, antihypertensives, certain antibiotics, and ADHD medications
Predisposing medical condition.	Reluctance to report problems, issues, or illnesses
Lack of awareness of heat illnesses.	Inadequate acclimatization
No emergency plan to identify and treat exertional heat illnesses.	High muscle mass-to-body fat ratio
Minimal access to fluids before and during activity.	Presence of a fever
Delay in recognition of early warning signs.	Skin disorder

Exertional heat stroke requires immediate action. Upon collapse, it is important to assess vitals. Check rectal temperature to differentiate heat exhaustion from exertional heat stroke, as well as airway, breathing, pulse, blood pressure before immersion. If exertional heat stroke is suspected, rapid cooling takes precedence over anything else. The most effective method for reducing core body temperature is cold water immersion. Submerge the individual up to the neck first to be efficient with time and then remove extra equipment and clothing. The body must be submerged within 30 minutes of the collapse, as time is crucial when heat stroke occurs. If the body is not cooled in time, serious injuries or even death can occur. If immediate cold-water immersion is not feasible, partial-body immersion, focusing on the torso, is an alternative. As soon as the cooling process begins, activating EMS becomes the next critical step to ensure the individual receives proper medical care and is safely transported to a healthcare facility.

Recovery is dependent on initial care and treatment. Medical testing and physical clearance are required before the individuals may return to activity. Many patients who experience heat stroke and are cooled effectively are sent home the same day. They may be able to resume modified activity within 1 month with a physician’s clearance. However, when treatment is delayed (not provided within 30 minutes), patients may experience complications for months or years after the event.

EXERTIONAL RHABDOMYOLYSIS

Exertional Rhabdomyolysis (ER) is the breakdown and necrosis of striated skeletal muscle after engaging in physical activity. Rhabdomyolysis can also be caused by acute trauma due to the rupture of the cellular membrane.[12] ER is an uncommon condition with approximately 29.9 per 100,000 patients per year. Rhabdomyolysis can have very serious consequences that can include muscle ischemia, cardiac arrhythmia, and death.[12]

Athletes may complain of proportional pain, tenderness, weakness, and swelling in the muscles affected following athletic activity. Labs will showing significantly elevated levels of creatine kinase (CK) is also an indicator of exertional rhabdomyolysis.[12] The range for diagnosis of rhabdomyolysis differs for each laboratory, but traditionally, it includes an increase of CK 5 to 10 times the upper limit of normal.[12] CK levels that are elevated 5 times the upper limit of normal along with symptoms are required for diagnosis.[12] A cardinal sign that an individual should seek immediate treatment is dark-colored urine that occurs due to the kidneys clearing myoglobin from the blood, spilling over into the urine.[13]

African American football players with sickle cell trait are at a 37 times higher risk of exertional-related death when compared with their non–sickle cell trait counterparts. Repetitive eccentric loading, hyperthermia, and dehydration are contributing factors.[12] Furthermore, ER has been linked to hyper- and hypothermia, sickle cell trait (and other ischemic conditions), exertion, crush syndromes, infection, autoimmune and metabolic disorders.[12]

The correlation between certain supplements and the incidence of rhabdomyolysis is a topic of growing interest and concern in recent research. Currently, studies indicate that creatine supplementation has no effect on muscle damage nor does it provide protection when taken before, during, or after exercise.[2] On the other hand, supplements with high caffeine content could have some effect, enhancing the risk of rhabdomyolysis. The lethal dose of caffeine is 10 g or higher, so direct causation remains unproven as a significant amount of caffeine would need to be consumed.[3]

In mild cases, ER may go undiagnosed and could be managed on an outpatient basis with oral hydration and rest.[12]

However, severe symptoms including dark urine and Creatine Kinase levels greater than 5 times the upper limit require hospital admission for intravenous hydration with normal saline and maintaining normal urine output. This prevents kidney injury and hyperkalemia.[14]

Establishing a guideline for returning to physical activity is crucial for athletes who have experienced exertional rhabdomyolysis. It is important to ensure their safe and effective recovery while minimizing the risk for recurrence. Return to activity can happen in the following phases[17]:

Phase I: Athlete returns to normal daily activities for 2 weeks. The athlete should be monitored by an athletic trainer, nurse, or other healthcare provider for recurring muscle soreness, hydration status, and urine characteristics. It is also important that the athlete receives at least 8 hours of uninterrupted sleep. Near the end of 2 weeks, their primary care physician should check creatine kinase levels. If CK levels were less than 5 times normal (1000 U/L), the athlete may move on to phase II.

Phase II: In this phase the athlete may begin to reintegrate into physical activity in a climate controlled environment based on a 5-day training regimen. Initial physical activity should include stretching, foam rolling, swimming, and dynamic warm-ups. Stationary bike can be introduced later in phase II. Daily monitoring of hydration, muscle soreness and swelling should continue. The athlete's CK levels should be checked to ensure they remain below 5 times normal (1000 U/L) before moving onto the next phase.

Phase III: During this phase, the athlete can progress physical activity with bodyweight training, resistance bands, core training, and cycling.Time spent on the stationary bike, resistance levels, and maximum heart-rate goals should gradually increase. Like the previous phases, symptoms will need to be monitored daily, and CK levels should be checked prior to moving on to the next phase.

Phase IV: The athlete may begin to initiate resistance training, agility drills, and running. Athletes may start resistance training at 20%-25% of 1 rep max and slowly increase. Agility drills should be performed at 70%-80% percent of maximum effort. Running should start off at a short distance, untimed, and at a slower pace than normal and progress to a pace that is 1 second slower than usual pace.

Once the athlete has completed Phase IV, they should continue reintegration of strength and conditioning and skills until the athlete is able to participate in a full practice with no recurrence of symptoms.

SICKLE CELL

Sickle cell trait is a genetic condition where an individual inherits one gene that causes the red blood cells (RBC) to sickle and one for normal hemoglobin. During intense or extensive exertion, the sickle hemoglobin can change the shape of red cells from round to quarter-moon, or "sickle." This change, exertional sickling, can pose a significant risk for some athletes.[16] The sickled cells block the blood vessels leading to the breakdown of muscles due to lack of blood, or ischemic rhabdomyolysis. Sickling can begin within 2-3 minutes of any all-out exertion and can continue as the athlete exercises. Environmental and internal factors such as heat, altitude, dehydration and asthma can increase the risk for and worsen sickling, even when an athlete is not exercising at maximum capacity.[16]

Sickle cell collapse is often confused with cardiac collapse or heat collapse. However, athletes experiencing sickle cell collapse will experience generalized weakness unlike the abrupt collapse associated with cardiac dysrhythmias. In addition, the larger muscles (calves, quads, hamstrings, glutes) may look and feel normal as compared to the cramping associated with heat cramps. Athletes experiencing sickle cell collapse are usually alert and conscious, and their muscle pain or cramping due to exertional sickling usually comes on very quickly and occurs during the first half hour of the training. As the sickling continues, pain and weakness increases in the large muscles of the leg.[15] Dehydration has been associated with of the reported cases of sudden death in sickle cell trait.[15]

Prevention of sickle cell episodes should focus on proactive measures. Preparticipation examinations are especially important in confirming sickle cell trait status in all athletes.[16] "Nearly all of the 13 deaths in college football have been at institutions that did not screen for sickle cell trait or had a lapse in precautions for it."[16] Coaches and athletic trainers should be mindful of environmental factors that could potentially trigger sickle cell episodes and plan accordingly.

In the event of sickling collapse, treat it as if it were a medical emergency. Vitals should be checked, oral hydration should be given immediately, and if necessary give supplemental oxygen.[16] Rapid cooling may be required. If vitals decline, activate EMS, attach AED, start IV (if available) and get the athlete to hospital quickly. Be sure to communicate with treating physicians to expect issues such as explosive rhabdomyolysis as well as serious metabolic complications. "In the past four decades, exertional sickling has killed at least 15 football players. In the past seven years alone, sickling has killed nine athletes: five college football players in training, two high school athletes (one a 14-year-old female basketball player), and two 12-year-old boys training for football."[16] It is crucial to proactively prepare for sickling collapse by preparing a specific emergency action plan and ensuring the availability of appropriate equipment for practices and competitions.

Individuals with sickle cell trait should be allowed to gradually build endurance and tailor workouts to their own pace with frequent rest periods to ensure proper acclimatization.[15] Older or obese individuals may need to take extra precautions or be given less strenuous regimens. Hydration is vital for these athletes. Water should be consumed before, during and after sessions on workout and non-workout days. Ensure additional electrolytes are added for environmental conditions such as high heat, humidity, and altitude.[15] Workouts should also be adjusted for ambient temperatures and altitude.[15] Reintegration after a sickling collapse depends on the severity of the incident. Vitals and blood work needs to be back at baseline before reintegration begins. Refer to phases in exertional rhabdomyolysis for guidelines

HYDRATION AND RE-SUPPLEMENTATION: WHAT TO DRINK BEFORE, DURING, AND AFTER PHYSICAL ACTIVITY

During physical activity, athletes lose electrolytes through sweating and burn the carbohydrates stored in their muscles. Carbohydrates are essential in replenishing the muscles' glycogen or energy stores, which can be beneficial to sports performance.[19] Electrolytes are minerals within your bodily fluids such as sodium, potassium, and chloride They serve multiple functions within the body like regulation of fluid balance, muscle contractions, and nerve signaling.20 Sodium is the primary electrolyte that is lost through sweating. Insufficiency in sodium and sodium chloride can result in cramps, altered mental status, increased hyponatremia, rhabdomyolysis, and seizures. Potassium insufficiency can result in muscle weakness, cramps, muscle twitching, seizures, and abnormal heart rhythms. The amount of electrolyte loss is different for everyone and can potentially affect sports performance. In most cases, water is sufficient for pre-hydration and rehydration as it is quickly absorbed, easily digestible, and cost-effective.[18] Electrolyte and carbohydrate replacement can both be obtained through food as well as fluids.

Sports drinks can be of great benefit to the athletes who had poor hydration prior to physical activity and athletes who sweat excessively or are "salty sweaters, as they are quick way to replenish electrolytes and easily obtainable.[18] Sports drinks with 6%-8% carbohydrate content and sodium concentration of 0.4-1.2 grams/L are beneficial to athletes participating in extended physical activity of 1 hour or more; multiple, same-day sessions of intense and strenuous exercise; and during warm-hot and humid weather conditions.[18]

Athletes should not consume fluids such as fruit juices with carbohydrate content higher than 8% or carbonated beverages as they can slow the rate of fluid absorption and cause abdominal cramping and bloating.[18] Furthermore, athletes should stay away from drinks or supplements (pill and powder form included) that contain exorbitant amounts of sugar and caffeine as it may result in increased anxiety, jitteriness, nausea, upset stomach and diarrhea. They can also act as a diuretic if consumed in large quantities, which can increase risk of dehydration. [18] Caffeine consumption should not exceed 3 mg/kg during or after exercise.[19]

Fluids should be consumed before, during and after practices and competitions and should be consumed relatively in this manner if possible[18]:

Before	• Drink 16 ounces 2 hours prior to physical activity • Drink another 8-16 ounces 15 minutes before physical activity
During	• Drink 4-8 ounces every 15- 20 minutes. ○ Athletes who sweat excessively, can safely drink up to 48 ounces of fluids per hour.
After	• Drink 16-20 ounces of fluid per pound of body weight lost during physical activity to return to normal hydration status prior to the next game or practice..

Athletes should be able to achieve normal hydration status within a sufficient length of time. An excessive amount of water intake in a short amount of time can lead to hyponatremia.[18] Hyponatremia is a common electrolyte abnormality caused by having an excessive amount of water in the body in comparison to the sodium chloride. If hyponatremia suddenly occurs over 48 hours or less, it could cause Rhabdomyolysis, altered mental status and possibly death.

HYDRATION ASSESSMENT

The status of an athlete's hydration is important but can be difficult to accurately and reliably measure. An athlete's hydration state is in constant flux and depends on different factors. Multiple indicators such as thirst, body mass, and urine can be used to determine an adequate assessment of hydration status.

Thirst sensation is not a reliable tool for athletes to maintain hydration during physical activity, as the body is already in a dehydrated state. However, the perception of thirst at rest can be a helpful indicator for hydration status as there is a strong correlation between first morning thirst and an acute change of body mass. Thirst sensation occurs when the body approaches 2% hypohydration and decreases when fluid balance is restored.[19]

Body mass assessment for hydration is a valid assessment to show short-term changes between pre-exercise and post-exercise. Body mass is considered valid only when measurements are accurately observed (pre practice vs. post practice).[19] Typically a valid baseline requires 3 consecutive days of weight assessments in a hydrated state to establish normal body weight around the same time of day. Athletes should be weighed in shorts and t-shirt with no equipment before and after warm- hot weather practices and contests to assess estimated change in hydration status. [19] Weight loss of 1-2% of body weight can negatively impact performance. Loss of 3% or more of body weight during intense exercise can notably increase the risk of exertional heat illness.[18]

***Formula for weight loss → # Pounds Lost/Starting Weight x 100 = Percentage of Weight Loss**

The volume and color of urine is a good assessment of determining hydration status as it is noninvasive, reliable, and cost effective.[19] Small amounts of dark urine can indicate the need for more water while a "normal" amount of light- nearly clear colored urine can indicate proper hydration. Urine color of 8 on the chart can indicate rhabdomyolysis or kidney dysfunction. Athletes with this color of urine should seek further medical evaluation.[19]

Hydration: Urine Color Chart.; 12AD. Accessed August 8, 2024. https://www.osha.gov/heat/more-resources

DETERMINING HEAT SAFETY CONDITIONS FOR OUTDOOR PRACTICE:

Wet Bulb Globe Temperature (WBGT) vs Heat Index

We can reduce the risk of heat related illness by ensuring athletes are properly acclimated to the hot environment and assessing the wet bulb globe temperature (WBGT) or heat index daily before outdoor activity. WBGT measures the heat stress on the body by accounting for the major environmental heat factors: temperature, humidity, solar radiation(sunlight) and wind speed.[26] There are three components of WBGT, dry bulb temperature, natural wet temperature, and black globe temperature. Dry- bulb temperature (DB) is the measurement of the air temperature. Natural wet- bulb temperature (NWB) incorporates air temperature, humidity, and solar radiation into one measurement. The black globe temperature (GT) measures solar radiation and the temperature changes as the wind blows. These components together incorporate multiple factors into one measurement of risk.

$$WBGT = \mathbf{0.1} * DB + \mathbf{0.7} * NWB + \mathbf{0.2} * GT$$

Wet Globe Bulb Temperature (WBGT) Tool

Heat Index Chart. Accessed July 4, 2024. https://www.weather.gov/ama/heatindex

While heat index is simple and widely used, it assumes that you are only in the shade, therefore it is not always a sufficient metric to use for outdoor activity. On the other hand, WBGT accounts for multiple factors and is considered the “gold standard.” The information from these measurements can help determine modification for practices and games, rest and water breaks, and what equipment should be worn.

WBGT and Heat Index Comparison[24]

Parameters	Wet Bulb Globe Temperature	Heat Index
Measured in the sun	Yes	No
Measured in the shade	No	Yes
Uses Air Temperature	Yes	Yes
Uses Relative Humidity	Yes	Yes
Uses Wind Speed	Yes	No
Uses Sun Angle	Yes	No
Uses Cloud Cover	Yes	No

U.I.L. WBGT Activity Guidelines

Ways to Track the Weather

In order to determine the safety of participating outside, it is important to have a way to track or measure the temperatures. There are several options for tracking the weather. The cost can range from $0.00 to $200,000. Listed below are a variety of ways to track the weather depending on your budget.

Apps

There are a number of different apps that can be downloaded to your phone that can give you temperatures and relative humidity for your area. While having an app is convenient, users should be mindful of the proximity of the weather station the app is collecting data from.

https://www.weatherbug.com/
https://www.wunderground.com/
https://www.accuweather.com/
https://www.noaa.gov/

Weather Systems

Perry Weather is a complete weather system used by schools, cities and sporting event sites. It can be set up at various locations in a school district to track the weather at any school or sporting fields. It can send notifications to your staff, coaches, teams and spectators on inclement weather conditions, weather risks for the day, on-site hardware weather stations with outdoor warning systems and dashboard tablets. The weather system includes WBGT and heat index.

https://perryweather.com/

Weatherstem is another comprehensive real-time weather monitoring system similar to Perry Weather.

https://www.weatherstem.com/varsity

WBGT Meters

There are digital WBGT Meters that can simplify the process of taking wet bulb globe temperatures. There are various makes and models that range in prices of least expensive to the most expensive. The most popular is the Kestrel Meter.

https://kestrelmeters.com/

https://www.tekcoplus.com/products/tk286plus

https://www.triplett.com/products/heat-stress-wbgt-wet-bulb-globe-temperature-meter-hs10

HYDRATION SYSTEMS FOR YOUR TEAM

There are several ways to keep your athletes hydrated during practices and games to help prevent heat illness. Many schools use either water bottles, hydration systems, or both to help keep their teams hydrated. Water bottles are inexpensive and a great way to keep your athletes hydrated. Water bottles are best used with small teams or during time outs or huddles during practices and games with larger teams. Hydration systems are great to keep your athletes on large teams hydrated. They can also serve as refill stations for your water bottles. There are a variety of systems that are currently on the market. These systems can feature wheels for easy transporting, battery operated for portability, hook up to a water hose for a continuous flow, and an insulated tank to keep ice longer and numerous drinking spouts. There are also more simple hydration systems which use a 10 gallon cooler, have an attachment for a hose and a lid with four drinking spouts. See the links below for more information.

https://www.friohydration.com/hydration-systems
https://www.waterboysports.com/
https://www.wisstechenterprises.com/
https://www.alertservices.com/hydration-equipment.aspx

RESOURCES FOR EDUCATION, RULES, REGULATIONS FOR OUTDOOR SPORTS ACTIVITIES

The University Interscholastic League (UIL) website contains valuable information regarding the health and safety of athletes in Texas public and private school systems. There you can find recommended heat protocols and procedures for outside activities as well as recommended WBGT forecast measurements for monitoring environmental conditions.

Athletics — University Interscholastic League (UIL)

Heat Stress and Athletic Participation Recommended Plan — Health & Safety

Founded in honor of Korey Stringer (former offensive lineman for the Minnesota Vikings) by his wife and Douglas Casa, Ph.D.ATC, the Korey Stringer Institute is dedicated to research, education, and optimizing the safety and prevention of sudden death for athletes. This site is complete with information regarding hydration, heat acclimatization, heat safety, sports medicine policies and procedures, and more.

https://ksi.uconn.edu/

National Federation of State High School Associations (NFHS) is another resource that contains information regarding health and safety of middle school and high school athletes.

https://www.nfhs.org/resources/sports-medicine/#

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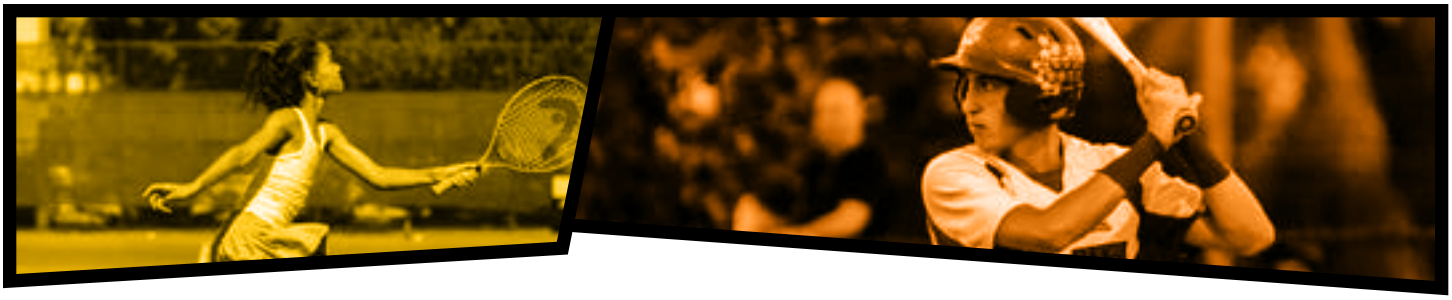

THSCA RECOMMENDED BEST PRACTICES FOR TRAINING AND GAMES IN THE HEAT

TRAINING AND PRACTICES:

- Provide easily accessible hydration stations.
- Allow players to get water whenever they feel they need it. Make sure it is communicated to athletes.
- Schedule frequent water breaks in your practice plans.
- Designate an emergency cooling-zone location and method. Make sure everyone involved in the practice understands where and how athletes will be cooled during a heat emergency/ illness.
- Designate a climate-controlled facility for a “re-set” acclimation during a WGBT controlled practice. Examples include an indoor facility, a near-by gym, locker room, or even a school cafeteria.
- Encourage loose-fitted, light-colored clothing when possible.
- Provide light snacks post-practice, such as bananas, oranges, watermelon, fruit snacks, pickles.
- Monitor athletes’ nutrition daily and be intentional about educating athletes on the importance of nutrition.
- When possible, provide nutritional meals for athletes. This could potentially be done by working with your district’s food service department.
- Schedule practices early in the morning or early evening to avoid the hottest part of the day.
- Work with administration prior to the school year to ensure that early morning practices do not conflict with coaches’ staff development or classroom schedules.
- Prior to the season, spend time with athletic trainers and entire coaching staff to review the Emergency Action Plan, including how to treat a heat emergency.
- Schedule time to “practice” your Emergency Action Plan with athletes, student trainers, managers, and anyone else who is involved in a typical practice.

GAME TIME:

- Consider intentionally scheduling games/ events later in the evening (8:00 pm and 9:00 pm start times for a lighted stadium should not be ruled out) during the first few weeks of the fall season.
- Monitor weather starting 1-2 days prior to a game to help guide game-time decisions.
- Create student athlete hydration and nutrition plan for game day starting the night before the contest.
- Provide Emergency Action Plan instructions to referees, visiting coaches, visiting athletic training
- staff, and visiting administrators on duty.
- Include all student groups in your Emergency Action Plan, including band, cheer, and all student groups.
- Meet with officials and opposing coach in pregame to add a designated timeout at the midpoint of each quarter that is an “Official timeout” not charged to either team, extend the length of half time by 5-10 minutes, to potentially adjust the clock in the 2nd half by playing with a ”Running Clock” or shrink the number of minutes per quarter.
- Designate an emergency cooling zone method and location for all participants and fans. Communicate the plan to both home and visiting administrators on duty.