



Exertional Heat Illness in Athletes

“Cool First, Transport Second”

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Learning Objectives

1. Differentiate the disorders along the spectrum of heat illness.
2. Formulate a strategy to communicate with the sports medicine team regarding a cold water immersion strategy.
3. Apply prevention and preparedness measures such as acclimitization.
4. Implement graded return to play after exertional heat stroke.

Case Study: “Eli”

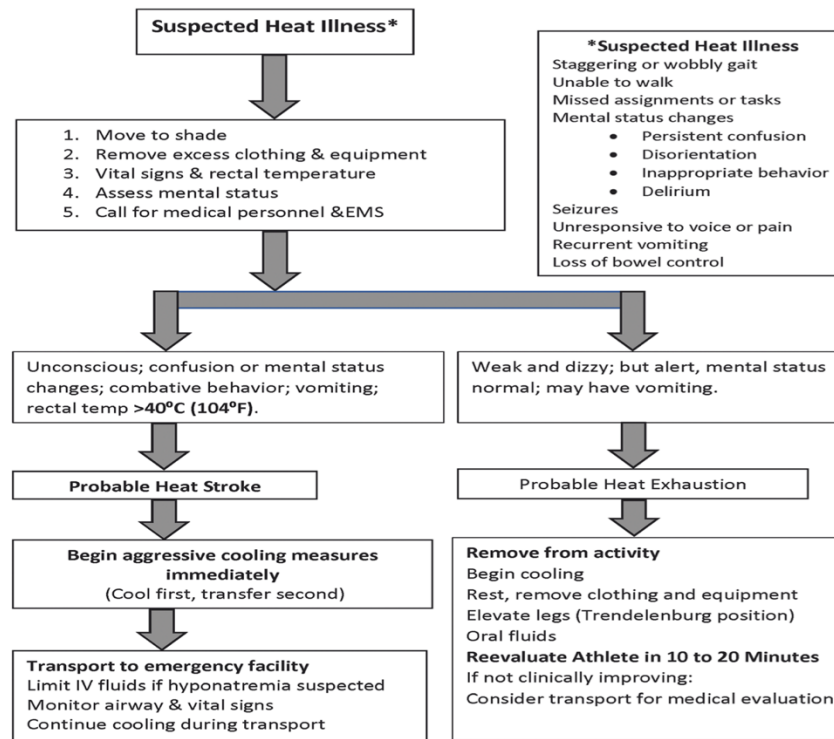
- Eli, a 16-year-old starting linebacker, is known for being tough at practices. He has barely missed a practice all summer prior to this season. He has been taking a stimulant-containing pre-workout supplement so that he could “get amped up for the game today.”
- On a defensive drive, Eli misses an assignment, then stumbles after the play. He appears irritable and pushes away a teammate trying to help him. He walks slowly to the sideline.
- The trainer speaks to him after the play. He is slow to respond to the trainer’s questions.

Exertional Heat Illness is a Spectrum

Condition	Core Temp	CNS Status	On-Site Mgmnt
Exercise Associated Muscle Cramps (EAMCs)	Not tied to temperature	Normal, fully responsive	Rest, stretching, sodium-containing fluids
Heat Syncope	< 39° C (102° F)	Brief fainting/dizziness; rule out cardiac cause	Shade, legs elevated, rehydrate
Heat Exhaustion	Usually < 40.5° C (105° F)	Intact — headache/dizziness only	Remove from heat, cool, oral/IV fluids
Heat Injury	Usually > 40° C (104° F)	No significant CNS dysfunction	Cool; evaluate for organ/tissue injury
Heat Stroke	> 40° C (104° F)	Dysfunction present — confusion to coma	Immediate whole-body cold-water immersion

Source (clickable): [NATA](#), [ACSM Consensus Statement](#)

ACSM Consensus Statement Algorithm



Source (clickable): [ACSM Expert Consensus Statement](#)

Recognition: NATA and ACSM Criteria

Criterion	NATA	ACSM
Diagnosis	CNS dysfunction + core (rectal) temperature $>40.5^{\circ}\text{C}$ (105°F)	CNS dysfunction + core (rectal) temperature $>40^{\circ}\text{C}$ (104°F)
Core Body Temp	- Rectal thermometry is the clinical gold standard and accepted medical standard of practice - Oral, axillary, tympanic, forehead-sticker, and temporal methods are explicitly invalid post-exercise	Rectal temperature is the best field estimate of core temperature Aural canal, oral sublingual, temporal artery, and axilla sites are inaccurate and should not guide decisions
Rectal Unavailable	Do not delay treatment substituting an invalid method — rely on CNS dysfunction and circumstances of collapse	Evaluate collapse circumstances, vital signs, and CNS function; body cooling should still take priority
CNS Signs	- Disorientation, confusion, dizziness, loss of balance, irritability, irrational behavior, aggressiveness, seizures, collapse, coma - Skin often hot and wet (vs. dry skin in classic, non-exertional heat stroke)	Continuum: mild personality change → confusion → delirium → stupor → unconsciousness May include severe agitation, psychosis, ataxia, stool incontinence, recurrent vomiting, or seizure

Source (clickable): [NATA Position Statement](#) | [ACSM Expert Consensus Statement](#)

Wet Bulb Globe Temperature (WBGT) as Measure of “Heat Stress”

- WBGT: these are heat stress monitors that combine air temperature, humidity, radiant solar heat, and wind speed into a single index.

$$\text{WBGT} = 0.7T_w + 0.2T_g + 0.1T_d$$

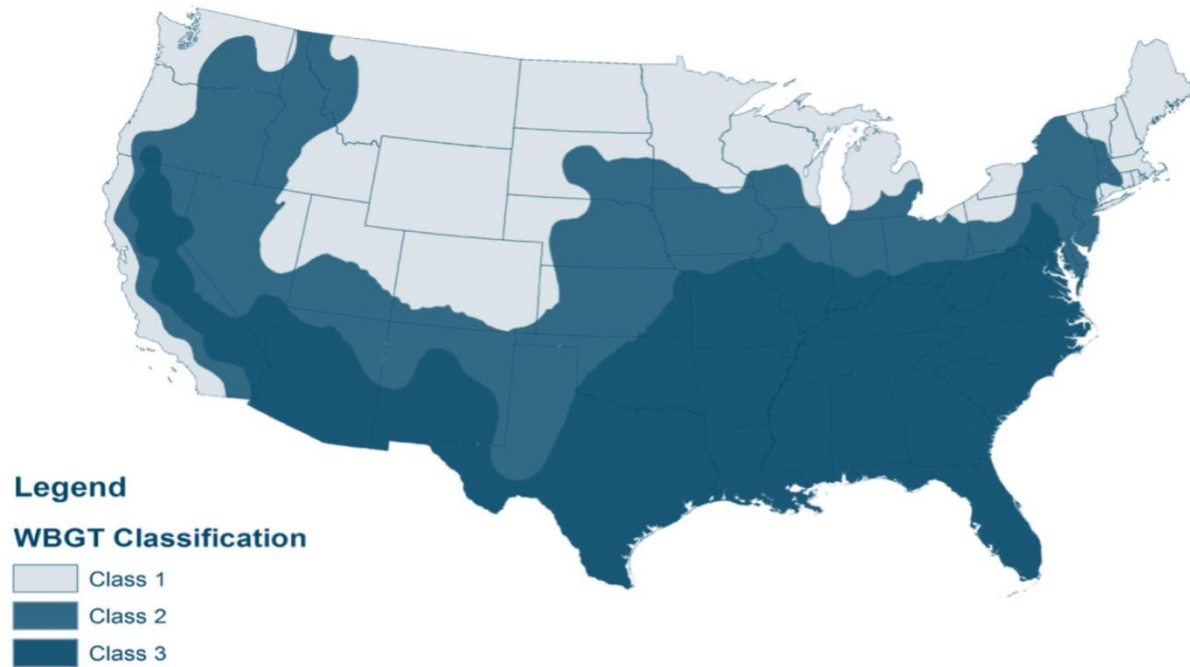
T_w is the wet bulb temperature, which indicates humidity

T_g is the globe temperature, which indicates radiant heat

T_d is the ambient air (dry) temperature

- Several brands/ types
- Some types monitor heat stress but also real-time weather and lightning

Athletic Heat Stress Zones in the US



Source (clickable): [Heat Stress Zones Article](#)

More Exposure to Heat = Generally Better Acclimitization and Higher Practice Thresholds

Cat 1 WBGT (F)	Cat 2 WBGT (F)	Cat 3 WBGT (F)	Activity Guidelines
< 76.1	< 79.7	< 82.2	Normal Activities – Provide at least three separate rest breaks each hour with a minimum duration of 3 min each during the workout.
76.2- 81.1	79.8 - 84.6	82.3 - 87.0	Use discretion for intense or prolonged exercise; Provide at least three separate rest breaks each hour with a minimum duration of 4 min each.
81.2 - 84.1	84.7- 87.6	87.1 - 90.0	Maximum practice time is 2 h. <u>For Football</u> : players are restricted to helmet, shoulder pads, and shorts during practice. If the WBGT rises to this level during practice, players may continue to work out wearing football pants without changing to shorts. <u>For All Sports</u> : Provide at least four separate rest breaks each hour with a minimum duration of 4 min each.
84.2 - <u>86.0</u>	87.7 - 89.6	90.1 - 92.0	Maximum practice time is 1 h. <u>For Football</u> : No protective equipment may be worn during practice, and there may be no conditioning activities. <u>For All Sports</u> : There must be 20 min of rest breaks distributed throughout the hour of practice.
≥ 86.1	≥ 89.7	≥ 92.1	No outdoor workouts. Delay practice until a cooler WBGT is reached.

Source (clickable): [Heat Stress Zones Article](#)

Acclimitization Guidelines: FHSAA All Sports

- First 7 days of participation, athlete should not do more than one practice per day (no “two a days”).
- Practices do not exceed 3 hours. Practices do not occur on same day of a game.
- A walk-through is permitted during Days 1 – 6 of the acclimatization period. However, a one-hour recovery period is required between the end of practice and the start of the walk-through or vice-versa.

Source (clickable): [FHSAA Handbook](#) (see Policy 41)

Acclimitization Guidelines: FHSAA Football (as an example)

- First 2 days: helmets only
- Days 3-5: add shoulder pads and shorts with helmets
(First 5 days – no person-to-person contact; contact with dummies/ sleds/ devices permitted).
- Day 6 onward: full gear with body-to-body contact permitted
- First availability for a game would be after completion of the 6 practice sessions as listed above.

Source (clickable): [FHSAA Handbook](#) (see Policy 41)

Prevention: NATA and ACSM Criteria

Strategy/ Domain	NATA	ACSM
Pre-Par Screening	- Physician-supervised pre-par screening before season (Recommendation 1, Grade C) - Structured history: prior EHS/heat exhaustion, hydration habits, sweat rate, recent conditioning, sleep, supplements	- No single mandated screening tool; risk stratifies via a predisposing-factor table (environmental, individual, medication, health, behavioral) - Recommends a "buddy" system to monitor higher-risk individuals
Acclimitization	- Gradual over 7–14 days (Recommendation 2, Grade B); full physiologic adaptation by 10–14 days - Benefits decay within ~3 weeks without maintenance; first 2–3 weeks of preseason carry the highest EHI risk	1–2 weeks recommended to induce most physiologic adaptations - Elite/continuous-activity classification requires ≥12 weeks acclimatized; low-risk fitness threshold is ≥3 weeks
Environmental	- WBGT drives practice/competition modification - WBGT >28° C (82° F) = "very high" — delay, reschedule, or move indoors	Predisposing-factor table used for monitoring rather than a fixed WBGT action chart
Administrative	- Written emergency action plan (EAP); athletic trainer has authority to restrict participation - Notify local EMS/hospital before mass-participation events	- Mandated heat-safety policy and EAP at every activity site - On-site health care delivery team of trained, licensed providers

Source (clickable): [NATA Position Statement](#) | [ACSM Expert Consensus Statement](#)

Rest and Recovery FHSA Guidelines: **Football**

- Beginning Day 8, it is required that the practice schedule not exceed a 2-1-2-1 format - this means that a day consisting of two practices should be followed by a day with only one practice. One walk-through session may be added to a day with a single practice session.
- No practice should exceed 3 hours
- Total practice time in a day cannot exceed 5 hours.
- Weekly practice time should not exceed 24 hours.

Source (clickable): [FHSA Handbook](#) (see Policy 41)

Zachary Martin Act (Florida 2020)

- Codified that all FHSA member schools have EAP guidelines that specify availability of cold-water immersion **before** transport.
- Establishes **requirements** for cooling zones.
- **Requires** annual training for coaches and others.
- **Requires** annual medical eval – even for conditioning and/or training that occurs **outside** of the school year!

Educational Video: https://youtu.be/7F3we21cJ_k

Link to Zachary Martin Act:

<https://img1.wsimg.com/blobby/go/1293e1f4-3806-4d5c-acc4-b945fe8a89f1/downloads/House%20Bill%207011%2001%2029%202020.pdf?ver=1653530753830>

Cold Water immersion Steps: Suspected EHS

https://koreystinger-institute.media.uconn.edu/wp-content/uploads/sites/3814/2024/08/ColdWaterImmersionGuide_ResourceUpdate_8.pdf

- Early recognition
- Activate EMS if not on-site.
- Prepared – staffing/ zones/ practice scenarios/ equipment ready
- Clothing/ probe placement
- Monitoring (vitals, CNS)
- Transport AFTER cooling

What If No Rectal Thermistor? (Using Time As A Guide)

Water Temp	Immersion Time
VERY COLD/ ICE WATER (< 48F or 9C)	11-12 MINUTES
COLD TAP WATER (50-78F or 10-26C)	18-19 MINUTES

Source: <https://pmc.ncbi.nlm.nih.gov/articles/PMC9732943/pdf/fphys-13-1055810.pdf>

What is a Rectal Thermistor?

https://koreystinger-institute.media.uconn.edu/wp-content/uploads/sites/3814/2024/08/RectalProbes_ResourceUpdate_8.19new-GG-1.pdf

- About \$50 per probe – may involve pitching cost to administrators!
- Other methods **not recommended**: oral, infrared, axillary, tympanic, etc)
- Monitor other vitals as well in addition to Trec (HR, BP, RR, CNS) – not Trec as a standalone measure.

Placing the Rectal Thermistor

- Gloves are a great idea! (keep them in your pockets or fanny pack)
- Insert 6-10 inches (15 cm)
- Mark the probe
- Use water-based lubricant
- Maintain privacy
- Tape the probe to the inside of the leg using waterproof tape
- Place athlete on side, drape, lower pants, glove up, lubricate probe, have someone maintain contact with athlete and monitor.
- Education is key – get “buy-in” from athletes/ admins/ parents.
- If probe cannot be placed – do not delay immersion.
- Maintain professionalism.

Cold Water Immersion (CWI): Equipment List

<https://koreystringer-institute.media.uconn.edu/wp-content/uploads/sites/3814/2024/08/KSI-EHS-Emerg-Kit-7.25.19.pdf>

- Wet Bulb Globe Temperature (WBGT) Device
- Rectal thermometer
- Lubricating gel
- Tub or “kiddy” pool
- Cooler with ice
- Water source
- 3-4 towels
- Tent for shade

Cold Water Immersion: The Techniques

- Play from 8:50 until 9:55:

<https://youtu.be/lztHtCgjlwBM>

Rectal thermistor placement (on field versus off field), staffing considerations, monitoring of vitals, etc.

Good practice: if ice stays on top – it is a good temperature – but better to monitor with functional pool thermometer (35-59 degrees). Circulate the water consistently!

Ingestible Thermometers

- Show promise- but not part of current recommendations
- Provide good insight *as athlete continues sport* – but not as efficient in providing core temp during cooling specifically
- 50-100\$ per capsule (cost)
- Depend currently on GI transit times and other factors.

Treatment: NATA and ACSM Criteria

Similarities	Differences
• Rectal temperature is the only field-valid measurement of core temperature • CNS dysfunction is the key diagnostic signal for EHS • Cold/ice-water immersion to the neck, with stirring, is the most effective on-site cooling method • Cooling begins on-site immediately — never delayed for transport or EMS arrival • Return to activity requires medical clearance and normalized lab values before progression • Gradual heat acclimatization (days-to-weeks) reduces EHI risk	• Minor differences in threshold: NATA >40.5°C (105°F) vs. ACSM >40°C (104°F) • NATA covers the full EHI spectrum broadly; ACSM focuses on EHS • NATA rest window is 7–21 days; ACSM specifies ≥7 days plus a named 7-stage RTA ladder • ACSM defines numeric cooling-rate benchmarks (>0.08 / >0.15°C/min); NATA gives a fixed field target (<102°F within 30 min) • ACSM cites a validated heat-tolerance test (IDF protocol) with sensitivity/specificity data; NATA references HTT only as an emerging adjunct • ACSM specifies an explicit 2- to 4-week window to full competition once medically eligible; NATA does not set an equivalent post-clearance heat-exposure timeframe

Source (clickable): [NATA Position Statement](#) | [ACSM Expert Consensus Statement](#)

Promoting an Effective Emergency Action Plan (EAP)

- Collaboration is key!
- Buy-in
- Specificity matters
- Communication and documentation

Medications That Can Increase EHS Risk

- Stimulants (Adderall, Ritalin): these are quite common
- Diuretics
- Anticholinergics (Benadryl)
- Beta-Blockers
- NSAIDS
- SSRIs, SNRIs, TCAs
- ASA, Plavix
- ACEIs, ARBs

Follow-Up Care and RTA/ RTP

ALL of these should be **normal** before starting a return protocol:

- Complete blood count w platelets, serum electrolytes (sodium, potassium, chloride, bicarb), serum calcium and phosphorus, serum glucose, serum creatinine and blood urea nitrogen
- Serum uric acid
- Serum AST, ALT, LDH, alkaline phosphatase, and total bilirubin
- Creatine kinase, myoglobin blood and urine
- Fibrinogen, fibrinogen degradation products
- PT and activated partial thromboplastin
- Serum lactate
- Arterial blood gases

Return to Activity (RTA): NATA and ACSM Criteria

Domain	NATA	ACSM
Rest Period	7-21 days	>7 days; ADLs only for first 2 weeks
Clearance	Asymptomatic, normal renal/hepatic panels, electrolytes and muscle enzymes, plus physician clearance	Weekly medical evaluation until all symptoms, signs, and labs normalize (CBC, electrolytes, CK, myoglobin, coagulation studies, and more)
Activity Progression	General framework, not numbered stages: low → high intensity, temperate environment first, equipment phased in; supervised	Explicit 7-stage protocol (see next slide)
Re-Acclimitization	"Graded progression of heat acclimatization" required concurrently; no fixed week count specified	Gradually increase duration, intensity, and heat exposure over 2 to 4 weeks once medically eligible
Heat Tolerance Testing	clinical adjunct; no standardized protocol endorsed	Optional IDF-model HTT (~6 wk post-EHS); consider if not progressing by 4–6 weeks (sens 66.7%, spec 77.7%)
Time to Full Return	As early as ~1 month with prompt cooling and clearance; delayed treatment (>30 min) risks complications lasting months to years	Full competition typically permitted 2–4 weeks after demonstrating sport-specific heat tolerance; complicated cases take longer

Source (clickable): [NATA Position Statement](#) | [ACSM Expert Consensus Statement](#)

ACSM Stages for RTA

Stage	Focus	Activity	Duration
1. Recovery & Rest	Physician guided organ system based	ADLs only	1-2 weeks; gradual home activity without fatigue
2. Medical Recovery – Reconditioning	Sustain minimal aerobic fitness & confidence	Self-paced comfortable walk, low heat-stress setting	20–60 min at HR <100 bpm (<50% age-max HR)
3. Early Exercise Adaptation	Gradually improve aerobic capability	Walk at 3.5 mph, low heat-stress setting	60 min at HR <140 bpm (<70% age-max HR)
4. Mid Exercise Adaptation	Improve aerobic capability & fitness	Walk/run progression, low heat-stress setting	60 min, increasing run-to-walk ratio to a constant 60-min run
5. Heat Acclimatization	Improve heat-acclimatization status	Run in ambient warm/hot conditions	60 min, progressively increasing to constant 60-min run
6. Sport-Specific Acclimatization	Sport-specific heat acclimatization & fitness	Sport-specific drills → full training/scrimmage	Progressive; trainer/coach-guided
7. Return to Sport	Monitored competition re-entry	Normal game/competition participation	Athletic trainer monitors warm-up and competition

Source (clickable): [ACSM Expert Consensus Statement](#)

Osteopathy in the Cranial Field (OCF) as an Adjunct to CWI

- Studies are currently lacking with OCF and body temperature regulation.
- Hypothesis: can help with ease of cooling and durability?
- Environment is favorable (airway positioning)
- Promote team concept

Becker Cranial Hold



Picture Source: [Becker Cranial Hold Picture](#)

Alternate Frontal Cranial Hold



Picture Source: [Alternate Frontal Cranial Hold](#)

What About the Case Study: “Eli”?

- Diagnosis?
- Treatment Considerations?
- Return to Activity/ Return to Play?

Additional References & Resources

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4. <https://koreystringer.institute.uconn.edu/heat-stroke/>
5. https://www.nata.org/sites/default/files/2025-10/hydration_heat_illness_handout_2025_updated.pdf. (NATA 1-page Infographic).

Contact Information

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