



6 Pillars of Exertional Heat Stroke Prevention

1) Heat Acclimatization

- Heat acclimatization is a series of physiological adaptations that allows the body to better tolerate exercise in the heat and occurs over a period of 10-14 days. This includes a reduction in heart rate and internal body temperature and an increase in sweat rate.
- Athletes should complete a heat acclimatization protocol at the start of exercise in the heat. The duration, intensity and amount of equipment worn during exercise should be gradually increased throughout heat acclimatization.
- For full heat acclimatization adaptations, it is imperative that athletes maintain an appropriate level of hydration.

2) Body Cooling

- Body cooling can be an effective means of decreasing internal body temperature and can be done pre-exercise, during exercise, and post-exercise.
- There are a number of cooling modalities that can be effective in assisting to keep the body cool during exercise in the heat such as cooling vests and cold wet towels.
- Body cooling should be applied during breaks in activity and included in activity modification guidelines.

3) Work-to-Rest Ratios / Environmental Considerations

- Having appropriate work-to-rest ratios (the amount of time spent exercising versus the amount of time spent in recovery) should be modified according to environmental conditions, athletes' fitness levels and exercise novelty.
- Environmental conditions should be measured using a wet-bulb globe temperature (WBGT) device. WBGT takes into account ambient temperature, relative humidity and the radiation from the sun to calculate a more comprehensive measure of the heat stress that the athlete will be experiencing during exercise in the heat.
- Examples of modifications of work-to-rest ratios include increasing the number and duration of rest breaks and reducing the total duration and intensity of physical activity.

4) Hydration

- Maintaining appropriate hydration mitigates increases in internal body temperature during exercise in the heat.
- Evidence shows that during exercise internal body temperature increases by 0.5°F (0.22°C) for every 1% of body mass lost as fluid.
- Athletes are encouraged to minimize fluid losses during exercise. Fluid needs of the individual athlete depend on the athlete's sweat rate. This sweat rate changes for each athlete based upon exercise intensity, environmental conditions (both temperature and humidity) and acclimatization status.
- Athletes should have unrestricted access to fluids during physical activity in the heat.
- Fluid consumption should be based off individual losses. Athletes should not be encouraged to drink fluid in excess.
- Sports drinks may be useful for activities lasting longer than 1 hour (or during heat acclimatization periods, or during days with more than 1 exercise session) where energy and electrolyte replacement are necessary.

5) Sleep

- Partial sleep deprivation increases skin and internal body temperature, sweat rate, thermal unpleasantness during exercise.
- Sleeping 6-8 hours (or more if necessary) in an air-conditioned environment allows for appropriate recovery and preparation for subsequent exercise sessions in the heat.
- Napping during the day after a night of partial sleep deprivation can help to alleviate any thermoregulatory or neurobehavioral deficits associated with sleep deprivation.

6) Education

- Athletes, coaches, parents, athletic trainers, and other medical professionals should all be educated on the proper preventative strategies, signs and symptoms, and treatment of EHS.
- If a healthcare professional is present and EHS is suspected, the patient must be cooled first, and then transport for follow up care.
- If no healthcare professional is present and EHS is suspected, immediately activate emergency medical service (9-1-1) and begin cooling the athlete as aggressively as possible. Whole body cold-water immersion is the gold standard cooling modality.



Three Pillars of Exertional Heat Stroke Survival

1) Recognition

- Exertional heat stroke (EHS) is defined as a body temperature greater than 104°F in addition to signs of central nervous system (CNS) dysfunction (dizziness, collapse, loss of consciousness, confusion, mood changes etc.).
- Any athlete with signs of CNS dysfunction during intense exercise in the heat should be suspected to be suffering from EHS until a rectal temperature confirms or refutes this diagnosis.
- A rectal temperature is the only valid field option to assess internal body temperature in an exercising individual. Aural, oral, tympanic, axillary and forehead measurements have all been shown to be invalid for measuring body temperature in exercising individuals.

2) Treatment

- Cold-water immersion should be used to cool any EHS patient due to its superior cooling capacity.
- To ensure survival, cooling tubs should be set up prior to any event involving exercise in the heat. This works best if tubs are filled with water with ice available nearby. Tubs should be large enough to accommodate the full-immersion of a large individual.
- An individual with EHS should be cooled to 102°F within 30 minutes. If this is followed, future problems and death may be avoided.
- If cooling is available on-site, the individual with EHS should be cooled prior to transportation to a hospital.

3) Return-to-play

- An individual should refrain from exercise for at least 7 days following their EHS, and should schedule an appointment with their primary care physician for a follow-up evaluation within those first 7 days.
- A physician should be immediately contacted if an individual's condition worsens.
- Individuals should not exercise until clearance is obtained from their primary care physician and all lab results (e.g., blood work) are normal.
- Athletes who have sustained an EHS likely had a predisposing factor at the time of their injury. Predisposing factors should be identified and remediated before returning an athlete to activity.
- Once medical clearance has been made, a cautious gradual return to exercise should be followed. At a minimum, the following return to exercise procedure should be implemented:

- 1) Exercise at a low intensity in a cool environment
- 2) Exercise at a higher intensity in a cool environment
- 3) Exercise at a low intensity in a warm environment
- 4) Exercise at a higher intensity in a warm environment

*NOTE: An individual should only proceed to the next step after they are able to successfully complete the previous step. Steps are considered successful if one experiences no issues with performing the given exercise, or no symptoms (see below)

- Throughout the recovery process, one should monitor for residual signs and symptoms of EHS, which include: inability to tolerate heat, difficulty concentrating, dehydration (dark urine), muscle soreness, difficulty sleeping, increased heart rate, lethargy, headache, and/or amnesia.
- Report to the hospital if one observes: chest pain/tightness, blood in the urine/stool, severe muscle pain, numbness, severe abdominal pain/pain with bowel movements, and/or any abnormal physical signs and symptoms that warrant medical attention.
- If difficulty exercising in the heat persists, heat tolerance testing may be warranted.

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