

PUBLIC HEALTH REFERENCE SHEET

Heat Illness



Name	Exertional heat illness, heat stroke (reportable), heat exhaustion (reportable)
Reservoir & Transmission	N/A
Incubation Period	Depending on ambient temperature, illness can occur within minutes
Common Symptoms	High temperature, red/hot/dry skin, dizziness; further symptoms depend on heat illness type
Gold Standard Diagnostic Test	N/A, though measurement of core body temperature can help determine between heat stroke and heat exhaustion
Risk Groups	Those who have previously experienced heat illness, poor fitness, current illness; those with chronic health conditions; those taking certain medications; young children (age 0–4); older adults (age 65+); pregnant women; and individuals working or participating in activities outdoors
Geographic Significance	Most frequently in regions with high temperatures (including low and high humidity) and excessive sunlight, though exertional heat illness can happen in any geographic location

What is heat illness?

Heat illness encompasses a spectrum of acute conditions associated with exertion or heat exposure. Exertional heat illness comprises heat exhaustion (HE), exertional heat injury (EHI), and exertional heat stroke (EHS). The descriptor “exertional” differentiates the form of heat illness experienced by physically active persons who are producing substantial metabolic heat loads (common among military personnel and athletes) from the “classical” form that occurs in vulnerable populations passively exposed to heat (young children, elderly persons, those without drinking water, or those with impaired thermoregulation due to illness or medication).

HE is the most common form of exertional heat illness without significant organ injury; however, it is a reportable medical event. It occurs when the body cannot sustain the level of cardiac output necessary to meet the combined demands of increased skin blood flow for heat dissipation as well as blood flow for the metabolic requirements of exercising skeletal muscle and vital organs. Contributing factors include dehydration-mediated drop in circulating volume, blood pooling in dilated blood vessels in the skin, and failure of vessels in the abdominal organs to maintain pressure, which together limit venous return. Service members who experience multiple episodes of HE may be placed on profiles, and/or require referral for evaluation regarding standards of medical fitness. Service healthcare professionals (HCPs) should consult current Service-specific guidance on heat illness profiling and medical fitness.

Exertional heat injury (EHI) is intermediate in severity between heat exhaustion and exertional heat stroke. Individuals with EHI will initially have clinical evidence of damage to a vital organ. The symptoms of EHI will improve slowly with cessation of exertion and cooling measures. Service members diagnosed with EHI may be placed on profiles, and/or require referral for evaluation regarding standards of medical fitness. Service HCPs should consult current Service-specific guidance on heat illness profiling and medical fitness.

Exertional heat stroke (EHS) is a serious and reportable life-threatening condition characterized by profound central nervous system (CNS) dysfunction (for example, delirium, agitation, inappropriate aggressiveness, convulsions, or coma) in the presence of severe hyperthermia.

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EHS involves multi-organ (heart, stomach and bowel, liver, kidneys, and skeletal muscle) damage that manifests across a varied time course, which depends on the magnitude and duration of elevated body core temperature (usually measured rectally) of greater than (>) 104 degrees Fahrenheit (°F). However, the temperature does not necessarily correspond with the amount of damage, and EHS should not be excluded if the temperature is not > 104 °F. The recovery period for an EHS casualty can vary greatly. An EHS casualty is placed on an initial profile for a minimum period of 2 weeks and is reevaluated weekly to determine need for further profiling, or a referral is made to a medical evaluation board.

How is heat illness transmitted?

Heat illness isn't "transmitted" like an infectious disease. It arises from individual exposure to excessive heat, often combined with exertion. People suffer heat-related illness when the body's temperature control system is overloaded. The body normally cools itself by sweating. But under some conditions, sweating isn't enough to release body heat. In such cases, a person's body temperature can rise quickly and dangerously. Very high body temperatures (>103°F or >39°C) may damage the brain and/or other vital organs. Heat illnesses can be life threatening and require immediate treatment to prevent death or permanent disability.

Who is at risk for heat illness?

Those at greatest risk for heat-related illness include infants and children up to 4 years of age; people 65 years of age and older; people who are overweight; people who are ill; people who have chronic health conditions; or people taking certain medications. However, anyone can be impacted by heat illness. Individual and environmental factors that adversely influence thermoregulation can increase the risk of an exertional heat illness as listed in the table below, published in the Headquarters, Department of the Army, Technical Bulletin, Medical (TB MED) 507, *Heat Stress Control and Heat Casualty Management*, 12 April 2022.

https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN35159-TB_MED_507-000-WEB-1.pdf

The risk for heat-related illness and death may increase among people using the certain drugs; a complete list of these drugs is available at

https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN35159-TB_MED_507-000-WEB-1.pdf.

What are the signs and symptoms of heat illness?

Signs and symptoms of HE are nonspecific and typically include undue fatigue, transient ataxia (slurred speech, stumbling, falling, incoordination), dizziness, headache, nausea, vomiting, malaise, tachycardia (rapid heart rate), hyperventilation, and transient mildly impaired cognition. Sweating persists and may even be profuse. Blood pressure may be normal to mildly decreased, and there may be an element of orthostasis. The diagnosis of HE versus severe exertional heat illness is important due to the difference in treatment and prognosis. Treatment should entail cessation of exertion, removal from heat stress, and expeditious cooling to prevent progression to severe heat illness. The skin may be cool and moist. The pulse rate will be fast and weak, and breathing will be fast and shallow. If heat exhaustion is untreated, it may progress to heat stroke.

Signs and symptoms of EHS may vary but may include red, hot, and dry skin (no sweating), nausea or vomiting, and elevated core body temperature with CNS dysfunction such as change in mental status, confusion, slurred speech, delirium, stupor, coma, or seizures. It might also be accompanied by organ/tissue damage and systemic inflammatory activation.

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What are possible complications from heat illness?

Complications can range from organ and tissue damage to systemic inflammatory activation and disseminated intravascular coagulation.

How is heat illness diagnosed?

- Heat Exhaustion: Clinical presentation during or after exertion or heat exposure with core body temperature between 100.5°F (38°C) and 104°F (40°C).
- Heat Stroke: Clinical presentation during or after exertion or heat exposure with core body temperature \geq 104°F (40°C), combined with CNS dysfunction.

A consistent definition to the type and diagnosis of exertional heat illness is critical to the safe disposition, profiling, prevention of further injury, and the prognosis of the Service member. All medical personnel must familiarize with and be able to differentiate the types of exertional heat illness according to AR 40–501. Service members admitted to the hospital with EHI or EHS will have an eProfile up to the maximal time required for recovery documented prior to discharge. See AR 40–501, Table 3–2 for details on profiling for HE, EHI, and EHS with or without sequelae.

How is heat illness treated?

For heat exhaustion, rapid resolution is often seen with minimal cooling intervention. The first line of treatment for victims of heat stroke is cooling; thus, immediate and aggressive cooling, along with medical interventions for complications, may be required.

The following can be used as cooling measures:

- Get the victim to a shady area.
- Remove excess clothing.
- Cool the victim rapidly, using any available means. For example, immerse the victim in a tub of cold or ice water; wrap the victim in a cold, wet sheet (i.e., ice sheet).
- In addition to early rapid and effective cooling, the clinician should activate the EMS, administer IV fluids, provide supplemental oxygen (if available), and communicate with the receiving Military Treatment Facility (MTF). The receiving emergency department physicians should be alerted to the possibility of explosive rhabdomyolysis and possible grave metabolic consequences. Treatment will include immediate hospital transfer for aggressive fluid and electrolyte management, as well as cardiac monitoring.
- Refer to the link below for the field treatment of heat casualties.
https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN35159-TB_MED_507-000-WEB-1.pdf

How can heat illness be prevented?

The body normally rids itself of heat through the skin, constituting heat relief. Some heat is lost by radiation and convection (movement of air) from the skin, but the body relies mostly on evaporation of sweat from the skin to cool itself. The adverse impact of high environmental temperature can be reduced by—

- Acclimatization to the heat over time. A Service member can take up to 21 days to adapt to an increased heat and humidity environment, with regular exposure to heat and strenuous exercise. Factors to consider in acclimatizing Service members are the Wet Bulb Globe Temperature (WBGT) index work rates and duration; uniform and equipment; and Service members' physical and mental conditions.
- Adequate hydration. See tables below for fluid replacement guidelines.
- Regular breaks in shade or cool environments.

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- Wearing appropriate clothing and use sun protection. Service members need to maintain their supply of sunscreen and lip balm, apply it approximately 30 minutes before sun exposure, and reapply at least every 2 hours throughout the day.
- Avoiding strenuous activities during peak heat hours.
- Electric fans may provide comfort, but when the temperature is in the high 90s, fans will not prevent heat-related illness. Taking a cool shower or bath or moving to an air-conditioned place is a more effective way to cool off. Air conditioning is the strongest protective factor against heat-related illness.
- The WBGT is an effective measure for assessing the risk of heat-related illnesses. Monitoring WBGT can help in setting guidelines for activities during hot conditions.

What are some public health considerations?

Surveillance, recordkeeping, and reporting.

- Surveillance is the cornerstone to the public health approach to exertional heat illness prevention because an understanding of the presence and magnitude of a problem is necessary before any of the other steps can be implemented. Surveillance includes heightened provider and leadership awareness of cases meeting the exertional heat illness criteria and vigilance in recordkeeping and disease reporting through the installation public health department or, in an operational or training setting, preventive medicine units, through appropriate channels to the Armed Forces Health Surveillance Branch. Only through data-based-policy and decision-making can exertional heat illness and its serious complications be minimized.
- Recordkeeping provides data for DoD and the Army. Safety and medical documentation of a heat illness event should include the following circumstances under which the exertional heat illness occurred and the time course of clinical symptoms and signs:
 - Training activities at the time of the exertional heat illness event
 - Personal risk factors in the training population
 - Weather conditions
 - Amount and timing of exercise
 - Adherence to work-rest cycles and fluid consumption
 - Clothing and gear involved
 - Medications (prescriptions and over-the-counter) taken in the days preceding the event
 - Nutritional supplement use taken in the days preceding the event

When combined with active monitoring of outcomes and all exercise-related deaths, a more thorough understanding of trends and potential areas for programmatic interventions to reduce morbidity and mortality can be gained at tactical, operational, and strategic levels.

- Reporting instructions include the following:
 - EHIs occurring in deployed settings will be reported according to applicable combatant command/unit level policy to include safety channels (Mishap Reporting) and Disease Reporting System internet (DRSi).
 - Non-deployed units should coordinate with the installation public health department, examining provider, MTF, and command safety to ensure that heat illnesses diagnosed at any level/location are reported. National Guard and Reserve units with or without preventive medicine personnel should report heat illnesses through command channels and command safety through the USACRC.

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- All heat illnesses meeting the case definition outlined by the Armed Forces Reportable Medical Events Guidelines and Case Definitions should be entered into the DRSi.

References:

Defense Health Agency. 2022. *Armed Forces Reportable Medical Events Guidelines and Case Definitions*.

<https://www.health.mil/Reference-Center/Publications/2022/11/01/Armed-Forces-Reportable-Medical-Events-Guidelines>

“Heat Illness Prevention & Sun Safety,” Defense Centers for Public Health – Aberdeen, last reviewed August 17, 2023.

<https://ph.health.mil/topics/discond/hipss/Pages/default.aspx>

Department of the Army. 2022. Technical Bulletin, Medical (TB MED) 507, *Heat Stress Control and Heat Casualty Management*.

https://armypubs.army.mil/epubs/DR_pubs/DR_a/ARN35159-TB_MED_507-000-WEB-1.pdf

“Heat Stress – Heat related illness,” Centers for Disease Control and Prevention (CDC), last reviewed May 31, 2022.

<https://www.cdc.gov/niosh/topics/heatstress/default.html>

Heymann, David L. ed. 2022. *Control of Communicable Diseases Manual*. 21st Edition. Washington DC: APHA Press.

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