

Guidelines for Return to Duty (Play) After Heat Illness: A Military Perspective

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Since Biblical times, heat injuries have been a major focus of military medical personnel. Heat illness accounts for considerable morbidity during recruit training and remains a common cause of preventable nontraumatic exertional death in the United States military. This brief report describes current regulations used by Army, Air Force, and Navy medical personnel to return active duty warfighters who are affected by a heat illness back to full duty. In addition, a description of the profile system used in evaluating the different body systems, and how it relates to military return to duty, are detailed. Current guidelines require clinical resolution, as well as a profile that protects a soldier through repeated heat cycles, prior to returning to full duty. The Israeli Defense Force, in contrast, incorporates a heat tolerance test to return to duty those soldiers afflicted by heat stroke, which is briefly described. Future directions for U.S. military medicine are discussed.

Heat injuries have been a major focus of military medical providers and commanders for centuries, as successful prevention and treatment have often meant the difference between success and failure on the battlefield. The Bible, references to ancient battles, data from World War II, as well as the current involvement in the Middle East, all highlight the tremendous morbidity and mortality associated with exertional heat illness. Heat illness has also been a major problem during peacetime with considerable morbidity during recruit training. Heat stroke remains a common cause of preventable nontraumatic exertional death in the United States military.^{1,2}

The United States military has been very proactive in the prevention, identification, and management of exertional heat illness. As such, multiple guidelines to affect prevention and treatment with a strong command emphasis have been developed.^{2,3} This brief report will describe and discuss the current guidelines used by Army, Air Force, and Navy medical personnel to return active duty soldiers, airman, sailors, and marines afflicted by a heat illness back to a full duty status.

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Epidemiology of the Problem

Historically, heat-related injuries have been significant threats to the health and operational effectiveness of service members and their units. The U.S. military has developed doctrine, equipment, and training methods that reflect decades of operational lessons learned and results from numerous research studies; however, physical exertion in hot environments still precipitates heat casualties in soldiers, which may occasionally be fatal.

The Medical Surveillance Monthly Report (MSMR) is the Army Medical Surveillance Activity's (AMSA) principal vehicle for disseminating medical surveillance data and reports. Each year, the MSMR summarizes the heat injury experiences of active duty soldiers during the prior year. During 2002, 1816 heat-related injuries were reported among active duty soldiers, with a crude incidence rate of 3.8 per 1000 person-years (p-yrs). In general, heat injury rates declined with increasing age such that crude rates were more than 10 times higher among soldiers less than 20 as compared to those older than 39 years old. Rates declined among males in a linear fashion over the entire age range (Figure 1). Rates among females also fell from a peak for <20 year olds to a sharp decline with increasing age. Although a sharp drop was noted for women between 20 and 24 years, no explanation for this can be offered.⁴

The rate of heat injuries in 2002 was the highest annual rate over the preceding five years (Figure 2). The relatively high overall rate in 2002 was attributable primarily to an increase in the number of ambulatory visits, which led to an increased number of cases being reported. Of note, the rate of hospitalizations for heat injuries in 2002 was similar to rates for the prior four years (and slightly lower than the rate in 2001; Figure 2). Whatever the explanation(s) for increasing rates, exertional heat illness is a clear and significant threat to the health and operational effectiveness of warfighters.⁴

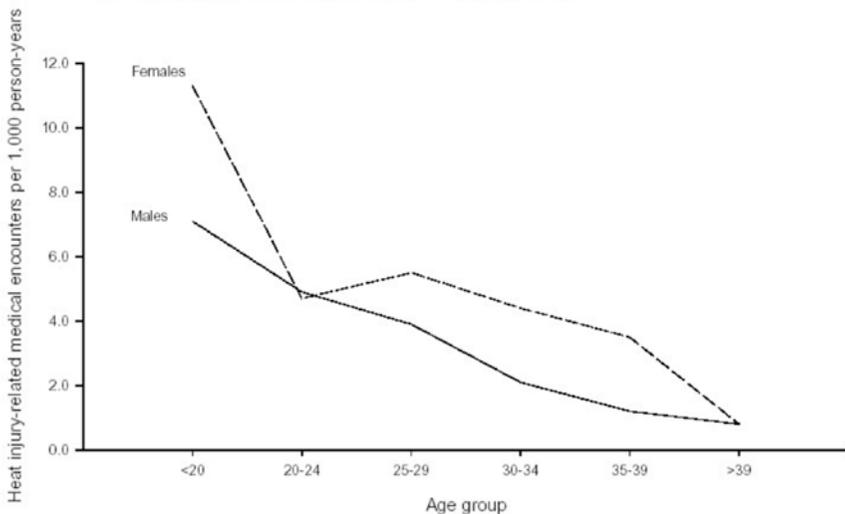


Figure 1 — Rate of medical encounters with heat injury-related diagnoses, by age and gender, active duty. U.S. Army, 2002. Reproduced with permission from MSMR.

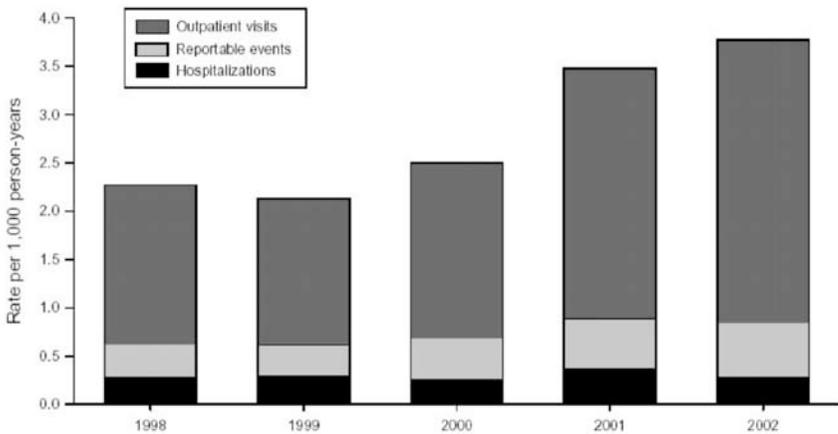


Figure 2 — Rate of heat-associated injuries, by source of report and year of diagnosis, active duty. U.S. Army, 1998-2002. Reproduced with permission from MSMR.

Background

To understand how the military approaches return-to-duty for soldiers, airmen, sailors, and marines after a heat injury, some background information warrants review. The military uses a system of regulations to govern the suitability of individuals for military service. Army physicians must refer to medical fitness standards provided in Army Regulation (AR) 40-501.³ This regulation lists various medical conditions and physical defects that may render a soldier unfit, details how to appropriately “profile” or restrict a soldier, and specifies when a soldier should be referred to a formal medical hearing or board to determine fitness for further duty.

A physical profile is a serial system used by the military to evaluate the different body systems and how they relate to military duties. Because the analysis of the individual’s medical, physical, and mental status is important in future assignments and welfare, the functional grading must be executed with great care.

The purpose of the physical profile is to provide an index of overall functional capacity. The functions of the individual are evaluated under six different areas known as “P-U-L-H-E-S.” The “P” is for physical capacity or stamina, “U” is for the upper extremities, “L” is for the lower extremities, “H” is hearing and ears, “E” is for eyes, and “S” is for psychiatric functioning. Table 1 presents the numeric values assigned for quantifying the ability to function in these areas. A lower functional capacity is designated by a higher number and can be temporary or permanent. Table 2 presents a guideline for each of the six different areas and the level of functional capacity. For example, a healthy soldier would have a 1 for each of the six areas. A heat stroke victim may be assigned a temporary 3 [T-3] in the “P” or physical capacity category, eg, P-[T-3]. The numeric designator is not an automatic indicator of “deployability” or assignment restrictions, nor does it indicate an immediate referral to a Medical Evaluation Board (MEB) and then possibly a Physical Evaluation Board (PEB). Rather it is a subjective indicator of functional capacity.

Table 1 Categorization of Functional Capacity

Characteristics	Score
A high level of medical fitness	1
A medical condition or physical defect that may require some activity limitations	2
One or more medical conditions or physical defects that may require significant limitations	3
One or more medical conditions or physical defects of such severity that performance of military duty must be drastically limited	4

The conditions or defects requiring an MEB/PEB are listed in AR 40-501 Chapter 3 (Medical Fitness Standards for Retention and Separation, Including Retirement). The MEB is an informal proceeding wherein at least two physicians evaluate the medical history of a soldier and determine how the injury/disease will respond to treatment protocols. The physician uses the MEB process to construct a detailed narrative summary of the soldier's condition and prognosis, which will be forwarded to the PEB. The PEB is a formal hearing process where the soldier's condition is discussed and evaluated so that a final determination can be made concerning retention, transition to another military specialty, or separation from the service with disability.

Heat exhaustion is defined in AR 40-501 as collapse, including syncope, during or immediately following exercise—heat stress, without evidence of organ damage or systemic inflammatory activation. Individual episodes of heat exhaustion are not cause for MEB referral; however, soldiers suffering from recurrent episodes of heat exhaustion (three or more in less than 24 months) should be referred for complete medical evaluation to determine contributing factors. If no remediable factor can be identified for causing recurrent heat exhaustion, the soldier will be referred to an MEB.

Heat stroke is defined in AR 40-501 as a syndrome of hyperpyrexia, collapse, and encephalopathy, with evidence of organ damage and/or systemic inflammatory activation, which occurs in the setting of environmental heat stress. Heat stroke is an automatic MEB referral.

U.S. Army and Air Force Return to Duty After a Heat Injury

As clearly stated in AR-40-501, all soldiers are referred to a MEB after an episode of heat stroke to determine when and if they can return to duty (Figure 3). If the soldier/airman fully recovers clinically, which is determined by normalization of labs (electrolytes, creatinine, creatine kinase, liver function tests) and normal mental status, or if a circumstantial contributing factor to the episode can be identified, the MEB may recommend a trial of duty with a P-[T-3] profile, which restricts the soldier/airman from performing vigorous physical exercise for periods longer than 15 minutes. Maximal efforts, such as the Army Physical Fitness Test (APFT) two-mile run are not permitted. If the soldier/airman has not exhibited any heat

intolerance after three months, the profile may be modified to P-[T-2] wherein normal, unrestricted work is permitted; however, maximal exertion and significant heat exposure, such as wearing Mission Oriented Protective Posture (MOPP) IV, are still restricted. If no further heat intolerance is manifest, particularly during a season of significant environmental heat stress (working in the spring, summer, and fall exposed to the heat or in a vehicles/building with an increased heat index), the soldier may resume normal activities and return to duty without a PEB. Any evidence of significant heat intolerance during the period of restriction, or subsequent to resumption of normal duty, requires a referral to a PEB.³

These general guidelines are for return to duty after a heat injury, but some units have their own specific guidelines. The following is an example at Womack Army Medical Center in North Carolina, home of the 82nd Airborne.⁵ Their guidelines state two groups of patients will generally exist, although categorization is sometimes unclear: Group A is Mild Exertional Heat Illness and defined as heat exhaustion, exertional dehydration, heat cramps, potential hyponatremia. Group B is designated as having Severe Exertional Heat Illness (defined as heat stroke) or Rhabdomyolysis. Group A patients are usually alert, with appropriate behaviors, near normal and rapidly stabilizing vital signs, and able to drink fluids. Such patients may receive care outside of the hospital. However, upon realization that the patient might not fully recover within one hour, evacuation to an emergency department should be quickly arranged without further delay. Group A patients may progress to group B if they are not identified as having heat exhaustion. Transitioning to group B can occur rapidly with little advanced warning and can lead to inadequate treatment of these patients.

Patients categorized as group B typically present with a history of mental status changes or amnesia, a history of syncope or seizure, unable to drink fluids, rectal temp $>104^{\circ}\text{F}$, systolic BP <90 or orthostatic symptoms, and/or severe muscle or abdominal pain (or numbness). Treatments, which include rapid cooling (preferably with ice bath), must be aggressive for those who transition to group B. This group will require laboratory evaluation, follow-up the next day, and profiling P-[T-4]. All group B patients will be evaluated in an emergency department, with immediate treatment beginning before and continuing into evacuation.

Mildly ill patients who appear to be fully recovered in the emergency department and have no laboratory abnormalities may return to light duty the next day and limited duty the following day; however, important deficits are sometimes subtle or delayed, and the patient should be carefully observed. Strenuous exercise (eg, APFT, airborne operations, road marching) should be avoided for several days. Patients not fully recovered and those with laboratory abnormalities will require follow-up by a residency-trained physician and a laboratory evaluation on the following day. They should also be referred to preventive medicine for reporting and MEB referral if necessary.

Seriously ill patients require hospitalization. This will generally include those with delirium, obtundation, coma, persistent altered mental status, shock, persistent electrolyte abnormalities, creatinine (Cr) >2.0 (milligrams per deciliter, mg/dL) or creatine kinase (CK) $>4,000$ U/L, and abnormal liver function tests (Aspartate aminotransferase-AST, Alanine transaminase-ALT). As with mildly ill patients, seriously ill patients should be referred to preventive medicine for reporting, following-up of laboratory review, and MEB referral upon hospital discharge.

Table 2 Guide for Physical Profile Functional Capacity

Profile	P	U	L	H	E	S
Serial	Physical Capacity	Upper Extremities	Lower Extremities	Hearing—Ears	Vision—Eyes	Psychiatric
Factors to be considered.	Organic defects, strength, stamina, agility, energy, muscular coordination, function, and similar factors.	Strength, range of motion, and general efficiency of upper arm, shoulder girdle, and upper back, including cervical and thoracic vertebrae.	Strength, range of movement, and efficiency of feet, legs, lower back, and pelvic girdle.	Auditory sensitivity and organic disease of the ears.	Visual acuity and organic disease of the eyes and lids.	Type severity, and duration of the psychiatric symptoms or disorder existing at the time the profile is determined. Amount of external precipitating stress. Predisposition as determined by the basic personality makeup, intelligence, performance, and history of past psychiatric disorder impairment of functional capacity.
1	Good muscular development with ability to perform maximum effort for indefinite periods.	No loss of digits or limitation of motion; no demonstrable abnormality; able to do hand-to-hand fighting.	No loss of digits or limitation of motion; no demonstrable abnormality; able to perform long marches, stand over long periods, run.	Audiometer average level for each ear not >25 dB at 500, 1000, 2000 Hz with no individual level >30 dB. Not >45 dB at 4000 Hz.	Uncorrected visual acuity 20/200 correctable to 20/20, in each eye.	No psychiatric pathology. May have history of a transient personality disorder.

2	Able to perform maximum effort over long periods.	Slightly limited mobility of joints, muscular weakness, or other musculo-skeletal defects that do not prevent hand-to-hand fighting and do not disqualify for prolonged effort.	Slightly limited mobility of joints, muscular weakness, or other musculo-skeletal defects that do not prevent moderate marching, climbing, timed walking, or prolonged effort.	Audiometer average level for each ear at 500, 1000, 2000 Hz, or not >30 dB, with no individual level >35 dB at these frequencies, and level not >55 dB at 4000 Hz; or audiometer level 30 dB at 500 Hz, 25 dB at 1000 and 2000 Hz, and 35 dB at 4000 Hz in better ear. (Poorer ear may be deaf.)	Distant visual acuity correctable to not worse than 20/40 and 20/70, or 20/30 and 20/100, or 20/20 and 20/400.	May have history of recovery from an acute psychotic reaction due to external or toxic causes unrelated to alcohol or drug addiction.
3	Unable to perform full effort except for brief or moderate periods.	Defects or impairment that require significant restriction of use.	Defects or impairments that require significant restriction of use.	Speech reception threshold in best ear not >30 dB HL; measured with or without hearing aid or acute or chronic ear disease.	Uncorrected distant visual acuity of an degree that is correctable to not <20/40 in better eye.	Satisfactory remission from an acute psychotic or neurotic episode that permits utilization under specific conditions (assignment when outpatient psychiatric treatment is available or certain duties can be avoided).
4	Functional level < P3.	Functional level < U3.	Functional level < L3.	Functional level < H3.	Visual acuity < E3.	Does not meet S3 above.

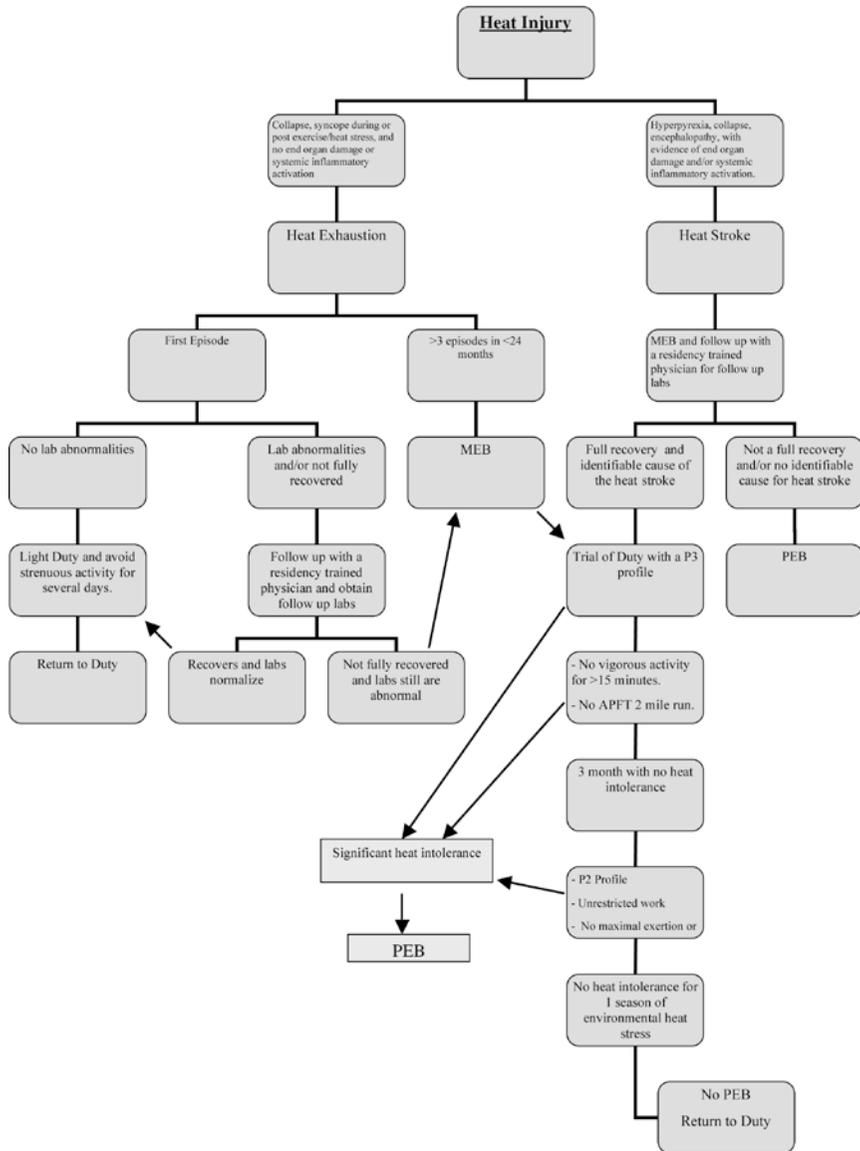


Figure 3 — Return-to-duty flow chart per AR 40-501.

All patients should remain on P-[T-4] profile, in quarters (where the soldier is staying), or convalescent leave (sick days) until all symptoms and laboratory tests have returned to normal (eg, CK <700 U/L, Cr <1.4 mg/dL). Also, a preventive medicine clinic must clear the patient (for reportable cases). When fully recovered,

the patient may gradually resume exercise at his/her own pace and build up to maximal exercise over several weeks.

A diagnosis of heat exhaustion or exertional dehydration must be reported if medical intervention is required or when there is more than four hours of lost duty time. Heat stroke patients (most of group B) must be reported and referred to an MEB. The return to duty guidelines at Womack Army Medical Center for heat exhaustion/heat stroke follow the AR 40-501 guidelines as stated earlier.

U.S. Navy and Marine Corps Return to Duty After Exertional Heat Injury (EHI)

U.S. Navy physicians, who care for marine and sailor warrior athletes, are guided by the Secretary of the Navy Instruction (SECNAVINST 1850.4E) of 30 April 2002, which covers medical conditions that result in referral to the Physical Evaluation Board (PEB). The PEB consists of physicians and non-physicians who consider each case based on medical and nonmedical input. Further, they determine if a given sailor is fit to continue Naval service or not. If a sailor is not fit, they are discharged from service with or without disability benefits. A specific “cause for PEB” diagnosis does not automatically determine a sailor is unfit, and an appeal is possible. Furthermore, the presence of a condition alone is not sufficient criteria for submitting a medical report to a PEB. War fighters who are not fit for full duty may be granted up to 90 days of light/limited duty 30 days at a time with a clinician’s hand written form. A typed abbreviated medical board may be used for limited duty up to 12 more months written 6 months at a time. If more limited duty is required, an additional 6 month (21 months total) dictated medical board is required. Physicians must document how a warrior’s ability to perform duties is impaired. SECNAVINST 1850.4E lists heat injury as a cause for referral to a PEB and states:

Heat Injury

1. Recurrent Heat Exhaustion. Manifested by collapse, including syncope, sometimes mild mental status changes, no end organ damage or serious lab abnormalities. Occurring during or immediately following exercise or in an environment of increased heat. Must occur at least 3 or more times in 24 months. No complicating factor can be identified.
2. Heat Stroke. Hyperpyrexia (core temperature >106 degrees Fahrenheit), collapse, encephalopathy, severe mental status changes, and end organ damage and/or systemic inflammatory activation during the episode. In the absence of encephalopathy, exertional rhabdomyolysis and myoglobinuria are sufficient. A trial of duty may be recommended if complicating factors have been identified and there are no residuals.

That said, U.S. Navy physicians consider each case individually and commonly use the following functional definitions under the general “EHI” term:

1. Heat Exhaustion (HE): Exerting and can’t go on, may be confused;
2. Heat Stroke (HS): Not strictly defined by T >104°F (40°C); exerting and symptoms of HE and evidence of end organ damage exist such as mental status change or marked laboratory study abnormalities.

The exact diagnosis is often unknown until labs are reviewed. In general, all EHI patients are on limited duty (no exertion) the day of the EHI episode and the following clinical follow-up day. Symptom-free warriors with normal exams and “normal” heat panel laboratories may return to full duty once they are motivated to do so. Heat panel laboratories evaluate blood counts, chemistries, liver function tests (LFT’s), urine parameters, and CK. Additional labs or studies may be indicated in a specific case. CK levels are considered normal if <1000 IU/L in warrior athletes who have undergone strenuous exertion. All other clinical laboratory values must return to their normal reference values. It is important to note that LFTs often limit return to duty. Most EHI warriors, including those who suffered heat stroke, return to full duty between two days (rare) and two to three weeks (more common) with individualized and general guidance on EHI risk and prevention. A warrior athlete is usually allowed two heat strokes before being considered for discharge from service. Heat exhaustion is rarely, if ever, a reason for discharge or physical evaluation board.

Future Direction

Although a single episode of heat exhaustion is not cause for reporting to the medical evaluation board (MEB), warfighters who suffer from recurrent episodes of heat exhaustion (three or more in less than 24 months), or an episode of heat stroke, are referred for complete medical evaluation to ascertain contributing factors. Soldiers can be profiled for up to 15 months and may be referred to an MEB. If a Nary/Marine warfighter does not return to normal or has a recurrence, he/she can be on LIMDU for up to 12 months and then referred for a PEB. With the current operational tempo for military members, large numbers of soldiers on profile for heat illness can significantly compromise unit readiness. The lead author’s personal communication with the preventive medicine office at Fort Bragg revealed that nearly 180 soldiers are currently on a profile for EHI;⁶ they will remain there pending completion of their profiles. Development of criteria for return to duty and biosignatures for heat tolerance/intolerance would expedite the process of evaluation for physicians.

The Israeli Defense Forces (IDF) have had a heat tolerance test for many years and used it successfully for determining when soldiers are able to return to duty. The first controlled heat tolerance test (HTT) was conducted by Shapiro et al in 1979, who used a three-hour step test under high heat load conditions. In 1983 the HTT was modified and since then it has been performed at the Heller Institute of Medical Research at the Sheba Medical Center.^{5,6,7,8}

According to the IDF regulations, the Heller Institute (the Military Physiology Unit) is informed of every suspected heat stroke case. Each case establishes a preliminary investigation to characterize the diagnosis and examine the circumstances leading to the heat stroke illness. The soldier is treated and then sent to rest for 4 to 6 weeks. After the rest period, the soldier goes through HTT. The soldier’s physiological response is used to decide whether he/she will gradually return to duty or receive a limited duty profile. Usually the HTT is conducted only once, but in special cases it may be repeated a few months later.

The HTT requires a soldier to walk on a treadmill at a speed of 5 km/hr on a 2% grade for two hours under a high heat load (40°C, 40% relative humidity).

Rectal temperature (T_c) and heart rate (HR) are continuously monitored during the test, and sweat rate is computed from body weight prior to and after the test, after correcting for fluid intake and urinary losses. Heat intolerance is accepted when rectal temperature (T_c) rises above 38.6°C and the dynamics of T_c are unable to achieve plateau. Heart rate serves as a supporting measure for heat intolerance, particularly when HR rises above 160 bpm.

Conclusion

Exertional heat illness continues to occur on every military post, during deployments and other places where soldiers, sailors, airmen, marines, and/or coastguardsmen are engaged in strenuous physical activity. This review summarizes the process clinicians are expected to execute when attempting to safely return individuals to duty. It is our observation and expectation that bringing more science to the clinical decision-making process, as illustrated by the IDF model, offers the promise of lowering the morbidity and mortality of our warfighters, and thereby maintaining force readiness.

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Note

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