

PUBLIC HEALTH REFERENCE SHEET

Cold Weather Injuries (CWI)



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| Name | Hypothermia, freezing peripheral injuries, and non-freezing peripheral injuries |
| Reservoir & Transmission | N/A |
| Incubation Period | Depending on ambient temperature, injuries can occur within minutes. |
| Common Symptoms | Varies depending on type |
| Gold Standard Diagnostic Test | N/A |
| Risk Groups | All are susceptible to a CWI given the environmental conditions |
| Geographic Significance | Occurs worldwide; freezing temperatures are not required for hypothermia to occur. |

What are cold weather injuries (CWIs)?

CWIs include three types of reportable injuries: hypothermia, freezing peripheral injuries, and non-freezing peripheral injuries. These injuries could occur simultaneously.

Who is at risk for cold weather injuries?

All are susceptible to a CWI given the environmental conditions. However, surveillance data from the Army and other Services indicate that rates of CWI appear higher among African Americans, women, Service members under 20 years old, and enlisted personnel. Because a person can have multiple CWIs at the same time, prevention of further cold exposure is crucial.

Other risk factors include:

- Prior CWI or medical conditions**
 Soldiers who have had a CWI in the past are much more likely to develop a new CWI sooner or a more severe one in the future. Existing medical conditions may predispose an individual to a CWI. For example, Raynaud’s Disease is a disorder that causes blood vessel constriction in cold temperatures or during emotional distress, resulting in reduced blood flow to the extremities (e.g., fingers and toes). Other conditions, such as anemia, diabetes, sickle cell disease, hypotension, and atherosclerosis, may also increase susceptibility to frostbite and injuries related to cold exposure.
- Dehydration**
 Inadequate fluid intake affects the body’s ability to sustain physical activity, which in turn affects thermoregulation (i.e., the balance between heat production and loss). Sensitivity to thirst declines in cold environments; this can increase the risk of dehydration during strenuous activity, where fluid loss often exceeds intake.
- Over- and Under-Activity**
 Vigorous exercise/activity induces sweating, which leads to wet clothing and subsequent increased heat loss. Conversely, under-activity results in low heat production, which may lower the body’s core temperature.
- Tight clothing**
 Close-fitting clothing and reduced insulation may restrict movement, resulting in heat loss. Clothing should be worn loosely and layered to allow adjustments as physical activity levels and environmental conditions change.

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- **Inadequate nutrition**
Underfeeding can cause low blood sugar (hypoglycemia) which impairs shivering, thereby making it difficult to generate body heat. Low carbohydrates also limit the ability to maintain physical activity.
- **Alcohol and nicotine**
Alcohol imparts a sense of warmth and causes dilation of skin blood vessels, which increases heat loss to the environment. It may also impair the senses to judgement, making it difficult to detect signs and symptoms of a CWI. Tobacco use (smoking or chewing) causes increased constriction of skin blood vessels, which increases the risk for frostbite.
- **Medications**
Some medications may affect thermoregulation by impairing vasoconstriction. These include benzodiazepines, tricyclic antidepressants, barbiturates, and general anesthetics.

How can CWI be prevented?

Be aware of risk factors and mitigation strategies.

For clothing: remember the acronym C-O-L-D: Keep it CLEAN, avoid OVERHEATING, Wear clothing LOOSE and in LAYERS, and keep clothing DRY.

For eyes: wear dark UV protective glasses; if no glasses are available, improvise with cut slits in cardboard/cloth, or use tape over regular eyeglasses.

For skin: keep skin clean, covered, and dry; use sunscreen and lip balm; and use gloves to handle all equipment and fuel products. Consider not using skin camouflage below 32°F or when windchill is -10°F or below because skin camouflage obscures detection of cold injuries.

For hydration: drink warm liquids and monitor urine color for dehydration.

For environment: use warming tents and monitor environmental conditions such as the wind chill index.

What are some public health considerations?

Critical Reporting Elements and Comments:

- Specify the type of injury.
- Document the anatomical site of injury.
- Document the circumstances under which the case patient was exposed including duty exposure, occupational activities, environmental exposures, or other high-risk activities.
- Specify the ambient temperature, if known, in degrees Fahrenheit (estimate if unknown).

Hypothermia

Hypothermia is the reduction of body temperature to $\leq 95^{\circ}\text{F}$. It can result from either dry-land whole body exposure to cold temperatures or immersion in cold water. Freezing temperatures are not required to produce hypothermia. The initial stages of symptoms include shivering, dizziness, irritability, confusion, slurred speech, and stumbling. The later and more severe stages include a stop to the shivering, a desire to lie down and sleep, a faint heartbeat and

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breathing, and unconsciousness. If the person is conscious, they should drink warm, sweet liquids. Rewarm with body-to-body contact or in a warmed sleeping bag and evacuate to higher level of medical treatment.

Freezing peripheral injuries

Freezing peripheral injuries (e.g., frostbite) result from the freezing of tissue fluids in the skin and/or subcutaneous tissues and cause a loss of feeling and color in the affected areas, which are most often the hands, fingers, feet, toes, ears, chin, nose, and groin area. Freezing peripheral injuries occur only when exposed to temperatures that are below freezing.

Although it has often been classified as first to fourth degree levels of injury severity, final classification often takes weeks and is not helpful for immediate treatment. A more recent classification system uses two levels, superficial or deep.

- Superficial frostbite: Partial or full thickness freezing of the epidermis without involvement of the underlying tissue. Mobility is unaffected, and blistering may occur.
- Deep frostbite: Full thickness freezing of the epidermis accompanied by freezing of subcutaneous tissue, which may involve muscles, tendons, and bones as severity increases.

What are the signs and symptoms of freezing peripheral injuries?

The skin may feel cold, stiff, or woody. It may turn grey or a waxy-white color, and blisters may form. The person may feel numbness, a tingling or stinging sensation, or absent or restricted joint movement. As the frostbite progresses, the underlying tissue may harden, and the skin will turn purple or black.

What are potential complications of freezing peripheral injuries?

Frostbite can permanently damage body tissues, and severe cases can lead to amputation. In extremely cold temperatures, the risk of frostbite increases among those with reduced blood circulation and those who are not dressed properly.

How can freezing peripheral injuries be treated?

Anyone suffering from suspected freezing peripheral injuries should get to a warm room as soon as possible. The person should not walk on frostbitten feet or toes as this can increase the damage to those areas. The body part with the injury should be immersed in warm but not hot water (i.e., the temperature should be comfortable to the touch for unaffected parts of the body). The affected areas should be warmed using body heat; for example, the heat of an armpit can be used to warm frostbitten fingers. The affected areas should not be rubbed or massaged as this can cause further damage. Do not use a heating pad; heat lamp; or heat of a stove, fireplace, or radiator for warming. The affected areas will be numb and can easily be burned.

Non-freezing peripheral injuries

Non-freezing peripheral injuries are a spectrum of localized non-freezing injuries, usually of extremities (e.g., chilblains, trench foot/immersion foot); these injuries occur due to prolonged vasoconstriction in response to cold that leads to tissue injury and destruction. The areas commonly affected by non-freezing peripheral injuries include ears, nose, fingers, and toes. (Note: The term “trench foot” is also used to describe a tropical foot injury or “jungle rot”.) These injuries develop over a period of hours to days, may occur at temperatures below or above freezing, and, with prolonged exposure, can occur at temperatures as high as 60°F. Injury is accelerated by exposure to damp conditions.

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Chilblains are caused by the repeated exposure of skin to temperatures just above freezing to as high as 60°F. The cold exposure causes damage to the capillary beds in the skin. The damage is permanent, and the redness and itching will return with additional exposure. The redness and itching typically occurs on cheeks, ears, fingers, and toes. The symptoms of chilblains include redness, itching, possible blistering, inflammation, and possible ulceration in severe cases. If someone is suspected to have chilblains, they must avoid scratching, slowly warm the skin, use corticosteroid creams to relieve itching and swelling, and keep blisters and ulcers clean and covered.

Trench foot, also known as immersion foot, is an injury of the feet resulting from prolonged exposure to wet and cold conditions. Trench foot can occur at temperatures as high as 60°F if the feet are constantly wet. Injury occurs because wet feet lose heat 25 times faster than dry feet. Therefore, to prevent heat loss, the body constricts blood vessels to shut down circulation in the feet. Skin tissue begins to die because of a lack of oxygen and nutrients as well as the buildup of toxic products. The symptoms of trench foot include reddening of the skin, numbness, leg cramps, swelling, tingling pain, blisters or ulcers, bleeding under the skin, and gangrene (i.e., the foot may turn dark purple, blue, or gray). If someone is suspected to have trench foot, they should immediately remove shoes/boots and wet socks, dry their feet, and avoid walking on their feet as this may cause further tissue damage.

References:

- “Cold Weather,” Centers for Disease Control and Prevention (CDC), last reviewed March 16, 2023. <https://www.cdc.gov/niosh/topics/coldstress/>
- 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>
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