RESISTANCE MEDICINE

# PREVENTION & TREATMENT OF COLD-RELATED INJURY

Sanctum of the Craft

# Cold-Related Injury

*Resistance Medicine*

*Akiima Nicholls Shields*

*Sanctum of the Craft*

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# Homeostasis

Ultimately, the body's function is to survive. A body's survival is dependent on its ability to maintain and restore homeostasis.

Homeostasis is the stability, balance, equilibrium, and relative constancy within an organism, from a single-cell organism to the entire human body. Etymologically, "homeostasis" descends from two Greek words - "homeo," meaning the same, and "stasis," meaning standing. "Standing or staying the same" is the literal meaning of homeostasis.

An organism must maintain a relatively consistent internal environment. Keeping a stable internal environment involves constant adjustments as conditions change inside and outside every single cell, all the way up to inside and outside the entirety of the body. The constant fluctuation and adjustment of body systems to maintain homeostasis is referred to as homeostatic regulation.

Because the internal and external environments are constantly changing (whether looking at an individual cell or an entire body), adjustments must be made constantly and continuously. Homeostasis is a dynamic and fluid equilibrium, rather than a rigid one - it is flexible, changing, and relatively adaptable.

Thermoregulation is a vital part of the body's ability to maintain homeostasis. It is the body's attempt to balance heat production and heat dissipation. The human body needs to maintain a constant core temperature of approximately 98.6°F (37°C), at which its metabolism functions normally. The temperature of the skin and extremities fluctuates more.

Hypothermia is a decreased core body temperature starting at 95°F (35°C).

The body produces heat by metabolizing nutrients (mostly carbohydrates and fats). The basal metabolic rate (the energy used by the body at rest, by a body

going through its normal metabolic processes) of a person is higher during cold weather. It takes more energy for the body to maintain thermogenesis in the cold.

How much extra energy a body will need to stay warm varies by many individual factors (age, AFAB vs AMAB, stress, nutritional status, sleep status, hormones, chronic health conditions, etc.) Body surface area has a major effect - as the ratio of body surface to body volume increases, heat loss to the environment increases. Exertion in the cold also increases the body's metabolic rate and thus energy needs.

The body sheds heat in four ways (other than through behavioural changes, like seeking shade, air conditioning, etc.) These are conduction, convection, radiation, and evaporation.

These mechanisms cool the body when the outside environment is colder than the skin temperature. In a warm or hot environment, these mechanisms may transfer heat into the body, although evaporative cooling may still occur so long as humidity is not over 75 percent.

Conduction is the transfer of heat from one thing to another through direct contact. More heat is transferred from a very hot object to a relatively cooler object. More heat is also transferred if the area of surface contact is larger. Some surfaces conduct heat much more effectively than others - metal conducts heat faster than concrete, for example, so sitting on a cold metal bench (or hot metal bench) can more rapidly affect the temperature of all tissues in contact with it (back, buttocks, thighs).

Air is relatively bad at conducting heat, so less than two percent of body heat is lost to it. The ground is a much better conductor and can take a lot of body heat from a person. Water is an extremely effective conductor of heat. A person who is working in a cold, damp environment may lose heat rapidly to clothing soaked with rain, snow, or perspiration. Falling into cold water is extremely dangerous, as the cold water will rapidly pull heat from the body.

Insulation slows down conduction, which is one reason why dressing with the appropriate insulation is so important in cold weather.

Convection is the transfer of energy due to the movement of molecules in a fluid, which can be a gas or a liquid. When air or water moves across a person's body, heat is lost to it. In cold weather, more heat is lost if there is a big difference in temperature between the fluid and the object (the colder the air or water, the more heat is lost due to convection). More heat is lost if there is a lot of exposed surface area for the fluid to make contact with.

Additionally, the more rapidly the fluid is moving, and the body within that fluid is moving, the more rapidly heat is lost. So, falling into a still cold lake is less dangerous than falling into rapidly moving cold water, and staying still in a cold environment loses less heat to it than a body that is running. This is why wind chill is a factor in how quickly a body loses heat in an environment. The faster the wind is moving, the more chilling it is. Clothing that is windproof is more protective against this effect.

Heat loss through respiration involves both conduction (heat loss from blood to air from surface contact in the lungs) and convection (warm, moist air moves out of the lungs and cold air moves into the lungs, over and over and over again). Respiration is a significant way that people lose heat in cold environments, especially if breathing rapidly. The percentage of body heat lost to the environment by breathing varies significantly based on environmental factors and how active a person is. It may be as low as two percent in some environments and as high as 30 percent in very cold weather, when breathing rapidly. A scarf or gaiter worn over the mouth and nose can help insulate from this.

Radiation is the transfer of heat in the form of waves or particles, which includes the radiation of heat from the body to the environment. Human bodies can lose more than 65 percent of their heat in this way if the environment is cold (or gain heat from radiation in hot environments).

Evaporation is the conversion of a liquid into a gas, during which molecules with more energy (heat) escape into those with less energy (heat). Sweating and heat dissipation by evaporation cause about 30 percent of the body's cooling. In hot environments with lower humidity, evaporation is the primary way the body is cooled down. But evaporative cooling can still happen in the cold, especially on dry cold days when a person is sweating heavily from exertion or illness. Evaporative cooling can also happen due to wet clothing, which causes heat loss by conduction while wet and cold, and then by evaporation as it dries.

# Preparation

People should avoid being outdoors in the coolest parts of the day. They can check weather predictions for temperature fluctuations during the day and plan accordingly, although generally the warmest part of the day is in the middle.

People should avoid extreme activity during the coldest part of the day, as exertion worsens heat loss in the environment. Extreme temperatures also worsen fatigue and cause stress, which restricts the body's ability to maintain homeostasis.

People should not restrict their energy intake during activities in the cold. They need to give their body adequate fuel to warm themselves. They should eat a good, balanced meal of carbohydrates, fats, and proteins before activity, snack as needed through activities, and eat again after their activities. They should not restrict their food intake (unless indicated by another health condition).

People should drink large amounts of non-alcoholic, decaffeinated fluids before, during, and after activities in the cold. They should not restrict their fluid intake (unless indicated by another health condition). Although it is a myth that hot drinks raise core body temperature (they don't), frequent breaks to drink

something warm can make a person *feel* warmer and reduce the stress of their activity. They should avoid large amounts of caffeine, which can hinder the body's temperature-regulating mechanisms. They should avoid alcohol, which can lower their core body temperature, despite making them feel warm. It increases blood flow to the skin, causing heat to dissipate faster, which can lead to hypothermia, especially in cold weather.

People should take frequent breaks to reduce stress and strain on the body so that they can continue maintaining body heat in the cold.

Aid stations can be set up for cold-weather actions. People should take frequent breaks to warm up, dry off, and have something to eat and drink. Pop-up tents with walls and either wool or Mylar blankets can be used to give people a break from the cold.

# What to Wear

**A rain-appropriate jacket:**

Although any jacket offers some level of weather resistance, understanding some basic terminology can help a medic select the right one for storm-related crises. Gear can be water-resistant (resist rain for a brief time) or fully waterproof (resist rain entirely for longer periods). Waterproof materials that are labeled "breathable" are constructed to still allow sweat to evaporate off the skin, keeping the body cool during exertion. Most emergency ponchos are not breathable.

Gear can also be wind-resistant or windproof. REI labels a jacket windproof when it can withstand 60+ miles per hour winds.

A softshell jacket is another term for a water-resistant jacket. A hardshell jacket is another term for a waterproof jacket. Soft shells tend to be best for packing (they pack down smaller), weight, and for breathing through high-exertion activities. Hard shells aren't insulated, and so warmth needs to come from base layers or midlayers. There are also hybrid shells.

An insulated shell jacket will be filled with down or synthetic insulation (more on this in the section on extreme cold). Most insulated jackets are at least water-resistant, and some are seam-sealed to be fully waterproof.

There are many kinds of synthetic waterproof coatings - exploring all of them would be too much detail for this write-up. We will note here that Akiima doesn't like what is referred to as Durable Water Repellent (DWR) coatings, which make a normally non-water-resistant a water-resistant with a finish that causes water to bead up and roll off. The finish wears off fairly quickly, leaving the garment not very usable.

Ideally, a rain jacket will be seam-taped, have a flap over the zipper, have a hood, and have vents.

**Rain Poncho:**

Staying as dry as possible is important during heavy storms. A rain poncho is one of the few pieces of clothing we say can be made from plastic or vinyl.

**Recommendation:**

We like the Arcturus Poncho, as it is made from 210T Ripstop Taffeta, which is coated with 2 layers of waterproof PU coating. It is more sturdy than many of the plastic ones we've tried.

https://arcturusgear.com/products/arcturus-lightweight-waterproof-rain-poncho-olive

**Waterproof Thermal Insulated Boots:**

Wet, cold feet lead to illness (and trenchfoot). Keeping feet comfortable and dry is essential during actions in the wet and cold.

We recommend waterproof boots with a thermal lining, sealed seams, and grippy rubber soles for traction on ice and snow.

**Waterproof suit, pants, or waders:**

In addition to a poncho, if it is storming out, we recommend that people who have a chance of needing to wade through cold waters (which is extremely dangerous and not recommended!) wear a waterproof

suit, pants, or waders to keep themselves as dry and protected as possible. Rain suits, jackets, coats, pants, overalls, and ponchos can be combined into whatever rain protection outfit best suits the medic's needs. Brightly colored rain gear can help people in need of help spot a medic.

**Extra Changes in Clothing:**

The recommendation for clothing doesn't change much. We still recommend natural fibers. We definitely do not recommend cotton for extreme damp, from storms or flooding. But for a storm bag, we recommend extra changes of clothing, because staying damp is dangerous. A medic should tet changed into dry clothing as soon as they are in a covered shelter. Dry clothing thoroughly before wearing it again, if possible.

**For Extreme Cold:**

**Layers, Layers Everywhere:**

Layering allows medics to adjust their temperature by adding and removing items to maintain comfort through different conditions and exertion levels. Layering for cold weather requires a base layer for dryness, even when sweaty from exertion or damp from weather conditions, a middle layer to maintain body heat, and an outer layer to protect from rain, snow, wind, etc.

The base layer should be wool, silk, or specially formulated synthetics (not our preference).

The middle layer should be insulated. Insulation should be considered as to how it retains warmth, handles wet, how heavy it is, and how small it can pack down to.

The outer layer should ideally be extremely adjustable and practical. We recommend cold jackets that have a detachable hood. Additionally, it is our preference that they have vents in case exertion levels cause sweating. Ideally, any cold-rated jacket will also have a flap that covers the zipper, or the zipper will be water-resistant.

They should be considered for their temperature rating, although those are not always hugely accurate (they tend to be rated in still, cold air rather than in damp conditions, and they don't take exertion into account). Any jacket labeled waterproof is also windproof.

Shell pants or gaiters: If the cold weather is the kind with sleet or slush, it may be worth it to invest in winter shell pants or gaiters that go over the base layer pants.

**Appropriate accessories:**

We still recommend wool socks, gloves, hats, and scarves, but the ones for a cold-weather pack should be made of warmer, more insulating material. Socks can still be merino wool, but hats should be wool or cashmere beanies. We prefer merino or cashmere fingerless gloves under waterproof gloves for extreme cold. Scarves should be wool or cashmere.

**Winter boots:**

We recommend waterproof winter boots with good traction and insulation.

Recommendations:

Once again, we recommend 5.11 Tactical, though this time their ATAC Insulated Boot.

https://www.511tactical.com/a-t-a-c-2-0-8-insulated-boot.html

The Solomon Toundra Pro Climashield Waterproof Boots are also highly recommended by others, though we haven't tried them personally.

https://www.rei.com/product/105394/salomon-toundra-pro-climashield-waterproof-boots-womens

**Insulation Types for Jackets:**

The two choices are effectively natural down and synthetic. Down is very lightweight, breathable, very warm, very packable, and durable (and Akiima's personal preference). However, it doesn't do great in damp environments and isn't hypoallergenic. There is water-resistant down that is treated with a process

to make it still insulate in damp environments, but water-resistant down is more expensive.

It is worth noting high quality down that is less bulky and still warm can be expensive and difficult to find. Make sure to investigate any specific product that you are considering.

Synthetics are recommended for extreme cold and damp conditions. It's cheaper, quick-drying, hypoallergenic, and insulates when wet. However, synthetics are less durable, heavier, and harder to pack.

Short-staple insulation can behave like down due to being made from short strands of fine synthetic filaments that are packed like down. However, they tend to clump up in areas and resist being moved into place, leaving areas unprotected.

Continuous-filament insulation doesn't feel like down - it's stiff and not very compressible, and somewhat hard to pack. But they are durable, and the fibers don't shift and create unprotected areas.

The fill numbers (which are something like 40g or 60 g) indicate the weight of the fibers per gram in a square meter of the insulating material. Higher numbers mean thicker insulation.

Hybrid down and synthetic blends are also available.

# What to Pack

In addition to a volunteer or medic's everyday carry and supplies for their action, they should carry specific items to help themselves and others with the cold.

**Chemical Heat Packs:** There are essentially two types of chemical heating packs - reusable and single-use. Single-use heat packs are activated in one of two ways. Some require unwrapping the heating pack, exposing it to the oxygen in the air; typically, this contains a combination of salts and damp iron powder, and the heat is generated by the energy generated as the iron rusts at high speed. Others require squeezing,

causing the chemicals inside the pack to combine in some form of relatively slow exothermic reaction, releasing heat over time.

Reusable heat packs contain a supersaturated solution of sodium acetate in water, and a metal disc in the pack is flexed in order to start a crystallization reaction. This causes the energetic value of the crystal lattice to be released in the form of heat, generally over the course of a few seconds. They can be reused after being submerged in hot water. Chemically, this additional energy re-dissolves the sodium acetate, returning it to the state of a supersaturated solution. Conceptually, this can be thought of as adding heat to the pad to be released later when the disc is flexed.

Single-use heat packs generally continue to emit heat for a longer period of time, and are preferable when the goal is to either have a semi-sustained heat source or to have something that can be given away easily to individuals who need them. Reusable heat packs are more useful in situations where a single burst of heat (perhaps inside an insulating layer such as a glove) will be useful, and would generally be part of the kit a medic would keep for personal reuse in the future.

**Electrical Heating Accessories:** If medics prefer non-disposable heat sources, they can get rechargeable warmers, gloves, socks, and even insoles. They are very expensive and do require access to power to recharge, so it is something that we don't recommend to everyone. However, if medics feel they are worth the weight on their body or in their kit due to circulation or pain issues when exposed to extreme cold, then they are available at most camping supply stores.

**Extra Blankets:** Mylar survival blankets are great at making extremely warm shelters if you know how. We also recommend carrying fire-resistant wool blankets in a medic vehicle or a pack for extra warmth. Medics should carry enough for their own needs and to use them to assist others who are dealing with cold injury.

**Portable Hot Food:** Hot Cocoa, Cider Packets, and Instant Soup Packets are all great. Fueling with food that is also providing an additional source of heat

is a double win for continuing to function in cold environments. These do require that there be an available source of hot water, as well as any applicable dishes (hot drink cups for the cocoa and cider, bowls and/or spoons for the soups), so are not suitable for all occasions, and may require bringing secondary items. A medic tent in cold weather should absolutely have these to distribute to medics, volunteers at the actions, and people in need of treatment for mild cold injuries.

**Extra Snacks:** Keeping warm takes fuel! We recommend bringing snacks, shelf-stable energy-dense food such as protein bars, jerky, tail mix, etc. We think people should bring a mix of foods that will provide quick energy, such as Peanut M&Ms and Gatorade, and foods that will provide more sustained energy, like a snack pack of fruit, cheese, and crackers. The amount of food a medic needs will depend on the time of the action, how long the action is, how physically demanding the action is, how active the medic is, and their own specific bodily needs. They also need to account for how they use food to manage any medical condition, such as blood sugar irregularities.

**Extra Water:** Dehydration worsens hypothermia! They need to bring more water than they normally drink during the day to account for action-based dehydration. They need to have access to at least 2 liters of water throughout the day, either all of it in their kit, or some on them and some at the base set-up. They also need to account for how they use water to manage any medical condition, such as blood sugar irregularities. In freezing temperatures, they will need to use an insulated water bottle.

**Small Packing, Super Absorbent Camping Towels:** Being able to dry off in a cold environment is vital for preventing hypothermia, frostnip and frostbite, trenchfoot, and chilblains. This is one area where synthetic fibers are unavoidable - all of the small packing, high absorption, quick drying towels on the market are made of them. This is to ensure that it can meet all of those criteria, while also being mildew-resistant in case it is packed away while still slightly damp. PackTowl is generally well reviewed.

# Treating Cold-Related Injuries

Treating cold-related injuries is difficult without removing the injured person to a warm environment. The best treatment is prevention. Keeping someone warm and dry is easier than warming or drying a person.

Early intervention is much easier and more effective than trying to rapidly treat a person with worse injuries.

## Pay Attention to Cold

The first sign that there is a risk of cold-related injury is feeling cold. If a person feels cold (not a little chilly, but actively notes that they, subjectively, feel cold), that is the time to put on more insulating materials and seek a warmer environment.

The second sign of a risk of cold-related injury is shivering.

Although hypothermia is defined as a decrease in core body temperature starting at 95°F (35°C) and dropping from there, the mechanisms of hypothermia start at a much higher temperature.

It is a myth that only extreme cold can cause hypothermia. An older person with acute alcohol use disorder can become hypothermic in a home heated to 60°F (15.6°C). People who are in wet clothing or submerged in cold water can also become hypothermic even in non-freezing temperatures.

The body regulates its response to cold temperatures by increasing thermogenesis and decreasing thermolysis (the body's natural process of dissipating or losing excess heat). If the body's temperature continues to drop, it will stimulate shivering. The body will constrict its vascular action, keeping heat from dissipating.

As the exposure to cold continues, eventually the body cannot keep vasoconstriction going to restrict heat loss, and the body suddenly goes into vasodilation, which causes the core body heat to be lost.

Cessation of shivering is a bad sign, but not required for someone to have hypothermia.

**Risk Factors for Hypothermia:**

People with decreased thermogenesis (infants, the elderly, people with dysautonomia, people with class III/severe obesity, people with alcohol use disorder, diabetics, malnourished people, starving people, people with hypothyroidism, people with hypoglycemia, people with immotility disorders, people with liver disease, people on tricyclic antidepressants, people on phenothiazines, people on benzodiazepines, people with meningitis)

People with increased thermolysis (people with dysautonomia, people with hyperthyroidism, people with class III/severe obesity, people with malignant hyperthermia)

Fatigued people

People with substance use disorders

People who are dehydrated

People who are undernourished/malnourished

People who have been through a trauma

People with severe bleeding

People experiencing shock

People with severe burns

People with sepsis

Wet clothing

Cold water submersion

Wind-chill temperatures

Acute spinal cord injuries

Diabetic peripheral neuropathies

# Hypothermia

Acute hypothermia is also called immersion hypothermia, but it does not require immersion for it to be caused. It is the rapid onset of hypothermia, often caused by a person being soaked in cold water. It can happen because they fell into cold water, were completely soaked by environmental conditions like falling rain or snow, or because they were soaked by a water cannon. In acute hypothermia, the onset of cold core temperatures occurs in less than two hours.

Subacute hypothermia is when hypothermia occurs from exposure to cold conditions for two to six hours.

Chronic hypothermia occurs when the body temperature takes longer than six hours to arrive at the reduced body temperature. It can take days to occur. It causes other physiological effects, as compared to acute hypothermia, which include dehydration, exhaustion, and dangerous chemical changes in the body.

Chronic hypothermia can occur at temperatures between 30°F to 50°F (0 to 10°C). It is extremely common amongst the unhoused and elderly, disabled people living alone.

Primary hypothermia is the term for hypothermia that is caused by cold exposure, whereas secondary hypothermia is caused by other problems, such as severe sepsis. Trauma-related hypothermia is caused by blood loss and is part of the Trauma Triad of Death.

## Assessment

Assessment always begins with a scene assessment. Please refer to our other guides for information on scene assessment, the xABCDEs, and head-to-toe assessments.

## Taking Temperature

The temperature of the human body varies away from the core. In very cold environments, the extremities may be very cold, but that is not a reliable indicator of internal temperature. It is often difficult to get an accurate core temperature reading in the field.

In order to accurately read body temperatures below 95.9°F (35:5 °C), people need a special thermometer. They need to check that their thermometer is rated for hypothermic temperatures before attempting to use it to measure a hypothermic person's temperature.

Infrared forehead thermometers are used to measure the temperature of the temporal artery using an infrared sensor. They are good for detecting fever, but not great for use in the field. They give less accurate readings of very cold skin. They are not good for diagnosing hypothermia.

Tympanic temperature is taken on the eardrum, which measures the intracranial temperature. Some search and rescue medics carry specialized thermistor-based types of tympanic thermometers with good insulation, which are useful for assessing hypothermia, offering a fast, non-invasive core temperature reading close to the hypothalamus, but regular infrared tympanic thermometers might struggle with accuracy in very cold environments or water-related hypothermia. Additionally, they are difficult to learn to use safely.

In the field, the oral temperature is commonly used. But it should be noted that it can vary pretty dramatically from the core body temperature if the person has been mouth breathing or drinking hot or cold liquids. It can vary by nearly 1°F (0.6°C) from the core body temperature, even if the person has been heavily exerting themself or drinking hot or cold liquids. However, many medics use it and adjust the temperature by 0.5°F (0.3°C) to 1°F (0.6°C).

Axillary temperature is taken using a digital thermometer under the person's armpit, directly against the skin. However, it, again, will be likely be colder than their actual core body temperature. The reading should be adjusted 0.5°F (0.3°C) to 1°F (0.6°C).

The most accurate means of determining core body temperature is to use a rectal thermometer capable of reading hypothermic body temperature; however, medics should refrain from taking rectal temperatures.

The 2014 WMS "Practice Guidelines for Out-of-Hospital Evaluation and Treatment of Hypothermia" defines mild hypothermia as a CBT of 95°F to 90°F (35°C to 32°C), moderate hypothermia as between 90°F and 82°F (32°C and 28°C), and severe hypothermia as below 82°F (28°C).21 Some experts have proposed an additional level of severe hypothermia, representing CBT of less than 75°F or 68°F (24°C or 20°C). The American Heart Association (AHA) guidelines, most recently updated in 2015, define mild hypothermia as >93°F (34°C), moderate hypothermia as between 93°F and 86°F (34°C and 30°C), and severe hypothermia as <86°F (30°C).

These guidelines have been criticized, however, as being inconsistent with more standard classifications and emphasizing response to defibrillation (which is less likely to be successful below 86°F [30°C]), a single criterion, versus more universal and widely relevant physiologic changes present at each stage.

It is not necessary to get an accurate temperature rating to begin treatment for hypothermia.

It is important to emphasize that in the early clinical stage of hypothermia, before the technical threshold for hypothermia has been met and when the CBT may still be greater than 95°F (35°C), the patient still may show obvious signs and symptoms of hypothermia. Fortunately, the body may compensate for this condition through thermogenesis until the patient finds a way to increase heat production or the glycogen energy stored in the muscles and liver is exhausted.

Mild hypothermia has a set of signs and symptoms referred to as the "umbles". The National Institutes of Health even initiated a public awareness campaign to

help the public notice and act on hypothermia before it worsens, using the umbles as the signs to watch for.

**The Umbles:**

Stumbles

Mumbles

Fumbles

Grumbles

Crumples

The early stages of hypothermia affect cerebral and cognitive functioning. People develop coordination and fine motor control issues (fumbles), they have difficulty moving around and maintaining their balance (stumbles), they have speech difficulties and incoherence (mumbles, grumbles), and they become incoherent (mumbles, grumbles). Eventually, they begin having trouble staying upright and continuing to function (crumples).

The last stage is a critical, life-threatening state where the circulatory system fails to maintain adequate blood flow (pressure and volume) to the body's organs, leading to severe hypoperfusion, oxygen deprivation, and potential organ failure. This is called hemodynamic collapse, which is essentially a form of severe shock, characterized by very low blood pressure, rapid heart rate, confusion, and shortness of breath. A person collapses (crumples) and is then considered to be in the secondary stage of hypothermia.

Older people may present with a flatter, less exaggerated affect, with symptoms that more closely resemble cognitive dysfunction, like what can be caused by a stroke or dementia. They are more likely to present with dysarthria, a motor speech disorder caused by neurological damage, affecting the muscles for speech, leading to slurred, slow, quiet, or robotic-sounding speech, mumbling, or difficulty controlling volume and facial muscles. They are still very likely to present with exaggerated ataxia, which is the medical term for that lack of voluntary muscle coordination, which causes the clumsiness, unsteady walking, speech issues, and poor balance (the umbles).

One of the dangers of even mild hypothermia is that it impacts decision-making. Hypothermia dramatically affects thinking and impairs reasoning. People with hypothermia may be apathetic and uncaring about their own symptoms, may not be able to recognize that something is wrong, and even if they can, may not be able to think through and act on addressing the problem before it worsens.

One strange behavior observed in people who are in advanced hypothermia is paradoxical undressing, which occurs in up to 30 percent of fatal hypothermia cases. The combination of confusion and a false sensation of intense heat may lead victims to strip off their clothes, anywhere from partially to full undressing. This drastically speeds up fatal heat loss, often just before unconsciousness or death. This may be explained by exhausted blood vessel constriction giving up on its constriction, causing a "hot flash." Or it may be due to a malfunction in the brain's temperature center.

The signs and symptoms of this central nervous system dysfunction closely resemble those associated with head injury, alcohol intoxication, stroke, or acute psychiatric disturbance, such as acute psychosis. Unfortunately, due to this, many cases of hypothermia amongst the unhoused and the low-income elderly go unnoticed, with symptoms dismissed as indicative of other issues. This leads to a greater risk of death from hypothermia in already marginalized communities.

As hypothermia progresses, peripheral vasoconstriction pulls blood away from the skin and the extremities towards the core to prevent heat loss.

The vasoconstriction that prevents heat loss also concentrates blood volume into the inner core. This causes dehydration, which can be very severe (almost 5.8 quarts (5.5 liters) in someone whose core body temperature is below 90°F, equivalent to the entire circulatory volume). Cold diuresis, an increased urge to urinate out extra bodily fluids, is a symptom of this kind of hypothermia.

The dehydration and hypovolemia then cause the heart, at first, to speed up. Then the heart starts to struggle, with cardiac dysrhythmias and possible atrial fibrillation. This can increase the chances of a heart

attack, especially in the elderly struggling with chronic hypothermia.

In early, mild hypothermia, the respiratory rate speeds up, but as hypothermia progresses, it slows down. Cold-induced bronchospasms can occur (more on this later). As hypothermia progresses, the autonomic function of the airway declines, and oxygen consumption decreases. Slow, deep, sleepy breathing occurs with oxygen consumption cut down by about half.

As hypothermia starts, the body shivers to produce heat, warming the core body temperature by about 2°F/h (about 1°C/h). This increases the fumbles, making it hard for a person to have fine motor control. Cold muscles also stress and strain more easily. People become fatigued, weak, and stiff.

It also uses a lot of energy, so as the body runs out of fuel, it stops being able to shiver. As shivering depletes the body's glucose stores, people develop sudden hypoglycemia. Insulin levels fall, and the body starts having to burn fat stores. Even the metabolism of drugs is affected, with drugs lasting much longer in the system of a person with chronic hypothermia, which can lead to medication issues, especially for elderly people.

## Treatment of Hypothermia

Treatment of mild hypothermia first involves preventing further heat loss. If the person is damp or wet, they need to be dried off. All wet garments should be removed. They should be insulated from further heat loss with warm, dry blankets and clothing.

The second important part of the treatment is to provide fuel. The treatment of mild hypothermia involves giving the person hot, sugary drinks. It is a myth that the hot drink will raise the core body temperature (it doesn't). However, they can have a psychological benefit that eases the "umbles" by lowering stress. The primary benefit, however, is from the sugar. The body is burning through fuel. The hot drink should ideally not be coffee or contain alcohol. Something like hot cocoa, which contains a small amount of caffeine, is fine.

For mild hypothermia, moving around is indicated, as it can restore blood flow to the extremities.

For mild hypothermia, being put into a warm environment, about 82°F (28°C), is ideal. At this temperature, the person treating the hypothermic person will not risk becoming overheated, but the hypothermic person will warm up quickly. The hypothermic person should ideally not be warmed up in an environment cooler than 75°F (24°C), because lower than that their body can still lose heat and continue transitioning to worsened hypothermia.

There is some argument about heat packs. Some AHA guidelines recommend heating packs be placed in the groin, on the neck, and under the armpits to help warm a hypothermic person. The WMS recommends against this because the heating packs are not sufficient to raise the core body temperature and because they may cause burns if improperly used. However, the WMS still recommends heating packs be used on the hands and feet to prevent frost nip (but this, again, needs to be carefully done and is not recommended for frostbite).

Heated fans (we like the Vornado) can be very effective at drying a person off while also warming them up. Heated blankets can also be used. The combination of a heated blanket plus a heated fan can warm people up at a rate of about 4.3°F (2.9°C) per hour, which is much faster than just warm blankets alone (2.2°F [1.2°C]).

Street medics can carry heat-reflective blankets made of Mylar and chemical heating pads to address heat loss in mild hypothermia cases.

If they are working in environments where winter conditions are severe and they are likely to have to warm someone without access to emergency services (wilderness support after natural disasters, actions like No DAPL), they may want to consider investing in a hydraulic sarong. A hydraulic sarong is a thin, double-layered blanket with plastic tubing laid out in a grid between the two layers. Heated water (from a camp stove, a medic tent with a hot water setup, etc) is then pumped through the tubing to warm the person.

In worsening hypothermia, where the core body temperature is less than 82°F [28 °C], the person needs to be medically evacuated by emergency medical services. Emergency treatment needs to be in a hospital with warm IV fluids, treatment with warm oxygen, body cavity lavage, esophageal warming tubes, etc.

However, this isn't always possible. The following is NOT what is recommended, because what is recommended is emergency medical treatment by professionals. If that is not feasible, this is then a secondary option that is less effective.

In cases of severe hypothermia, chemical heat packs and the like will not add enough heat to rewarm the patient. Additionally, warming the body too quickly is extremely dangerous.

The person can be stripped, placed into a warm environment like piles of blankets or sleeping bags, and surrounded by one to two mostly undressed people who warm them with their own bodies. As they begin to warm up and leave behind severe hypothermia, heat pads can be added to the nest of blankets, and then, as they are warmed further, can be placed in the groin, armpits, back of neck, etc. Warming should be gradual, over a period of several hours.

It is a myth that their bodies should be rubbed all over to restore blood flow. If they have frostnip or frostbite, this is contraindicated. But, additionally, rubbing blood into the extremities is a bad idea – the core needs to be rewarmed first, and restoration of blood to the skin and extremities too soon can cool the core.

There is a pretty widespread myth that rough handling of a hypothermic person can cause the heart to enter into ventricular fibrillation and trigger a heart attack. Although hypothermia increases the risks of a heart attack, rough handling doesn't increase the chances of this (although, weirdly, a specific kind of intubation can, but that isn't relevant to street medics.) Handling a person to undress them, put them into a warming environment, get them into position between two bodies, put heat packs in place, etc, is not going to be what triggers a heart attack. Heating someone too quickly or rapidly dropping their body temperature using bad warming techniques might, though.

Once they are conscious and capable of drinking fluids, they can be given hot, sugary beverages like hot cocoa or cider. A warm rehydrating solution is also a good idea, as hypothermia dehydrates, and recovery is faster when someone rehydrates.

It is a dangerous myth that a person with severe hypothermia can be treated with a hot bath. Being placed into hot water can cause cold blood from the extremities to rush to the core, dropping the core temperature further and potentially causing cardiac arrest. The rapid external heat also causes blood vessels to open, reversing the life-saving vasoconstriction and blood to leave the core for the extremities, which can lead to shock. Hypothermic skin is also extremely sensitive to heat and burns easily, even from water that just feels mildly warm to a person who is not hypothermic.

It is not safe to put them in cool water either, which we've seen recommended. Cool water is the opposite of helpful! Remember that water is an excellent conductor, so cool water will cool the body down.

There was a theory that a warm bath could be used just on the trunk of the body, with the extremities out of the water, to prevent "afterdrop," the sudden dropping of core temperature observed from full submersion in hot water. Unfortunately, a study has found that this doesn't help, and afterdrop still occurred. (Hoskin RW, Melinyshyn MJ, Romet TT, Goode RC. Bath rewarming from immersion hypothermia. J Appl Physiol (1985).)

The ONLY way to use a bath to rewarm a person is to start with water that is room temperature - not cool, not warm, but ambient. And even this is very risky, and the naked snuggling method is more recommended.

If the person has stopped breathing or does not have a pulse, they should be given basic CPR while waiting for emergency services to arrive. CPR should be continued while warming is occurring and should not be stopped until they are breathing normally or until the body has been warmed to at least 86°F (30°C) and they are still not breathing. If the person is still unresponsive at that temperature, the victim may be considered dead.

It should be noted that some people with very severe hypothermia can appear dead, but the hypothermia may actually be protecting the brain and organs. Rewarming the person may actually restore pulse and respiration. This is why wilderness responders are taught a person isn't dead until they are "warm and dead." Rigor mortis, fixed, dilated pupils, absent pulse, absent respiration, and dependent lividity are not considered signs that someone is dead if they are suffering from severe hypothermia.

However, there are some clear signs that someone is cold and dead with no ability to be resuscitated after warming. These include fatal injuries, of course. But additionally, if the chest is so cold and stiff that it cannot be compressed during CPR, the person is very likely dead.

### Acute Hypothermia

### (Immersion Hypothermia)

Although acute hypothermia is called immersion hypothermia, it does not require immersion in water to occur. It can happen in damp environments or if someone is dressed inappropriately in cold weather, especially if their clothing becomes saturated with snow.

If someone has acute hypothermia and their body temperature has been low for less than 20 minutes, they can be rewarmed quickly. They should strip off their damp clothing, move their body, place themselves near a heat source (roaring fire, heating fan), rub their chest and core, put on insulating clothing, and use heat sources to warm themself. They can put heat pads on their inner thighs, under their armpits, on their hands and feet, on the back of their neck, and on their cheeks to warm up quickly.

If someone has been in water of 50°F (10°C) or less for a period of 20 minutes or longer, or soaking wet in the same temperature water from something like rainfall or water cannons, they are suffering from a severe amount of heat loss. Afterdrop is a major concern. Ideally, emergency services would be contacted for severe acute hypothermia. Absent that as an option, treatment is extremely similar to severe chronic hypothermia.

They should NOT move around, rub their limbs, or be submerged in hot water.

They should remove (or someone should remove it from them) any wet clothing, be dried off, and be placed inside insulating materials like blankets, ideally in a space with a hot air fan or fire. At least one person should undress and use their body heat to warm the person. After their temperature has come up, heating pads can also be used, but they should be monitored to prevent topical burns.

### The Trauma Triad of Death

If a person is bleeding in a cold environment, medics should be particularly concerned about the Trauma Triad of Death. The Trauma Triad of Death is the simultaneous presence of coagulopathy (impaired blood clotting), hypothermia (low body temperature), and acidosis (body fluid becomes too acidic) in a patient with severe trauma. These three conditions worsen each other in a vicious cycle.

The three in combination cause increased bleeding, shock, and ultimately a high risk of death. The medic may need to perform damage control resuscitation to reverse these effects and prevent a downward spiral.

Note: Some medical professionals are proposing a shift to a pentad model that includes a natural pattern of events occurring with hypoxemia (low levels of oxygen in the blood) as the main trigger for the development of hypocalcemia (low calcium levels in the blood), hyperglycemia (high blood sugar), acidosis and hypothermia, as they feel the original triad fails to establish a sequence, which would be relevant during the initial treatment of severe bleeding.

Even mild hypothermia can inhibit clotting and cause coagulopathy. Coagulopathy leads to increased hypoperfusion, reduced blood flow, which causes the cells to have to use anaerobic metabolism as they aren’t receiving enough oxygen. This causes acidic compounds to be released into the blood, which reduces myocardial performance. That then further reduces oxygen delivery even more, which further reduces the body’s metabolism and leads to increased hypothermia.

Trauma patients need to be kept warm. Even if it isn't cold out, heavy bleeding can reduce the body's ability to maintain its correct body temperature. But in cold weather, the combination of bleeding and cold is extremely deadly. This is one of many reasons medics should always carry shock blankets.

If a person has been injured and is bleeding in cold weather, simply covering their body with a blanket is not enough to prevent the hypothermia that can trigger the Trauma Triad of Death. Something insulating needs to be between them and the ground. This can be a Mylar blanket, a few wool blankets laid on top of each other, layers of hoodies and jackets, stacks of cardboard, a stretcher, or even someone holding them.

# Frostnip

Many injuries caused by the cold are localized to exposed parts of the body and the extremities. As heat pulls into the core to protect the core body temperature and organs, the extremities cool down. This increases the chances of cold injury to the extremities.

The most common places people experience topical cold injury are the tips of the ears, nose, upper cheek, and tips of the fingers and toes.

Both frostnip and frostbite are ischemic injuries, meaning they are caused by reduced blood flow, and thus oxygen and nutrients, to the tissues, causing cell damage and death.

Frostnip is superficial, whereas frostbite can be superficial, partial thickness, or full thickness.

Frostnip is a very light frostbite that is common in people who work in the cold or who participate in winter sports. If it is caught quickly enough, it can be prevented from developing into frostbite. Watching for the first signs of frostnip is important, as early prevention in frostbite cases can prevent severe injury.

The signs and symptoms of frostnip are easy to notice if one is paying attention. The tissue turns blueish, purplish, or white and goes numb.

Frostnip can often be treated simply by breathing warm air over the extremity and then putting on an insulating material. They can use chemical or electric heating pads or step into a warm environment to warm up.

The return of blood flow to an area generally causes redness and tingling.

If the fingers are frostnipped, people can make arm circles in the air to force blood back down their arm. Stomping the feet can also help with frostnip in the toes. However, these are temporary solutions. Without adequate insulation against the cold, frostbite follows frostnip.

# Frostbite

Frostbite is a dangerous freezing of tissues that occurs because of ischemia, the restriction of blood flow. As temperatures drop, vascular constriction occurs. In the cells of the fingers, toes, nose, ears, etc, microvasoconstriction occurs as water shifts in the body. As the tissues dehydrate and the constriction restricts blood flow, the fluids in the cells literally freeze and turn into ice crystals. This causes cell damage, and in severe cases, cell death.

Some people are more prone to frostbite due to poor circulation and other medical conditions. There are also behavioural issues that can lead to increased risk for frostbite.

**Risk Factors for Frostbite:**

Poor circulation (Reynaud's, dysautonomia, EDS, and others)

Impaired sensation from nerve disorders (Diabetic neuropathy, fibromyalgia, dysautonomia, chronic pain conditions, high opiate use)

Hypothyroidism

Arthritis

Dehydration

Malnutrition

Being unhoused

Starvation (including starvation diets and restricted eating disorders)

Infants and children

The elderly

Impaired judgement (from substance use, fatigue, stress, trauma, mental health conditions)

Alcohol use and abuse (especially heavy drinking in the cold)

Frequent nicotine smoking (constricts arteries)

Inadequate clothing

Restrictive tight clothing

Direct contact with cold objects (conduction)

Hypothermia

**Signs and Symptoms of Superficial Frostbite:**

Numbness

Tingling

Burning

White skin

Bluish or purplish skin

Firm skin

Swelling skin

Pain

The skin will be firm to palpation, but the underlying tissues should still feel soft. As thawing occurs, the tissues will swell, sting, burn, and turn red. Dull or even throbbing pain can persist for days and up to weeks after the injury.

**Deep Frostbite Signs and Symptoms:**

Numbness

Hard skin with no sensation

White skin

Yellow-white skin

Mottled blue-white skin

The damage caused by deep frostbite often occurs during the thawing process. As the tissues thaw, partial refreezing can occur as water in the tissues liquifies and then refreezes, causing tissue damage. Reperfusion injury can occur, which is paradoxical tissue damage that occurs when blood flow is restored to an oxygen-deprived (ischemic) area, overwhelming the tissue with oxygen, triggering inflammation, and causing oxidative stress that damages cells. As thawing occurs, the injured tissues turn red and purple, swell up, and become extremely painful. Gangrene (permanent cell death) can occur within a few days, causing a need for amputation of part of or all of the damaged area.

Medics should not attempt to thaw deep frostbite in the field, because severe damage can occur if the tissues are partially thawed and then refreeze. If emergency medical services are not available and the person cannot be treated in a hospital, then the following can be done, but the recommendation is to seek emergency medical services.

The first and most important step is to get the person out of the cold. They need to be removed to a warm environment, and all damp, cold clothing should be removed. Do not rub or massage the frost-bitten area, as this can cause damage to the injured tissues.

Rewarming of the tissues is done using a water bath with hot water, but the entire body should not be immersed or submerged, only the frostbitten tissues. The person can be given pain relievers (morphine, hydrocodone, acetaminophen) before the treatment is given.

Water should be heated in a second container (tea kettle, pot on a stove) and then slowly poured into the water in the basin until the water in the basin is between 98°F and 100°F (about 37°C and 38°C). The thermometer must remain in th ewater in the water.

When the water bath has reached the appropriate temperature, the medic should gently immerse the

injured extremity. It will hurt. As soon as the water drops below 98°F (37°C), temporarily remove the injured extremity from the water while more hot water is added. Once the temperature is back up to 98°F (37°C), the injured extremity can be placed back in the water. The rewarming normally takes 10 to 30 minutes.

The extremity is considered rewarmed when it is warm to the touch, pink, reddish, burgundy, bluish, or purplish, and remains warm when out of the warm water.

This treatment is done AT THE SAME TIME as treatment for hypothermia if the person is hypothermic. The person should be wrapped in insulated materials and kept warm by a warming fan, roaring fire, or naked bodies pressed close to theirs while treatment for frostbite is occurring.

The person should not ingest alcohol or use nicotine while the thawing is occurring.

Once the rewarming is complete, the tissues should be gently dried. The medic should wrap them in sterile nonadhesive gauze dressings, being careful to fully separate frostbitten fingers and toes with sterile dressings.

Frostbitten tissue often blisters. Do not open any of the blisters that form. Treat them with sterile petroleum jelly and sterile nonadhesive dressings. Hydrocolloid dressings can be used on the blisters, which can cushion them from being torn open and provide a better healing environment. Medics should not cut any skin away.

Ideally, treatment for the long-term injury caused by severe frostbite would be done by a medical professional. If a person cannot, for whatever reason, seek professional medical care in a hospital setting, they should consider trying to find it from the medic community. Some street medics are medical professionals, and a medic who is not should consider contacting one or finding a clinic that the person would be safe going to.

In cases where professional medical care is not available, the following would apply for long-term treatment, but it is not ideal.

The blisters generally heal over two to three weeks. They need to be checked daily, gently cleaned with a burn wound wash, and treated with raw medical-grade Manuka honey and hydrocolloid bandages. Honey should not be used by those with a sensitivity to bee venom.

In severe cases of frostbite, a black eschar/carapace can form, which is a form of dry gangrene. Medics should not attempt to cut away gangrenous tissue. The treatment is, instead, to wait as the blackened areas heal over six months to one year. The black areas should be dressed with a honey alginate dressing, which combines medical-grade Manuka honey (for antibacterial/healing) with calcium alginate (from seaweed, for high absorption), creating a flexible, moist dressing that promotes healing, cleans wounds, and manages moderate to heavy exudate from gangrene.

The black eschar/carapace will eventually fall away, oftentimes taking the tips of the fingers or toes with it, but leaving healed tissue. This only works if infection is prevented and IS NOT recommended. Professional medical treatment where a medical doctor can assess whether debridement (surgical or with larvae) is necessary.

Sanctum of the Craft is aware of medics who have successfully used larva debridement and honey in the treatment of gangrenous frostbite injury, but do not feel confident in teaching this. Larval debridement must not be done on people on blood-thinning medications or who have medical conditions that damage their clotting ability.

In the case of the most severe frostbite (also called Stage IV Frostbite), the only thing that can be done is surgical amputation of the frostbitten extremities, which absolutely must be done by a trained surgeon.

Sanctum of the Craft prefers to teach frostbite as two severities, mild and severe, because it is initially difficult to estimate the depth of the cold injury. Due to this, early injuries are best classified simply as either superficial or deep.

But we will note the four-stage classification due to the fact that fourth-degree frostbite must be treated surgically.

**First Degree:** Initial numbness, redness, and swelling upon rewarming, shedding of skin cells like after a sunburn, tingling, and burning while rewarming

**Second Degree:** The symptoms of First Degree Frostbite, but with blisters

**Third Degree:** Much harder tissue under the surface tissues before rewarming, hemorrhagic blisters (bleeding blisters), sloughing of the skin, formation of eschar (hard, dry, black, leathery scab, referred to as the carapace as well), skin necrosis, pain emanating from the area to the rest of the body after rewarming

**Fourth Degree:** Wooden feeling, severe burning, throbbing, and shooting pains emanating from the area to the rest of the body, non-blanching cyanosis (skin discoloration that doesn't fade when pressed) tissue damage through the entire thickness of the part, including deep structures, possibly including bone, necrosis, dry gangrene, and wet gangrene (severe frostbite can lead to wet gangrene, a serious condition where bacteria invade dead, damaged tissue, causing swelling, blisters, foul odor, and rapid spread, requiring urgent medical treatment with antibiotics and often surgery (debridement or amputation) to remove infected tissue and prevent life-threatening sepsis.)

If a person has frostbite in the field and evacuation is necessary to get to medical treatment, it is important to note that damage to the frostbitten tissue is increased by how long it stays frozen. Because of this, it is actually not recommended that medics evacuate someone by carrying them on a stretcher if this will make the evacuation take longer. If it is faster for the person to walk themself out of the wilderness than be carried, then that is what should be done, even though walking on frostbitten tissues may damage them, as it will damage them less than staying frozen for longer.

The person should never thaw their frostbitten feet and then try to evacuate by walking on them. They should, instead, walk on the frostbitten foot and then thaw the food when in safe, warm conditions.

Up to 65 percent of people who have had frostbite injuries experience chronic issues, including hypersensitivity to cold, pain, ongoing numbness, and increased chances of developing frostbite again in the future.

# Trench Foot

Trench foot, also called immersion foot, is an injury to the feet caused by the combination of prolonged cool, damp environments. It does not require cold temperatures and can occur at ambient temperatures as high as 60°F (16°C). The moisture causes conduction heat loss as wet feet lose heat 25 times faster than dry feet. Both the soft tissues of the foot and the peripheral nerves are damaged.

**Risk Factors:**

Poor circulation (Reynaud's, dysautonomia, EDS, and others)

Impaired sensation from nerve disorders (Diabetic neuropathy, fibromyalgia, dysautonomia, chronic pain conditions, high opiate use)

Hypothyroidism

Arthritis

Dehydration

Malnutrition

Being unhoused

Starvation (including starvation diets and restricted eating disorders)

Infants and children

The elderly

Impaired judgement (from substance use, fatigue, stress, trauma, mental health conditions)

Alcohol use and abuse (especially heavy drinking in the cold)

Frequent nicotine smoking (constricts arteries)

Poorly insulated shoes

Cotton socks in damp weather

Synthetic socks in damp weather

Wet shoes

Hypothermia

**Signs and Symptoms of Trench Foot:**

Pale, mottled skin on the foot/feet

Red or blueish skin on the foot/feet

Numb foot/feet

Cool foot/feet

Pulseless foot/feet

Immobile foot/feet

Wrinkly or pruney skin on the foot/feet

Numbness

Tingling

Possible Swelling

Pain, especially when drying off and rewarming

Foul odor

Trenchfoot is prevented by wearing properly fitting, insulating shoes that keep the feet clean, warm, and dry. Wet socks should be changed with dry socks as soon as possible, with the foot thoroughly dried before switching pairs. People should never sleep in wet socks or boots. They should not wear synthetic or cotton socks in cool, damp weather – wool is emphatically recommended. They should always dry their boots and socks overnight if they will have to wear the same pair the next day. They should monitor their feet for signs of trenchfoot and act to correct it as soon as possible.

The feet should be dried off thoroughly. They should then be elevated near a heat source, like a fire or a heating fan. They can then be dressed in sterile dressings, if necessary. In more severe cases, there may be a foul odor due to necrosis caused by fungal

or bacterial infection, in which case the foot/feet will have to be treated for infection.

After warming, the foot may remain insensate and immobile for a few hours. Then, it may swell and turn red, with severe burning pain. The swelling may last two to three days. Blisters may appear in this same time period.

In severe cases, tissue may slough off. In even more severe cases, wet gangrene may appear, which can be deadly if left untreated.

Cold and damp sensitivity may continue for years after a single case of trench foot. The feet may develop ongoing hyperhidrosis (excessive sweating) that endures for months to years.

# Chilblains (aka Pernio)

Chilblains, also called pernio, are lesions of the skin caused by exposure to damp, non-freezing temperatures. They are most common on the feet, hands, ears, and lower legs.

**Risk Factors:**

Infants and children

AFAB people

The elderly

Poor circulation (Reynaud's, dysautonomia, EDS, and others)

People with immune deficiencies and abnormalities (lupus, HIV, cancer treatment)

Impaired sensation from nerve disorders (Diabetic neuropathy, fibromyalgia, dysautonomia, chronic pain conditions, high opiate use)

Hypothyroidism

Arthritis

Dehydration

Malnutrition

Being unhoused

Starvation (including starvation diets and restricted eating disorders)

Impaired judgement (from substance use, fatigue, stress, trauma, mental health conditions)

Alcohol use and abuse (especially heavy drinking in the cold)

Frequent nicotine smoking (constricts arteries)

Poorly insulated homes

Homes without heating

Sleeping in damp environments

Staying in damp clothing

Restrictive and tight clothing

**Signs and Symptoms:**

Small, itchy areas, especially on hands, feet, and lower legs

Motled red patches on the skin

Blueish skin

Skin plaque (raised sections of different textures)

Blisters

Swelling

Numbness

Pain or stinging

In rare cases, cysts and ulcers

The affected skin should be rewarmed, elevated, and dressed in a sterile dressing with antimicrobial salve, such as petroleum jelly or medical-grade Manuka honey.

# Panniculitis

Panniculitis is a subcutaneous fat disorder where inflammation of the fat occurs during prolonged exposure to cold temperatures. It often appears after people have been exposed to ice (including ice packs that are held in place without a cloth between the ice and the skin), children who have eaten popsicles, and equestrians who ride for long hours on cold saddles.

**Signs and Symptoms:**

Red, swollen nodules

Skin plaques

Uneven, pitted skin

Itching

Symptoms appear 24 to 72 hours after exposure and typically resolve on their own within one to two weeks. Sometimes there is some lingering temporary hyperpigmentation that clears up after a few weeks to a few months.

Some medics have found it effective to treat the itching with antihistamines and anti-inflammatories.

# Cold-Induced Bronchospasm

Cold-induced bronchospasm is a form of asthma sometimes referred to as winter lung, frozen lung, or pulmonary chilling. It occurs when a person is breathing rapidly in very low temperature environments, below 20°F (29°C).

**Risk Factors:**

Asthma

Mouth breathing

Inadequate coverage of the mouth and nose during cold weather

Smoking and vaping

COPD

High rates of exposure to mold and mildew

Other respiratory tract infections (COVID-19, RSV, Flu, Cold, etc.)

Physical exertion in the cold

**Signs and Symptoms:**

Wheezing

Pain in the lungs

Difficulty getting enough air

Pain in the shoulders

Pai in the upper stomach

Coughing

Coughing up blood

Prevention is the best treatment. People who are sensitive should wear a scarf or gaiter over their mouth and nose and prioritize breathing through their nose.

The soreness and pain from cold-induced bronchospasm can be helped with drinking hot drinks, drinking extra water, steam inhalation, bed rest, and anti-inflammatories.

Cold-induced bronchospasms and pneumonia have very similar symptoms, but pneumonia will also include a fever.

# Cold Urticaria

Cold urticaria is a rare hypersensitivity to cold air or water. Cold exposure causes itchy hives and inflammation, which can occur from touching cold items, being in cold air, or even drinking cold drinks. The symptoms generally appear within 30 minutes to a few hours of warming up and worsen as the person warms up.

The range of reaction can be localized from small hives to headaches, palpitations, wheezing, and even to severe, life-threatening anaphylaxis.

It can be idiopathic, as in, no one knows why it happens, or an inherited condition. It can appear in those who have Mast Cell Activation Syndrome as one symptom of their mast cell activation.

People can be unaware that they have cold urticaria until they are warming up from their first exposure to extreme cold.

Treatment is primarily with antihistamines. In the very rare cases of someone developing difficulty breathing, treatment involves the use of an EpiPen and then emergency medical services. If an EpiPen has to be used, the person MUST follow up with emergency medical services.

# State Violence Related

The police have used water cannons in freezing and subfreezing weather to disrupt actions, including at the NO DAPL protests. Water cannons in cold weather can cause head trauma, fractures, severe bruising, internal injuries, and hypothermia. Warming aid is vital if the action is to continue.

**According to Håkan Geijer's Riot Medicine:**

*"Tea, Soup, and Blankets - Anonymous*

*In December of 2017, the German far-right political party Alternative für Deutschland (AfD) was having a national convention in Hannover. Our goal was to disrupt the event by blockading the streets to prevent the delegates from making it to the event. It was scheduled to start at 10 in the morning, so to beat the police, we left where we were staying at 05:00 to be at our rally points at 05:30. After clashing with cops and getting kettled, the groups at the different intersections sat down to form sit-blockades.*

*Eventually, the police drove water cannons at the blockades and hosed down the protesters in the subfreezing weather. Some people were prepared enough to wear waterproof clothing. Others brought umbrellas and emergency blankets to deflect the water, but most everyone got soaked.*

*After the blockades, there was a march through the city. That meant some people were outside, maybe wet, for 12 hours in weather that only ever reached maybe 2 °C. Luckily, there was wonderful support from the community. There were stations with hot food and drink as well as people with wagons filled with hundreds of emergency blankets to hand out. Even some of the dry protesters were cold-stressed, but they were able to wrap up and get something warm into them. The day was a success, and we managed to significantly delay the start of the event. I think if it wasn't for all of the non-medics handing out hot drinks and blankets, we would have seen a lot more ill and miserable protesters."*

# Recipes for Cold Weather Injuries

**Rehydrating Solution:**

A simple rehydration solution for the cold is hot water mixed 50/50 with hot cider or juice, with a pinch of salt. Hot water can also be mixed with honey or sugar, still with a pinch of salt. A simplified version of the most common solution is one liter of water, 25 grams of sugar (about a handful), and three grams of salt (a decent pinch).

The person should rehydrate for at least two hours at a rate of half to one liter of water per hour.

**Warming Spicy Hot Cocoa Mix:**

This mix creates a dark, superconcentrated, creamy hot chocolate with a bit of warming spices. The sugar and nonfat dry milk powder both contribute needed energy to a person suffering from cold-related injury. The recipe can be doubled, tripled, or increased however many times for a medic collective to keep it on hand. It can be stored in an airtight container at room temperature for two months.

The spices also have beneficial effects.

The cinnamon (Cinnamomum cassia or Cinnamomum ceylon, which have slightly different flavor profiles. Cassia cinnamon is what is most commonly found in grocery stores) is anti-inflammatory, antioxidant, and neuroprotective. It is antimicrobial against bacteria, fungi, and viruses. It lowers blood sugar. It also acts as a blood thinner. It is generally considered safe in culinary doses. It should be used cautiously by those on blood-thinning medications. People with hypoglycemia or who are on diabetes medications should be cautious about how much they ingest.

Chilis (Capsicum annuum) reduce inflammation and fight infection. They can be irritating for people with gastrointestinal disorders, including those with irritable bowel syndrome, irritable bowel disease, ulcerative colitis, and Crohn's.

Warming spices, chocolate, and creamy sweet beverages all have calming effects on the nervous system, helping to reduce stress and strong reactions to trauma.

**Ingredients:**

- One cup (seven ounces) of sugar
- Six ounces of unsweetened chocolate, chopped fine (baking chocolate is fine)
- One cup (three ounces) unsweetened cocoa powder (Natural or Dutch-processed)
- ½ cup (one and ½ ounces) nonfat dry milk powder
- Five teaspoons of cornstarch
- One teaspoon of finely ground whole vanilla bean
- One and 1/2 teaspoons of ground cinnamon
- ¾ teaspoon of ancho chile powder
- A pinch of salt
- A pinch of cayenne pepper

**To Make:**

Mix all the ingredients together thoroughly. Store in an airtight container.

For one serving of hot chocolate, heat 1 cup milk of choice (skim, 2 percent, whole, plant-based) until steaming in a small saucepan. Add ¼ cup of the hot chocolate mix and which constantly until it is fully incorporated, two to three minutes longer.

To make it in a mug, without access to a saucepan, put the powder mix into the mug and pour just enough

hot milk into it to saturate it (a couple of tablespoons). Stir until all the lumps are gone and the mixture is sludgy. Add a little more milk and stir again. Do this a few times until the milk and mixture are fully incorporated.


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