

Cold-Related Emergencies

Frostbite

Frostbite occurs when temperatures drop below freezing. Tissue is damaged in two ways: (1) actual tissue freezing, which results in the formation of ice crystals between the tissue cells; the ice crystals enlarge by extracting water from the cells, and (2) the obstruction of blood supply to the tissues; this causes “sludged” blood clots, which prevent blood from flowing to the tissues. The second way injures more than the freezing does.

Frostbite mainly affects the feet, hands, ears, and nose. These areas do not contain large heat-producing muscles and are some distance from the heat generation sources. Moreover, when the body conserves heat, the blood supply diminishes in these areas first. The most severe consequences of frostbite are gangrene and amputation. Some people are more prone to frostbite than others. Victims may also suffer from hypothermia.

Frostnip happens after long cold exposure but is not a serious problem. The condition is not usually painful. The skin becomes white or pale. First aid for frostnip consists of gently warming the affected area. This can be done with bare hands or by blowing warm air on the area.

Signs and Symptoms (Classified by Thawing)

Types Based on the Pre-Thaw Stage

Superficial

- Skin color is white or grayish-yellow
- Pain may occur early and later subside
- Affected part may feel only very cold and numb. There may be a tingling, stinging, or aching sensation.
- Skin surface will feel hard or crusty and underlying tissue soft when depressed gently and firmly.



Deep

- Affected part feels hard, solid, and cannot be depressed.
- Blisters appear in 12 to 36 hours.
- Affected part is cold with pale, waxy skin.
- A painfully cold part suddenly stops hurting.

Types Based on the Post-Thaw Stage

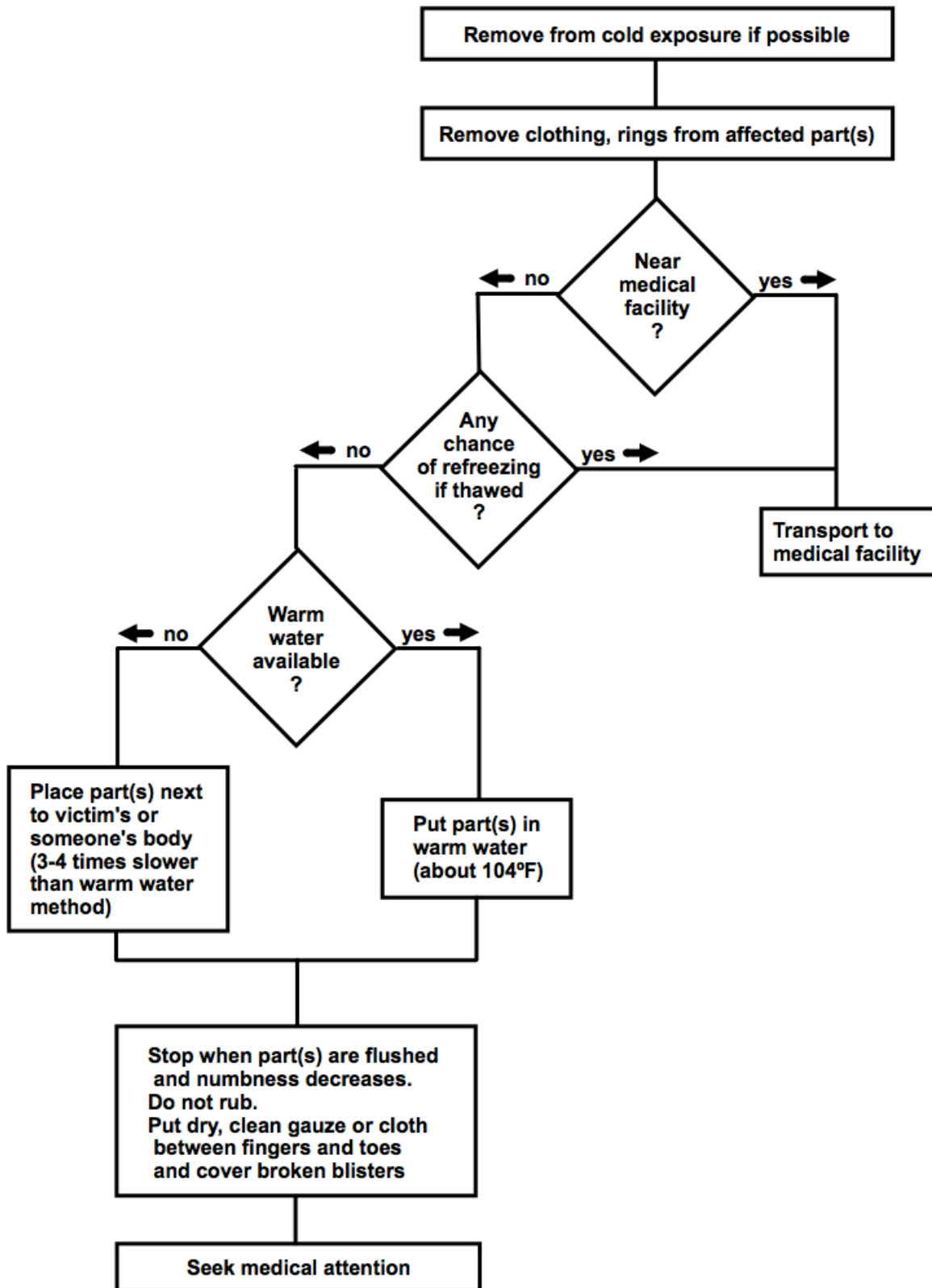
After a part has thawed, frostbite can be categorized into degrees similar to the classification of burns. First-degree frostbite is superficial, while the other three are degrees of deep frostbite.

- **First-degree frostbite.** Affected part is warm, swollen, and tender.
- **Second-degree frostbite.** Blisters form within minutes to hours after thawing and enlarge over several days.
- **Third-degree frostbite.** Blisters are small, and contain reddish-blue or purplish fluid. Surrounding skin may have a red or blue color and may not blanch when pressure is applied.
- **Fourth-degree frostbite.** No blisters or swelling occurs. The part remains numb, cold, white-to-dark-purple in color.

First Aid

All frostbite injuries follow the same first aid treatment. Seek medical attention immediately. Rewarming frostbitten parts seldom takes place

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outside of a medical facility because such facilities are usually nearby. However, if in a remote situation, the *wet, rapid rewarming method* may be used and is preferred to slow rewarming since the latter is associated with greater tissue damage.

Rapid Rewarming

- Do *not* attempt rewarming if a medical facility is nearby or if there is any chance that the part may refreeze.
- Remove any clothing or constricting items that could impair blood circulation (e.g., rings).
- Put the frostbitten part(s) in warm (not hot) water. Measure the water temperature with a thermometer. The water temperature should be 102-106°F. If you do not have a thermometer, test the water by pouring some water over the inside of your arm. Maintain the water temperature by adding warm water as needed.
- Warming usually takes 20 to 40 minutes and should be continued until the tissues are soft and pliable.
- For ear or facial injuries, apply warm moist cloths and change them frequently.
- To help control pain during the rewarming process, aspirin or acetaminophen may be given.

Post-Care

- Treat victim as a “stretcher” case.
- Maintain total body warmth.
- Protect injured part(s) from direct contact with clothing, bedding, etc.
- Leave any blisters intact.
- Place dry, sterile gauze between toes and fingers to absorb moisture and avoid having them stick together

- Slightly elevate the affected part to reduce pain and swelling.
- Keep both the victim and affected part as warm as possible without overheating.

Cautions

- Do *not* allow the victim to walk on frostbitten toes or feet, especially after rewarming.
- Do *not* use water hotter than 106°F since burns can result.
- Do *not* break any blister that may have formed.
- Do *not* rub the part even with snow.
- Do *not* rewarm the part with a heating pad, hot-water bottle, sunlamp, stove, radiator, exhaust pipe, or over a fire since this produces excessive temperatures and cannot be controlled, thus resulting in burns.
- Do *not* allow the victim to drink alcoholic beverages because they dilate blood vessels and cause a loss of body heat.
- Do *not* allow the victim to smoke since smoking constricts blood vessels, thus impairing circulation.
- Do *not* allow the thawed part to refreeze since ice crystals formed will be larger and more damaging.
- Unless circumstances justify its use (i.e., lack of water or fuel to warm water), do *not* use the “dry, rapid rewarming” technique (putting victim’s hands in armpits) since it takes three to four times longer than the wet method to thaw frozen tissue and slow rewarming results in greater tissue damage than rapid rewarming.



Hypothermia

Hypothermia results from a cooling of the body's core temperature. Hypothermia can occur at temperatures above freezing as well as below it. The victim may suffer frostbite as well, if the body loses more heat than it produces. If the body temperature falls to 80°F, most people die. Hypothermia does not result from outdoor exposure alone. It is also caused by cool indoor temperatures.

Types of Exposure

1. **Acute exposure** occurs when the victim loses body heat very rapidly, usually in water immersion. Acute exposure is considered to be six hours or less in duration.
2. **Subacute exposure** occurs when exposure is six to 24 hours, and can be either a land based or water immersion experience.

3. **Chronic exposure** involves long-term cooling. It generally occurs on land when exposure exceeds 24 hours.

Types of Hypothermia

A victim's core body temperature determines the type of hypothermia. To take the temperature, you need a low-reading thermometer, not the standard rectal thermometer, which is calibrated from 94 to 108°F. The recommended type is a rectal thermometer capable of reading temperatures between 84 to 108°F. These thermometers are hard to find.

1. **Mild** (above 90°F). Shivering, slurred speech, memory lapses, and fumbling hands. Victims frequently stumble and stagger. They are usually conscious and can talk. While many people suffer cold hands and feet, victims of mild hypothermia experience cold abdomens and backs.

How Cold Is It?

In addition to coldness, two other factors account for body heat loss: moisture and wind. Moisture— whether from rain, snow, or perspiration—speeds the conduction of heat away from the body.

Wind causes sizable amounts of body heat loss. If the thermometer reads 20°F and the wind speed is 20 mph, the exposure is comparable to -10°F. This is called the wind-chill factor. A rough measure of wind speed is: If you feel the wind on your face, the speed is about 10 mph; if

small branches move or dust or snow is raised, 20 mph; if large branches are moving, 30 mph; and if whole tree bends, about 40 mph.

Determine the wind-chill factor by:

1. Estimating the wind speed by checking for the signs described above.
2. Looking at a thermometer reading (in degrees Fahrenheit) outdoors.
3. Determining the wind chill factor by matching the estimated wind speed with the actual thermometer reading in the wind-chill table.

U.S. Customary Wind Chill Chart												
Estimated Wind Speed in MPH	Actual Thermometer Reading (F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Temperature (F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-21	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-36	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-124
25	30	16	0	-15	-29	-44	-59	-74	-88	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-125	-140
35	27	11	-4	-20	-35	-49	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect)	LITTLE DANGER* (for properly clothed person)			INCREASED DANGER* (for properly clothed person)				GREAT DANGER*				
*DANGER FROM FREEZING OF EXPOSED FLESH												

2. **Profound** (below 90°F). Shivering has stopped. Muscles may become stiff and rigid, similar to rigor mortis. The victim's skin has a blue appearance and doesn't respond to pain. Pulse and respiration slow down, and pupils dilate. The victim appears to be dead. Fifty to 80 percent of all profound hypothermic victims die.

First Aid

1. General Suggestions

Stop further heat loss by doing the following:

- Get the victim out of the cold environment.
- Have a source of heat (e.g., stove, fire).
- Add insulation beneath and around the victim. Cover the victim's head since 50

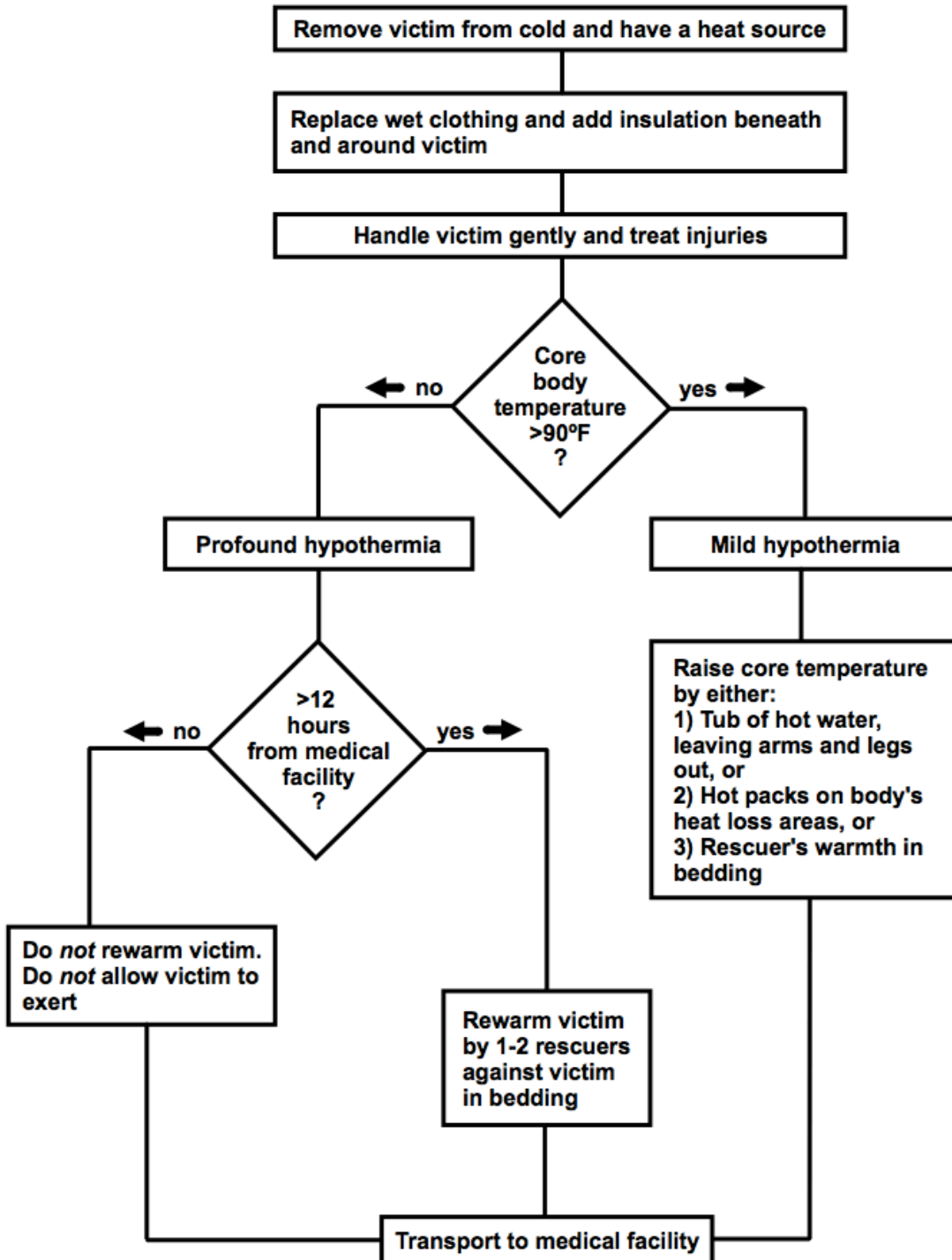
If a Blizzard Traps You While You Are Driving

- Don't panic.
- Stay in your vehicle. Do not attempt to walk out of a blizzard. Disorientation comes quickly in blowing and drifting snow. Being lost in open country during a blizzard is almost certain death. You are more likely to be found, and more likely to be sheltered, in your car.
- Avoid overexertion and exposure. Exertion from attempting to push your car, shovel heavy drifts, and perform other difficult chores during the strong winds, blinding snow, and bitter cold of a blizzard may cause a heart attack—even for persons in apparently good physical condition.
- Keep fresh air in your car. Freezing, wet snow and wind-driven snow can completely seal the passenger compartment, causing suffocation.
- Beware the gentle killers: carbon monoxide and oxygen starvation. Run the motor and heater sparingly, and only with the downwind window open for ventilation.
- Keep watch. Do not permit all occupants the car to sleep at one time.
- Exercise by clasp hands and moving arms and legs vigorously from time to time, and do not stay in one position for long.
- Turn on your car's dome light at night to make the vehicle visible to work crews.

Winter Wardrobe

	Advantages	Disadvantages	Wear In
Wool	Stretches without damage; insulates well even when wet	Heavy weight; absorbs moisture; may irritate skin	Layer 1, 2, or 3
Cotton	Comfortable and lightweight	Absorbs moisture	Layer 1 (for inactive people) or 2
Silk	Extremely lightweight and durable; very good insulator; washes well	More expensive; does not transfer moisture quickly	Layer 1
Polypropylene	Lightweight; transfers moisture quickly and dries quickly	Does not insulate well; low melting point; surface may pill up	Layer 1 or 2 (for active people)
Down	Durable, lightweight; most effective insulator by weight	Expensive; loses insulative quality when wet; difficult to dry	Layer 2 or 3 (especially in dry, extreme cold)
Nylon	Lightweight, wind- and water-resistant; durable	May not allow perspiration to evaporate; low melting point; flammable	Layer 3
Synthetic Polyester Insulation	Does not absorb moisture, therefore insulates even when wet	Heavier than down; does not compress as well	Layer 2 or 3 (especially in wet weather)

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percent of the body's heat loss is through the head.

- d. Replace wet clothing with dry clothing.
 - e. Handle the victim gently.
 - f. Treat any injuries.
2. Mild Hypothermia (core temperature above 90°F)
Raise core temperature by one of the following means available:
- a. Use a tub of hot water (no greater than 106°F) or electric blanket. *Leave victim's arms and legs out.*
 - b. Place hot packs against the body's areas of high heat loss (e.g., head, neck, chest, and groin). Do not burn the victim.
 - c. Have a rescuer lie trunk to trunk with the victim in a sleeping bag.
3. Profound Hypothermia (core temperature below 90°F)
- a. Do *not* rewarm the victim if he or she can be transported within 12 hours. Keep the victim from getting colder.
 - b. Do *not* jostle or jolt the victim during transportation.
 - c. *Avoid* CPR unless the victim has no pulse. Start CPR immediately in near-drowning cases. Pulses are difficult to detect so take a full minute to check them. CPR could actually induce cardiac arrest. Once CPR is begun, it should be continued until arrival at a medical facility. Hypothermic victims have survived after long-term CPR (unlike those with cardiac arrest from other causes).

Warm drinks have no warming effect and contain little energy. Warm drinks send a message to the brain to send more blood to the skin. Dilation of the skin's blood vessels produces a warm feeling and some heat loss since the capillaries are dilated.

Avoid cardiac arrest by observing the following guidelines:

- *Never* allow the victim to physically exert himself (i.e., no walking, climbing, etc.)
- Make *no* attempt to rapidly rewarm a profound hypothermic victim outside of a medical facility. Most circumstances require no rewarming attempts at all.
- Handle a profound hypothermic victim as carefully and gently as though every arm and leg were broken.

Cautions

- Do *not* put an unconscious victim in a bathtub.
- Do *not* give the unconscious victim anything to drink.
- Do *not* give the victim alcohol.
- Do *not* attempt to rewarm the body by rubbing the arms and legs.
- Do *not* allow the victim to move about, walk, or struggle.
- Do *not* wrap a victim in a blanket without another source of heat unless it is to protect the victim against further heat loss since such victims cannot generate sufficient heat to rewarm themselves, and blankets insulate them from the warm environment.
- Do *not* stop resuscitative attempts until the victim has been rewarmed and preferably evaluated at a medical facility.
- Do *not* rewarm the victim outside of a medical facility if he or she can be transported within 12 hours. Victims can be hypothermic for long periods of time and still recover.
- Do *not* give CPR unless the victim is pulseless. Use CPR in cases of drowning. Monitor pulse for a full minute.
- Do *not* rewarm extremities and body core (chest, abdomen) at the same time.

Guidelines to Avoid Hypothermia

- Dress appropriately. Wear a hat. Major heat loss occurs through the scalp.
- Stay dry. Wet clothes lose their insulating value and water robs heat faster than air at the same temperature.
- Beware the wind. A slight breeze carries heat away from the skin faster than motionless air.
- Never ignore shivering. Seek help.

Lowest Body Temperature

There are three recorded cases of people who survived body temperatures as low as 60.8°F. Dorothy Mae Stevens was found in an alley in Chicago on February 1, 1951. Vickie Mary David of Milwaukee, Wisconsin, at age 2 years, 1 month was admitted to the Evangelical Hospital, Marshalltown, Iowa, January 21, 1956, after having been found unconscious on the floor of an unheated house. Michael Trode, aged 2, was found in the snow near his home in Milwaukee, Wisconsin, on January 19, 1985. All three had a temperature of 60.8°F when found. People may die of hypothermia with body temperatures of 95°F.