regardless of training and experience, if sharing it with others does not relieve their accumulated emotional stress. To ensure the emotional health of rescuers, established preventive or therapeutic programs are essential. The following is an example of such a program:

- Within 24 hours after a rescue, team members should engage in vigorous exercise to relieve tension and achieve greater muscular relaxation.
- Within 24 to 72 hours after a stressful rescue, a mandatory "emotional debriefing" should be held for the entire team. Effective sessions require an hour or more and promote expression and sharing of emotional reactions to the rescue, specifically the pain, sadness, terror, guilt, or feelings of helplessness experienced by each in different ways. These emotions must be expressed and accepted without shame or embarrassment. The participants must be encouraged to share their humanity and support each other.
- The sessions must be entirely nonjudgmental. There can be no right or wrong, correct or incorrect, as long as emotions did not interfere with the rescue. To ensure absolute confidentiality, no records should be kept.

Although some groups can manage this process quite well by themselves, such sessions frequently are more effective when guided by someone experienced in stress management and not directly involved in the rescue. Completely resolving the stress may require more than one meeting, but all meetings should be conducted as close to the event as possible, preferably within three days. Delays of a week or more increase the risk of converting early, tenuous emotional reactions into entrenched, chronic disorders. The debriefing must be conducted without any alcohol or other drugs; to maximize the benefits, the minds of all must be fully functional.

Rescuers must realize that stress overload is virtually inevitable, regardless of training and experience, if sharing it with others does not relieve their accumulated emotional stress.

After debriefing, rescuers must eat and rest well, rounding out the recovery of the entire organism. Only after physical and emotional recovery has been assured should the rescue team critique the rescue objectively, learning from successes as well as mistakes, and planning for the future.

Posttraumatic Stress Disorder

If rescuers do not work through their normal reactions, they risk developing a more severe abnormality, posttraumatic stress disorder (PTSD). This condition has been repeatedly described and, depending on its origin, has been given widely varying names that include accident neurosis, shell shock, traumatic neurosis, combat fatigue, combat exhaustion, post-Vietnam syndrome, and neurasthenia. The term "posttraumatic stress disorder" unites these conditions under one label. The features of PTSD are:

- The individual has undergone a recognizable stressful experience that would evoke significant symptoms of distress in almost everyone.
- The individual reexperiences the event in one or more ways:
  - ✓ Recurrent and intrusive recollections
  - ✓ Recurrent dreams of the event
  - ✓ Sudden acting or feeling as if the traumatic event were recurring due to the stimulus of an environment or thought associated with the event
- The individual has numbed responsiveness to or reduced involvement with the external world that began some time after the event and is manifested by one or more of the following:
  - ✓ Markedly diminished interest in one or more significant activities
  - ✓ Feeling of detachment or estrangement from others
  - ✓ Constricted affect
- The individual usually has two or more of the following symptoms that were not present before the event:
  - ✓ Hyper-alertness or exaggerated "startle" response
  - ✓ Sleep disturbances
  - ✓ Guilt about surviving when others have not, or about the behavior required for survival
  - ✓ Memory impairment or difficulty concentrating
  - ✓ Avoidance of activities that arouse recollections of the traumatic event
  - ✓ Intensification of symptoms by ex-posure to events that symbolize or resemble the traumatic event

PTSD has been sub-classified as: acute when symptoms appear within 6 months of the trauma and last less than 6 months; chronic when symptoms appear within 6 months and last longer than 6 months; and delayed when symptoms appear 6 months or more after the trauma.

Diagnostic studies suggest that with sufficient unrelieved stress, anyone would develop a posttraumatic stress disorder. Vietnam veterans who developed this disorder shared five characteristics that correlate with experiences of wilderness rescuers:

Stress Sources for Vietnam Veterans and Wilderness Rescuers

Vietnam Veterans	Wilderness Rescuers
A positive attitude toward the war before engaging in combat	Unrealistic expectations
A high level of combat exposure	A high level of exposure to hazardous terrain or weather, and to massive trauma
Immediate separation from the military service upon returning to the United States	Infrequent opportunities to share emotions; "suffering in silence"
A negative perception of family helpfulness upon returning home	Lack of support or appreciation
A feeling that forces beyond their control were directing the course of their lives	Feeling that uncontrollable factors such as weather, timing, inadequate personnel or equipment, communication failures, or accidents involving members of the rescue group have determined the outcome of the rescue

Treating PTSD is the province of professional therapists. Recognizing stressful events, taking measures to relieve the emotional pressures they engender, and recognizing the symptoms of emotional disorders are certainly within the abilities of rescuers and their friends and should be the responsibility of their leaders.

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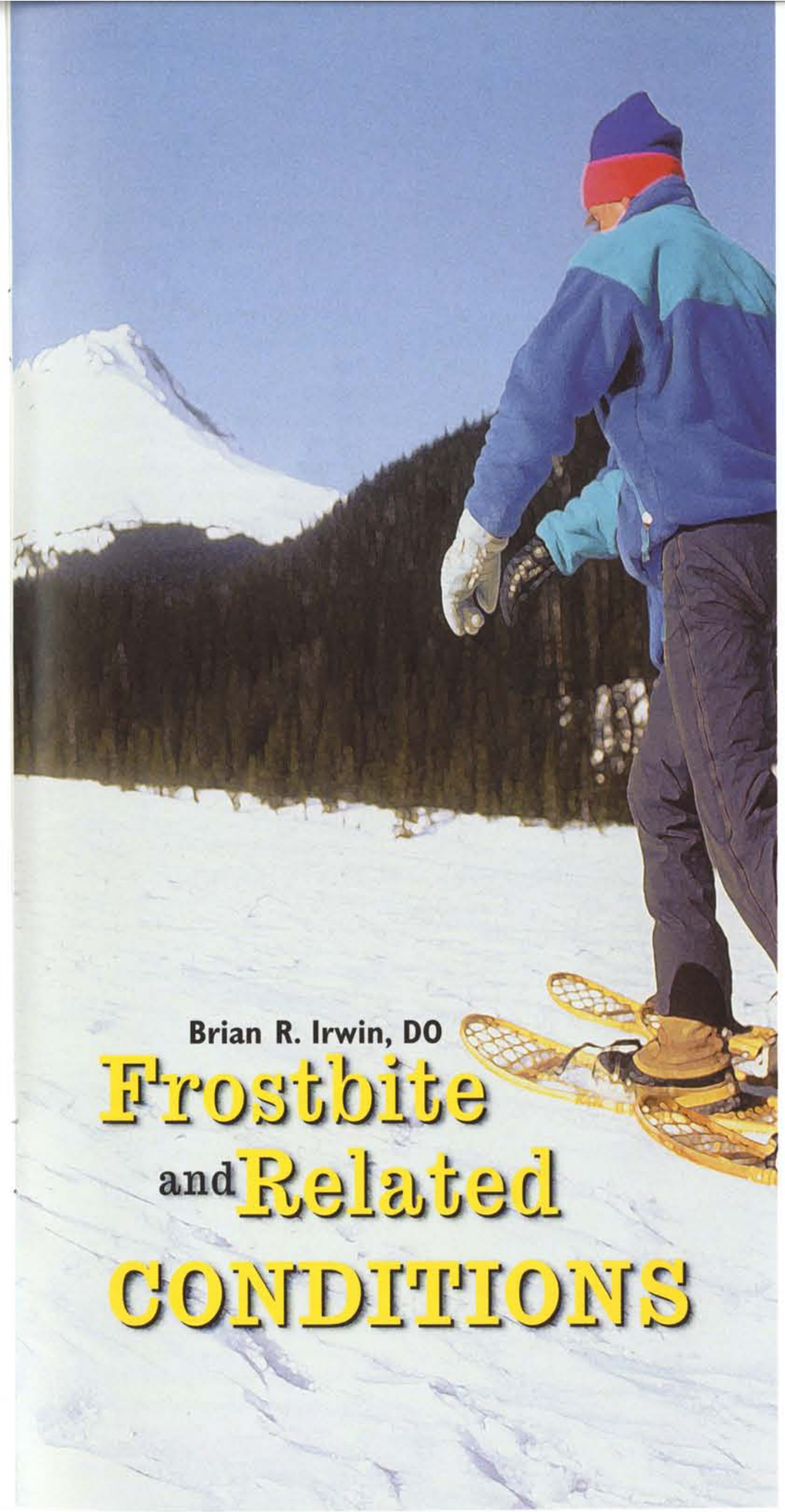

Humans are very efficient at maintaining a constant body temperature. When hot we seek out cool places, fan ourselves, anything to make ourselves more comfortable. An increase in core body temperature also triggers a series of physiologic changes to dump excess core heat and maintain a normothermic body temperature. To shed excess heat we dilate our peripheral vasculature, allowing us to pump as much blood to vessels closest to the air as possible. Body heat is thus transferred, by conduction, from a warm body to relatively cold air. Convection, or the loss of heat by any flowing medium over the skin (usually wind, but may be water) also contributes a great deal to heat dissipation.

In cold weather the response is opposite to tha in excess-heat states. We undergo peripheral vasoconstriction to avoid losing valuable heat through the aforementioned mechanisms. At a normal body temperature, we perfuse 250ML of blood/min to peripheral tissues. At cold temperatures, this drops to less than 50ML/min. To avoid tissue death from prolonged exposure to cold, a poorly understood "hunting response" occurs in which peripheral vessels dilate at 5 – 10 minute cycles to perfuse the extremities. Eskimos have been shown to have a particularly strong hunting response. Regardless of these protective measures, the combination of cold air, vasoconstriction, and other heat-robbing mechanisms lead to tissue heat loss. When the tissue temperature falls below 0° C (32°F) frostbite ensues.

Before tissue freezing takes place, sensation is lost and skin becomes blanched, due to vasoconstriction. Initially this takes place only at the level of the skin. This is rapidly reversed with rewarming and no long-term sequelae occur. Some refer to this as 1st degree frostbite but since no tissue damage occurs this is a misnomer. Rather it should be called by its commonly known name, frostnip. This is very common; most active people have had frostnip at some point in their lives. Skiers, bikers, and runners usually get it on their nose, ears and cheeks; in runners particularly, the scrotum and penis are other vulnerable areas.

When skin temperature reaches about 10° C (50° F), capillaries become "leaky" secondary to intense constriction, vessel damage and the release of inflammatory mediators. Capillary

tem becomes poor. This is the transition between the prefreeze and the freeze-thaw stage. When skin temperature reaches -4° C (25° F), ice crystals form. Initially the symptoms are the same as frostnip: numbness, tingling, and blanching. However, the skin looks "waxier" at this stage. Ice formation is the hallmark of true frostbite. Freezing leads to either cell collapse (if freezing is slow and ice forms on the outside of the cells, in the interstitial space) or cell expansion and membrane rupture (if freezing is fast and ice forms intracellularly). Rapid rewarming is the treatment for this stage too, which we call 2nd degree, or superficial frostbite.

When skin temperature reaches -4° C (25° F), ice crystals form. Ice formation is the hallmark of true frostbite.

Some authors define 2nd degree frostbite as that with vesicles and bullae, and 1st degree frostbite as that where erythema is present without vesicles or bullae. Others refer to frostnip as 1st degree frostbite and the early freezing stage as 2nd degree frostbite. Clinically this differentiation is unimportant, as treatment is the same. Rapid rewarming in 37 – 40° C (99° – 104° F) water until circulation returns is the cornerstone of therapy. This usually takes 20 – 30 minutes. Most experts now prefer water just above body temperature, since this causes less pain. Water temperature over 44.5° C (112° F) can cause tissue injury at margins and should be avoided. As you rewarm, expect the patient to experience significant pain. Extravasation of fluid and inflammatory mediators (thromboxane and prostaglandins) into superficial and subcutaneous tissue leads to rubor, a burning sensation and pain, both during and after rewarming. Analgesia is important and will often require ôpiates.

If freezing extends to deep tissues, including muscles, tendons, and bone it is referred to as deep frostbite. In deep frostbite severe muscle involvement and possible necrosis is possible. Creatine phosphokinase levels should be drawn to rule out rhabdomyolysis. Serum potassium levels should be obtained, as hyperkalemia from liberated cell contents is possible. Renal status needs to be monitored and aggressive intravenous hydration should be initiated to maintain a strong urine output. If urine output is poor, some experts advocate adding bicarbonate to IV fluids to alkalanize the urine (protecting renal function in the face of rhabdomyolysis). X-ray evaluation of the affected area should be performed after 5 – 7 days to assess possible bone necrosis. If the X-ray is negative but clinical suspicion is high, a repeat X-ray or bone scan is indicated.

Controversy exists as to how frostbite should be managed in the wilderness setting. In the field, frostbite should be treated based on the situation. Consensus suggests that providers should rewarm a frozen limb only if they can be sure it will not refreeze. Studies have shown clearly that tissue damage is much greater if there is a freeze-thaw-refreeze cycle than one freeze-thaw cycle. However, it has also been suggested that severity of tissue damage is directly related to the time it is frozen. If a limb is frozen in a remote area and it will take 3 weeks to get to the closest medical facility, then it becomes clear that thawing of the extremity should be done in the field, since waiting will ensure amputation. However, if the distance is only 8 hours to the car and you fear the area may become refrozen during evacuation, one might choose to delay thawing until evacuation is complete.

It has been argued that ambulating on a frozen limb worsens tissue damage, but the provider must carefully balance this against the complications of field rewarming. A frozen limb is a painless limb; after thawing you may convert an 8-hour hike-out into a 3-day litter-carry requiring 10 rescuers and, possibly, subjecting both the rescuers and the victim to hypothermia. Which represents greater overall danger for the patient and the rescue party?

To thaw a frostbitten area, ideally one should use sterile or at least clean water. In the hospital, an antiseptic skin cleanser, such as Betadine, should be added to that water, especially if there is any violation or damage to the skin. These modalities may be impossible to offer in the wilderness setting. Lack of proper analgesia and protection from refreezing makes many field thawing situations unrealistic.

The management of vesicles and bullae is controversial. Should they be drained? Serous fluid from frostbite vesicles has been analyzed and found to contain thromboxane, prostaglandins, and other inflammatory mediators. These factors have been shown in vitro to cause tissue damage. Theory would suggest that minimizing contact with these mediators should be beneficial, but drainage may introduce bacteria and induce infection. Most providers do not drain vesicles or bullae. However, if these are in a location where they are likely to rupture on their own through daily activities (i.e., the heels, toes, or fingers), some feel these should be drained under sterile conditions so contamination of the underlying tissue can be minimized.

Should antibiotics be prescribed as prophylaxis against skin infection in frostbite? While some centers use antibiotics routinely, most defer and rely instead on meticulous wound care and twice-daily whirlpool therapy to gently remove necrotic tissue. Antibiotics can be started if the frostbitten area becomes infected. If started, antibiotics should cover gram positive bacteria (skin flora), pseudomonas, and, in some cases, anaerobes. Frequently, infection will mandate prompt amputation of frostbitten tissue. Tetanus status must be updated in all frostbite cases with skin violation.

Initially, it may be hard to tell live from dead tissue. Even during the first few weeks, blackened skin may overlie healthy tissue. Damaged skin will eventually heal and a clear line of demarcation between viable and dead skin will become clear. This process can take up to three months. Only at that time should amputation be considered, as removal of any tissue prior to this "autoamputation" may result in the errant removal of viable tissue.

Two other cold-induced skin injuries deserve mention. Chilblains, also called pernio, is a condition caused by non-freezing, often repetitive, cooling of the skin and resultant vasospasm. This leads to microvasculitis in small, localized areas. Pruritis, redness, and pain are present at first. If the injury has been severe enough, blue patches, nodules, and even ulceration can occur. Because of the chronic vasoconstrictive mechanism, patients with Raynaud's disease are particularly at risk. Prophylaxis with calcium channel blockers is indicated in cases of severe Raynaud's disease and may help prevent the development of chilblains.

Another cold-induced skin condition, one which is probably underdiagnosed, is immersion foot or trench foot. Rather than chronic, repetitive intense vasoconstriction, longstanding, mild vasoconstriction with associated convective and conductive heat loss occurs. It is caused by long exposure to cold, damp environments, and typically affects the feet. The condition came into prominence in World War I among soldiers who spent days at a time in wet, cold conditions during trench warfare. But conditions do not need to be very cold and exposure does not need to be long. Trench foot occurs after exposure to water as warm as 10° C (50° F) and in time as short as 10 – 12 hours. Today trench foot is sometimes seen in people who wear impermeable footwear designed for cold, wet conditions, such as vapor barrier liners (neoprene socks), plastic mountaineering boots and rubber "duck" shoes.

In immersion foot, slow, constant release of inflammatory mediators leads to deep skin damage. The feet are waxy, mottled, cool, and doughy. After rewarming they burn somewhat and are painful. In severe cases vesicles or bullae may form. Treatment involves the same watchful waiting as frostbite injuries. The ecchymotic demarcation line of tissue damage will slowly recede. In the majority of cases, the skin heals completely, but in rare cases necrosis can occur. Unfortunately, severe neuromuscular damage can occur and long-term Raynaud's disease is common.

Although controversy exists over the management of frostbite and related conditions, the principles of treatment are fairly straightforward. Both in the field and in the hospital setting, correct management and care of these conditions can significantly improve morbidity and improve quality of life. Proper diagnosis of rewarming and support of cold-damaged skin conditions is an essential skill for all wilderness medicine providers.

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Spending a Night in YOUR VEHICLE

Peter Kummerfeldt

It's that time of year again, the time to check out your vehicle's survival kit or assemble one if you haven't done so in the past. Anyone who drives faces the possibility of spending an unplanned night in a vehicle. Bad weather, breakdowns, running out of fuel, and getting stuck are some of the more common reasons why a driver might have to bed down for the night (or perhaps for several nights) until the situation is resolved.

Dress to survive, not just to arrive!

A night out does not have to be a life threatening experience. Drivers who accept the possibility that the unforeseen may happen are drivers that prepare in advance for the experience. On the other hand, those drivers that deny the possibility may find themselves fighting for their lives until rescue arrives.

Preparation

Assembling a survival kit is the first step and, as with any survival kit, the contents should be selected based on personal needs, the season, and the geographic location. (See the list on page 9 for recommended equipment.) If you become stranded you'll be glad you took the time to put together an emergency kit. In addition to the kit you should also evaluate the effectiveness of the clothing you are wearing to keep you warm in a cold vehicle. Most people dress to arrive at a destination and not to survive a night out. The reverse would be more appropriate: "Dress to survive, not just to arrive!" When traveling with others don't forget to provide sufficient supplies for the additional people as well. Preparation also involves ensuring that your vehicle is ready for winter travel. Never set out in stormy conditions without a full tank of gas, a good battery, proper tires, a heater and exhaust system in good working condition, good anti-freeze and a good dose of common sense.

You're Stuck!

If you do get trapped by a blizzard or severe snow storm—don't panic! Stay with your car and use your survival kit. Your vehicle makes a good shelter and an effective signal – don't leave it. In your car you are warm (warmer than being outside), dry, and protected from the weather. Trying to dig yourself out or attempting to walk to help can be fatal. Sit tight – let the rescuers come to you! Move all of your equipment and any other emergency gear into the passenger compartment.

Sheltering Your Vehicle

While sitting out a storm you must use your resources sparingly—you don't know how long you'll be there. While the car will cut the wind and keep you dry, you will need to keep the interior warm. The heat your body produces is