

First Aid

Basic Field First Aid Manual

This First Aid Manual describes some of the medical issues that may be encountered in an Antarctic field environment. This is not an exhaustive manual, but it will serve as a guide to those with limited medical background to help treat their companions. It should be read in advance to help field team members recognize dangerous situations and help prevent injuries from occurring or becoming more serious if they do occur.

Antarctica is an inherently risky environment. Participants are often dehydrated, mildly hypothermic, and sleep deprived. This can lead to an increase in accidents. It is essential that all team members slow down, assess each task, and ensure the safety of the team.

There are a variety of medical kits provided to teams depending on their activities, locations and needs. Team members should familiarize themselves with the contents of the the kit – before there is a need to use it.

Hygiene

Occasionally, people deploying to the deep field use the remote environment as an excuse to abstain from normal hygiene and sanitation. Extreme cold temperatures, lack of running water, and communal living make bathing, brushing teeth, and basic hygiene a chore.

People must continue with a normal hygiene routine to avoid painful and distracting issues that can occur in the absence of cleanliness, such as dental abscesses, gum pain, yeast infections, skin rashes, cracked skin, and trench foot.

Wet-wipe and sponge baths are the norm. If wet wipes are preferred, personnel should bring enough for the anticipated time in the field. Blanket partitions can be set up in large tents to create a semi-private space.

Sprains and Strains

Sprains and strains are the most common injuries in Antarctica. People must work carefully, thoughtfully, and deliberately to avoid them. A sprain is an injury that involves tearing the ligaments that help keep joints intact. A strain involves overstretching a muscle.

Sprain and Strain Signs and Symptoms

Sprains and strains will manifest as pain at the site of the injury that may radiate outward. There will also be swelling and discoloration.

Sprain and Strain Treatment

- R** Rest: Stop activity, make the patient comfortable, and set up shelter if necessary.
- I** Ice: Cool down the affected area with water, snow, or ice for approximately 15 minutes. Don't apply directly to the skin.
- C** Compression: Wrap the affected area with an elastic bandage.
- E** Elevation: Keep the affected limb raised to reduce swelling.

Immobilize the Joint

Fingers: Wrap them together.

Wrist: Splint it if it is very swollen. If not swollen, or when the swelling subsides, bandage it from the palm to the elbow, including the thumb, with an elastic (ACE™) bandage. The patient should exercise the fingers, elbow and shoulder regularly.

Knee: If it is very swollen, suspect a more serious injury. With the knee as straight as possible, wrap a thick layer of cotton wool around the leg from mid-calf to mid-thigh and then apply an elastic bandage.

Ankle: The foot must be kept at a right angle to the leg. Remove the boot. Using an elastic or tape bandage, bandage the foot from the toes to just below the knee, keeping the foot up and covering all the skin. If the ankle is very swollen, especially on both sides, then a more severe injury should be suspected.

Caution: Do not wrap bandages too tightly. Toes must remain warm and pink and have feeling.

Bleeding and Wounds

Treatment of External Bleeding

Check the wound for foreign bodies, while being careful not to disturb any clots. If no foreign object is seen, apply direct pressure over the wound with your fingers, palm, or whatever is necessary to cover the wound, attempting to hold the edges of the wound together. This may be maintained by using Steri-strips® or tape. Place a sterile-dressing pad over the wound, ensuring that the edges of the pad

extend well beyond the edges of the wound. Secure the pad with a bandage.

If bleeding is not controlled by the first dressing, then apply another dressing on top. Do not remove the previous dressing before applying the second, as this might destroy any clotting that has occurred. If the bleeding is from a limb and no fracture is suspected, the limb should be elevated and supported.

Foreign Bodies

If foreign bodies are present on the surface of the wound, carefully remove them if they can be wiped off easily with a swab. If a large foreign body is embedded, never attempt to remove it. It may be plugging the wound and restricting bleeding. Moreover, the surrounding tissues may be injured further if it is pulled out. If the embedded foreign object is too tall to cover, place rolled up dressings on either side of it. Secure the dressing(s) with a bandage.

Treatment of Wounds

Clean all wounds with Betadine® antiseptic liquid and apply a sterile dressing. Small wounds can be taped together with Steri-strips® or Band-Aids®. Dry the edges of the wound, squeeze together, and stick the Band-Aid® across the wound. Several may be needed to hold the cut together. Apply a sterile dressing over the top and bandage it. If a serious infection is indicated, advise medical personnel as soon as possible. Infection may be present if there is increasing pain, swelling, redness, and/or fever.

Carbon Monoxide Poisoning

Carbon monoxide (CO) can be produced by burning anything containing carbon, including fuel in open flames, gas cookers, or engines. CO poisons by attaching itself to the hemoglobin in the blood. It does so about 200 times more readily than oxygen, easily displacing inhaled oxygen. When enough hemoglobin is compromised, the remainder cannot carry sufficient oxygen to the rest of the body. Oxygen starvation of the brain will cause permanent damage, even if the patient is revived. Furthermore, the toxicity of CO increases with altitude.

Carbon Monoxide Signs and Symptoms

Often there are none. However, the following may occur:

- Slight headache
- Shortness of breath
- Panting
- Confusion
- Nausea
- Chest pains
- Dimming of vision
- Feelings of exhilaration or lassitude
- Dizziness
- Excessive yawning
- Ringing in the ears

In latter stages, the patient's skin color becomes pink to cherry red, though the red and yellow polar tents will make it difficult to notice any skin color change. Unconsciousness and death is often rapid.

Carbon Monoxide Treatment

If carbon monoxide poisoning is suspected:

- Immediately move the patient to fresh air or to an uncontaminated tent.
- Provide the patient with 100% oxygen, if available.
- Contact Medical and describe the incident and symptoms.
- Keep the patient quiet and resting for at least eight hours. Early exertion may cause cardiac arrest.
- If breathing stops, commence cardio-pulmonary resuscitation (CPR).

Carbon Monoxide Poisoning Prevention

Field parties must utilize the issued carbon monoxide detector. Team members must ensure there is adequate ventilation at all times in all buildings, shelters, and vehicles. Tents or other shelters must be thoroughly ventilated during cooking and before personnel bed down each night.

Hypothermia

Hypothermia occurs when a person's core temperature is reduced to a level where normal brain and body functions are impaired. Hypothermia progressively affects a person's judgment, perception, and coordination.

Wind greatly increases the chilling effect of cold. The faster the air

moves, the more heat it can drag away. This is wind chill. The cooling effects of air can be seen by referring to the wind chill chart in the reference section.

Wet clothes, from sweating, marine dampness, or precipitation also cause chilling. Finally, fatigue reduces a person's ability to protect himself or herself, and it diminishes the physiological capacity to thermoregulate and maintain a proper core temperature.

Hypothermia Prevention

Hypothermia is prevented by wearing the proper clothing and by supporting and regulating the body's heat production. Proper nutrition and hydration help prevent hypothermia, and adequate rest is critical. Exhaustion promotes the onset of hypothermia and precedes its development in almost all cases. The tendency to "press on" has led to many unnecessary deaths.

A layered clothing system should be employed, where layers can be added or removed as needed. Field team members should not allow themselves to get either cold or hot and sweaty.

Hypothermia Signs and Symptoms

Hypothermia manifests in three stages:

- **Mild:** This stage includes shivering and personality changes. A person may become withdrawn, apathetic, or irritable. There is a loss of fine motor control. Field party members should always be on the alert for a team member displaying the "umbles": stumbles, mumbles, fumbles, and grumbles.
- **Moderate:** At this stage, hypothermia progresses to violent shivering, altered mental states, and disorientation. Moderate hypothermia also manifests as a loss of gross motor skills, such as balance and coordination (ataxia).
- **Severe:** In this stage, shivering stops and the level of responsiveness drops. A person becomes unresponsive and may appear dead, with very slow and weak pulse and respiration rates. An individual will appear cold and blue, and he or she may have associated frostbite. Cardiac arrest is possible.

Hypothermia Treatment

The essential and immediate treatment for hypothermia is to prevent further heat loss by insulating the body. If any member of a field party shows signs of developing hypothermia, the individual must be

moved into shelter immediately.

Mild hypothermia may be turned around quickly. A person with this condition should be:

- Helped into additional clothing layers and fed quick-energy carbohydrates and warm, sweet drinks, such as hot chocolate or warm electrolyte beverages.
- Encouraged to run in place or perform another exercise.
- Provided dry clothes, if necessary, and external heat sources, such as hot pads or water bottles filled with warm fluid.

If moderate to severe hypothermia is suspected, contact Medical immediately. The patient should be placed in a hypothermia wrap, which is a bundle made of sleeping bags and reflective sheeting, with warm heat sources on the patient's neck, armpits and groin. (Body-to-body rewarming in a sleeping bag is of limited usefulness and may result in two cold people.)

Frostbite

Frostbite is freezing of body tissue. Areas most at risk are the extremities and exposed skin (ears, nose, face). Factors that lead to frostbite are:

- Previous frostbite injury
- Cold temperatures and wind
- High altitude
- Overexertion (fatigue and dehydration)
- Touching metal or super-cooled liquid fuel
- Poor circulation
- Constrictive clothing or footwear
- Underlying medical problems
- Hypothermia

Frostbite Prevention

Frostbite is almost always avoidable. A buddy system should be established to observe any whitening on the face or ears of a companion. If any whitening or tingling of the face, ears, feet, or hands occurs, these areas should be warmed immediately. Socks and boots should fit snugly, with no points of tightness. Liner gloves should be worn so that skin is never exposed when performing work that can't be done in heavy gloves.

Strenuous exercise should be avoided in extreme cold, particularly at high altitudes. Very cold air brought too rapidly into the lungs will chill the body's core. Perspiration under conditions of extreme cold should be avoided. Perspiration evaporates, chilling the body.

Plenty of food should be consumed to produce maximum output of body heat. Food items in cold weather should tend toward quick energy first, such as fats and carbohydrates, and then proteins. In addition, personnel should drink two to three liters of water per day to stay hydrated.

Avoid the following, which can promote the occurrence of frostbite:

- Smoking
- Alcohol
- Excessive coffee and tea drinking
- Excessive fatigue
- Improper or inadequate eating habits
- Unnecessary medication
- Exposure to fuel, especially on bare skin

Mild Frostbite Signs and Symptoms (pre-thaw)

There is an uncomfortable sensation of coldness, followed by numbness and skin anesthesia. In superficial frostbite (frost nip), the skin turns red, then pale or waxy-white. In partial thickness frostbite, the skin becomes cold and frozen on the surface, but remains soft and pliable when gently pressed.

Full-Thickness Frostbite Signs and Symptoms (pre-thaw)

The skin is waxy-white. Toes and fingers become solid (like a piece of chicken taken from the freezer). They feel wooden, and the skin cannot be rolled over the bone.

Full-Thickness Frostbite Signs and Symptoms (post-thaw)

The entire hand or foot swells, which limits the mobility of the injured toes or fingers. Blue, violet, or grey (the worst) discoloration appears. After two days, the patient suffers severe throbbing and shooting pains. Huge blisters form, usually between the third and seventh day. These usually dry up, blacken, and slough off, leaving an exceptionally sensitive thin, red layer of new skin.

Frostbite Treatment

Frostbite should not be rubbed, as this will cause additional tissue damage from the ice crystals within. Treatment in the field for any-

thing beyond superficial frostbite is full of challenges and additional risk for the patient. Prevention is paramount!

Superficial Frostbite Treatment (Frost Nip)

Superficial frostbite can be treated effectively in the field. If noticed promptly, it can usually be treated by the firm, steady (no rubbing) pressure of a warm hand or by blowing onto it with warm breath. Superficially frostbitten feet are best treated by removing the patient's footwear the moment there is any suspicion of danger and rewarming the feet immediately. After warming is complete, the affected feet should be covered with dry socks. If footwear is replaced, it should be done loosely to ensure adequate circulation and warmth is maintained.

Partial-Thickness Frostbite Treatment

Partial-thickness frostbite of a small body area should be reheated in water that is between 42°C and 43°C (107°F and 109°F). Water at higher temperatures can burn the skin. The injury should then be treated to prevent infection, bandaged for protection, and kept warm. Refreezing must be prevented, as this will cause major additional damage. Medical personnel should be consulted if necessary.

Full-Thickness Frostbite Treatment

Because of limited resources in the field, full-thickness frostbite is a major medical emergency. Medical personnel should be contacted immediately for consultation and to discuss evacuation plans. Rewarming should not be attempted in the field if there is any possibility that the affected part may become refrozen. In such cases, the affected part must be kept frozen until it can be re-warmed rapidly under controlled conditions.

If rewarming is recommended, remove jewelry (especially rings) if possible. Immerse the injured part in 42°C to 43°C (107°F to 109°F) water, continually adding water and stirring it to maintain a constant temperature, until the digital tips (ends of fingers or toes) turn pink or burgundy red. This takes approximately 20 minutes to one hour. When adding water, take care that the water is not more than 44°C and is not poured directly over the injured body part.

Significant pain, swelling, and blistering will develop after re-warming. Do not puncture the blisters, and do not allow the injury to re-freeze.

Protect the thawed injury with sterile, soft, fluffy dressings. Separate toes and fingers with cotton wool. Wrap the whole part lightly with

gauze bandages. Do not change dressings unless they get dirty, and never rub the skin. Keep the patient and the injured body part warm. Pain medication will be needed, and medical personnel will advise on specific type and dose. In addition:

- Elevate the injured limb(s)
- Commence antibiotic treatment, per medical personnel instruction
- Keep the patient absolutely still, lying down
- Evacuate to a medical facility as quickly as possible

Immersion Foot

Immersion foot, or trench foot, is a medical condition caused by prolonged exposure to cold, damp, and unsanitary conditions.

Immersion Foot Prevention

Feet should be kept warm and dry by wearing protective footwear, and they should be checked frequently during wet and cold conditions. Footwear should not be constrictive, and it should be cleaned and dried at every opportunity. In the field, extra pairs of dry socks should be carried next to the abdomen under the shirt. Wet socks can be dried by placing them next to the abdomen, either inside or outside the shirt.

If feet get wet, they should be dried as soon as possible. They can be warmed by the hands. Foot powder should be applied and dry socks put on. If it is necessary to wear wet socks and footwear for any length of time, then the feet should be exercised at regular intervals by wriggling the toes and bending the ankles.

Immersion Foot Signs and Symptoms

The area becomes cold, swollen, waxy-white and mottled with burgundy-to-blue splotches. The skin becomes numb, deep sensation is lost, and movement of the affected area becomes difficult.

If allowed to continue untreated, the area becomes red, hot, and swollen, and blisters appear. The victim experiences constant throbbing and a burning sensation. Skin numbness is aggravated by heat and relieved by cold.

Immersion Foot Treatment

Remove wet footwear. Gently and rapidly rewarm the affected foot by immersing it in warm water (about 40°C). Once the foot is

warmed, dry it completely and elevate it in a warm room. Swaddle it with clean bandages or cloth to keep it warm and clean.

The injury must not be rubbed or massaged. Blisters should be kept clean and dry. Do not apply ointments. Two 200 mg ibuprofen tablets every four hours may be administered for pain, if required. Evacuate the victim to a medical facility.

Altitude Sickness

Altitude sickness (also called acute mountain sickness, or AMS) is caused by the body not adapting to the reduced availability of oxygen at altitude (as elevation increases, barometric pressure decreases). The higher the altitude, the more common AMS becomes. Symptoms may range from minor lethargy to a coma, and death may result, so any symptom must be treated with caution. Anyone can be affected by altitude sickness, regardless of age, fitness level, or previous experience at altitude. Healthy individuals may experience symptoms as low as 2,500 meters (8,200 feet). Beyond 3,000 meters (9,840 feet), 75% of people will experience some level of AMS. The symptoms usually start 12 to 24 hours after arrival at altitude and begin to decrease in severity around the third day. Mild AMS does not interfere with normal activity, but anyone experiencing symptoms should communicate this to others so the person can be monitored.

Many work sites in Antarctica, such as Amundsen-Scott South Pole Station and Mount Erebus, are at high altitude. The Fang Glacier acclimatization camp on Mount Erebus is at 2,900 meters (9,500 feet), with South Pole Station only slightly lower. Since the polar atmospheric effect raises the pressure altitude 10% to 15% above actual elevation, both of those locations will feel like 3,200 meters (10,500 feet) or more, increasing the risk of AMS.

AMS risk is also increased by rapid ascent to altitude (e.g., by aircraft), so team members must factor sufficient time for acclimatization into their schedule when flying to a high-altitude site. Minimum work should be planned for the first few days.

Altitude Sickness Prevention

It is common to fly to altitude in Antarctica, thus increasing the risk of altitude sickness. For those traveling to Mount Erebus (3,794 meters, 12,450 feet), spending at least two nights acclimatizing on the Fang Glacier seems to reduce altitude-related problems. Unfortu-

nately, it is usually not possible to have acclimatization camps for polar plateau work. For those traveling to the plateau, bring altitude medicine (if medical personnel advise doing so), and pack Gamow bags and oxygen, if possible. In addition, taking these steps can reduce the incidence of AMS:

- Do not overexert upon arrival at altitude (take it easy for the first three days)
- Avoid depressant drugs like sleeping pills and narcotics
- Avoid alcohol and tobacco
- Get plenty of sleep
- Stay hydrated
- Consider taking Diamox® (discuss this with Medical beforehand)

Above all, adjust expectations of how much work can be completed in the first few days at altitude. Team members should check in on each other constantly and let each other know how they are doing. Stoically withholding information could be dangerous and is poor expedition behavior. If a team member is still not feeling better after 72 hours, follow up with Medical.

Altitude Sickness Signs and Symptoms

Mild/Moderate AMS - Most people arriving at altitude will see their breathing rate increase immediately. Other mild symptoms include headache, nausea, fatigue, and lack of appetite. The average time to recover from mild AMS is approximately three days. Full acclimatization may take two months. Yet, a small number of individuals are unable to acclimatize at all. Prior experience at altitude does not exclude a person from contracting altitude-related illnesses, nor does a high level of fitness.

Moderate AMS - Moderate AMS will manifest as a more severe headache (which is not relieved by medication), increased nausea and vomiting, increased lethargy, loss of appetite, light-headedness, disturbed sleep, shortness of breath (even while resting), and decreased coordination. Normal activity becomes difficult. Though these symptoms may be due to other causes, it is wise to assume they are due to AMS until proven otherwise. The only treatments for moderate AMS are advanced medication or immediate descent to a lower altitude, with the latter being the preferable option. Without treatment, moderate AMS could become more severe.

Severe AMS - Severe AMS may manifest as High Altitude Cerebral Edema (HACE) or High Altitude Pulmonary Edema (HAPE), or

both. Signs and symptoms of severe HACE are loss of muscular coordination (ataxia), decreased mental status (confusion, coma), severe headache, weakness, and vomiting. It appears that persons who have had HACE in the past are more susceptible to developing it again.

HACE is a potentially fatal condition. Altered consciousness and loss of coordination are the base markers for HACE. The individual will be unable to take care of basic needs (eating and dressing). Within a day of losing coordination, HACE victims slip into a coma. Without proper medical care, death will result.

HAPE, however, is the most common altitude-related cause of death. Earliest signs are decreased exercise performance and increased recovery time. Specific HAPE signs and symptoms are dry cough, shortness of breath at rest, a gurgling/crackling noise heard in chest during breathing, and pale or blue color to skin and nail beds (cyanosis). In the late stages, a wet, productive cough will be present. As with HACE, people who have had HAPE in the past have a high likelihood of developing it again. Both the Lower Hut on Mount Erebus and South Pole Station have seen more than a few cases of HAPE over the decades.

Altitude Sickness Treatment

Acetazolamide (Diamox®) is used as a preventive measure before going to altitude. It is a diuretic and respiratory stimulant that accelerates the body's acclimatization. With the consent of medical personnel, team members should begin taking it several days before ascent.

Dexamethasone (Decadron®) is another preventive pharmaceutical that reduces swelling of the brain. It also used as a treatment. In the latter case, medical personnel can authorize its administration.

Mild to moderate AMS requires rest, medication for headaches and nausea, hydration, proper nutrition, and supplemental oxygen, if available. If AMS occurs, the best treatment is rapid descent. Contact medical personnel to discuss the severity of the case and recommendations for evacuation. Supplemental oxygen is helpful, in addition to using Diamox® and/or Decadron®.

A Gamow bag is a portable hyperbaric chamber that simulates rapid descent. It has saved hundreds of lives at altitude worldwide since its introduction in 1990. If descent isn't possible because of flight delays or because team members cannot take the victim down

themselves, a Gamow bag is the best asset to have. The elevation at which teams will be working will determine if the members need to be trained in Gamow bag operation and issued one for the field.

HACE Treatment

Early, simple tests (similar to roadside sobriety tests) can be conducted to look for the loss of coordination that is the hallmark of HACE. Individuals may be asked to stand with eyes closed and arms extended to the side, then asked to touch their nose. Also with eyes closed, they may be asked to walk forward, heel to toe. Be sure that someone is ready to catch them if they stumble. However, differentiating between moderate AMS and the initial stages of HACE may be difficult. Assume the worst and treat for HACE.

Severe AMS/HACE requires an urgent call to Medical. Evacuation is likely. If immediate descent is not possible, the patient should be placed in a Gamow bag. Provide the patient with oxygen. Medical personnel may also prescribe Diamox® and Decadron®.

HAPE Treatment-URGENT

If HAPE is suspected, contact Medical immediately to request an evacuation. Immediately descend 600 to 1,200 meters (2,000 to 4,000 feet), if possible. Use a Gamow bag while waiting for evacuation, and provide the patient with oxygen. *Nifedipine* may be helpful. Medical can authorize administration of this medication.

Eye Injuries

Tent Eye

Antarctica's extreme low humidity may cause the film of tears protecting the eye to dry up, making the cornea susceptible to damage from stove fumes in the tent. The condition can be treated by applying Chlorsig® ointment to the eye when it occurs and/or before going to sleep.

Snow Blindness

Snow blindness is caused by ultraviolet (UV) light burning the eyes. The danger of snow blindness is greatest not on clear, bright days but on dull, cloudy (whiteout) days, when crystalline snow mist is present. There is no warning that damage has been done until the symptoms begin to appear two to twelve hours after exposure.

Snow Blindness Signs and Symptoms

Snow blindness manifests as intensely painful, red, watering eyes that are sensitive to light. The victim will also feel as though there is grit in the eyes.

Snow Blindness Treatment

A single episode of snow blindness may last up to five days, even while being treated. The eyes should be rested for at least 24 hours. That means closing them and covering them with a non-fluffy pad. If the temperature is above freezing, a cold compress may be placed over the affected eyes to relieve pain. Medical should be contacted for treatment recommendations and possible medications. Medical personnel may recommend providing the victim two tablets of ibuprofen (400 mg) every four hours, as required, or putting Chlorsig ointment on the eyes every three hours.

Snow Blindness Prevention

This condition must be avoided, as it is a crippling injury that may seriously delay a field party. Team members should wear dark, UV-protective glasses or goggles with the appropriate lenses (not yellow) at all times when in the field, especially on overcast days.

Skin Injuries

Sunburn and Windburn

Direct exposure to the sun, especially when it is very windy or the body is wet with sweat, can result in a sunburn and chaffed skin. Because the Antarctic air is cleaner and thinner, there is greater ultra-violet penetration, so sunburn can occur even on overcast days. If sunburn occurs, apply aloe vera gel to the burn and provide the victim 400 mg of ibuprofen every four hours, as necessary, to relieve pain.

Sunburn and Windburn Prevention

Prevent sunburn by applying sunscreen ChapStick® to the lips and regular sunscreen to other areas of exposed skin. Covering the face with a balaclava will prevent both sunburn and windburn to this frequently exposed area.

Dental Health

Oral Hygiene

Oral hygiene can be inconvenient in the field, but it is just as important as bodily hygiene. Failure to maintain good oral hygiene may result in increased tooth decay (especially around the edges of fillings) and gingivitis. Ideally, teeth must be brushed after every meal, with snow if no water is available. Use toothpicks or waxed dental floss to clean gaps between the teeth that are hard to clean with the brush.

Controlled Medications

Issue of Restricted Drugs

The McMurdo clinic issues a field medication kit containing over-the-counter, prescription, and controlled medications (restricted drugs) to each designated field party medical lead. The field medication kit is the responsibility of this person. The medical lead (or any USAP participant) must contact a station doctor for consultation and authorization before administering any medication. Always check for any known allergies before administering drugs.

Chain of Custody

McMurdo clinic personnel will fill out a controlled drug Chain of Custody form and provide it to the field medical lead. The lead must account for all controlled substances when the kit is checked out, weekly, and when the kit is returned. If the lead departs before the end of the season, he or she must complete a new Chain of Custody form and count the medications before transferring the kit to another person. At the end of the season, the medical kit must be returned to the clinic.

