

25 POLAR EXPEDITIONS

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The polar traveller encounters meteorological extremes: strong winds can combine with low temperatures to create conditions similar to a blast-freezer but, in contrast, a cloudless summer's day may lead to heat exhaustion, sunburn or snow blindness. The first-time traveller will encounter many unfamiliar hazards. Good training and risk-management procedures can reduce the dangers of these hazards. The weather often makes travel difficult and electrical storms may disrupt radio communications. It can be difficult, dangerous and expensive to evacuate casualties.



Figure 25.1 *A dog ambulance approaches Finse in Norway (C. Johnson)*

Independent groups should have sufficient medical equipment and expertise to care for casualties for several days. Tents, clothing and equipment must be capable of surviving extreme conditions.

TABLE 25.1 POLAR HAZARDS

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| <ul style="list-style-type: none"> • Low temperatures • High winds • Whiteout • Avalanche • Crevasse • Shifting sea-ice • Thin lake and river ice • Dehydration | <ul style="list-style-type: none"> • Sunburn • Snowblindness • Frostnip • Frostbite • Hypothermia • Wildlife (bears) • Contaminated water • Transport (ski/skidoo) |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

PREPARATION

All expedition members should be instructed in basic first aid, personal hygiene and the hazards of the area they are to visit before departure. The expedition medical officer (MO) should contact the emergency services, if they exist, in the area to be visited and find out how they can be contacted and how casualties could be evacuated. Satellite beacons (emergency position indicating beacons – EPIRBs) may be worth taking if there are sophisticated emergency services in the area. Avalanche transceivers are required if you plan to travel in mountainous areas. You must have adequate medical insurance and some countries demand that expeditions hold search-and-rescue insurance.

To reiterate previous chapters, all travellers should have medical and dental examinations well before the date of departure so that any necessary treatments can be completed. Conditions such as toothache or piles which are merely a nuisance at home can become a serious problem on an expedition. People with a stable medical condition such as well-controlled hypertension, diabetes or epilepsy can take part in expeditions, but the expedition leader and the MO should be aware of their condition as worsening of the disease could cause problems to everyone. Several separate sets of their usual drugs should be carried in case some are lost. People with unstable medical conditions, for example those prone to hypoglycaemic attacks, grand-mal epilepsy or inflammatory bowel disease, should not travel to remote areas unless comprehensive medical support will be available nearby. The condition may worsen under stress and the infirmity of one expedition member may threaten the lives of all. People with poor peripheral circulation in the cold (Raynaud's disease) are more likely to suffer from cold injuries in severe conditions.

Eyes

Anyone whose vision is so poor that they always need to wear glasses or contact lenses must plan to avoid the difficulties that might arise from loss or breakage: as a minimum, a spare pair should be taken. When the air temperature is below -20°C glasses invariably mist over. Metal-rimmed spectacle frames can become very cold and cause frostbite if they are in direct contact with the skin; opticians sell silicon sheaths to cover the side arms of the currently fashionable metal spectacles. Plastic-framed glasses or snow goggles are preferable. For the same reason, exposed metal studs and earrings should not be worn in extreme conditions.

Infectious diseases

These are uncommon in polar areas. However, some sledge dogs carry rabies and a course of rabies inoculations is advisable if the expedition is to work with these animals. Other immunisations may be needed for the journey to and from the expedition base. It is always sensible to ensure that you are covered against tetanus.

Medical supplies

Medical supplies must be compatible with the potential needs of the party. Drugs and dressings are both bulky and expensive, and over-enthusiastic ordering of medical supplies may deprive the team of funds better spent elsewhere. Some aqueous drugs crystallise and degrade in the cold; therefore powdered preparations and plastic containers should be selected whenever possible. Careful packing is essential to prevent breakages. Most medical supplies will be stored together, but a standby kit should be available in case the bulk of the supplies is lost in an accident. Suggestions for basic medical supplies are given in Chapter 3.

FIELD ARRANGEMENTS

At base camp the MO should be responsible for supervising the water supply and sanitary arrangements (see Chapter 10). Fresh water can usually be obtained by melting snow, and this is safe to drink unless it comes from an area frequented by animals or birds. Deer and beaver live near to many apparently pristine melt streams. They can contaminate the water with giardia spores which, if drunk, cause chronic diarrhoea and crampy abdominal pain. Beware of glacier outwash streams, which contain fine, highly abrasive rock dust in suspension (see B. Dawson, 1994); this is a powerful laxative. If in doubt, boil water or use a filtration and sterilising system. Bathing in cold climates is a masochistic pastime, but both people and clothes must be washed whenever possible as skin infections are common among sweaty, unwashed individuals.

Toilet facilities and rubbish dumps should be well demarcated and sited downwind and downstream of the campsite and water supply. In cold climates human

waste and packaging materials break down very slowly and are your gift to future generations. As far as possible *all* waste should be removed from the area you visit. It may be hidden by a covering of snow during winter and spring, but it will be horribly visible at the end of the summer melt. There is now evidence that exposing excrement to direct sunlight results in less environmental pollution than hiding it away, as UV light sterilises harmful bacteria. Some North American National Parks are now recommending “smearing” rather than “digging” for small groups in very remote areas, but a properly designed field latrine is necessary whenever groups are bigger and stay longer.

Dehydration

Because polar air is very dry, sweat evaporates quickly and it is easy to underestimate the amount of fluid that is lost. Dehydration is a risk during the first days of an expedition, and everyone should be encouraged to drink enough to ensure that they produce plenty of urine even if they do not feel thirsty. A combination of malaise, headache and raised body temperature is common when parties first arrive in the cold, and this may be a mild form of heat exhaustion.

Food

Food is a much discussed topic on any expedition. It is necessary to balance variety with the need to obtain sufficient energy. While at base camp, or travelling using motorised transport, energy requirements will be similar to those of an outdoor worker in the UK (3,000cal/12,000kJ per day), but heavy outdoor work such as hauling sledges is an extremely energetic pastime requiring two or even three times this energy intake. In cold climates a greater proportion of the diet is likely to be made up of fatty foods. In the past polar expeditions have lived off the land, but nowadays many animal and bird species are protected and licences required before they are hunted. The internal organs of many polar animals contain toxic amounts of vitamin A and must be discarded; they are in any case not a gastronomic treat.

Fuel

As well as for heating food, fuel is required in polar areas to melt drinking water and dry clothing. It takes twice the energy to boil ice from -30°C as it does to boil water from 0°C . These additional energy demands must be considered when fuel needs are calculated.

Travel

Skidoos must be used with caution in areas where there are fences as garrotting injuries are a recognised risk. Tracked vehicles are usually noisy and should not be approached when moving. Expeditions should define safety procedures before entering avalanche and crevasse zones. Snow is an opportunity for recreation. Travellers on

polar trips should enjoy themselves, but expeditions may need policies to limit the risks of leisure activities. A ski injury that would merely be a nuisance in a resort may threaten life in the wilderness.

MEDICAL PROBLEMS SPECIFIC TO POLAR REGIONS

Cold injury is a risk whenever it is cold and windy. The risk of frostbite is low when air temperature is above -10°C , but becomes significant whenever the air temperature falls below -25°C . Prevention of cold injury requires constant vigilance on the part of expedition members who should be paired off in the “buddy” system to check each other regularly for the telltale signs. Peripheral parts of the body such as fingers, toes and ears may become chilled causing frostnip or frostbite or, far more seriously, the victim may be unable to maintain his or her body temperature and become hypothermic.

Hypothermia

Hypothermia is a fall of the victim’s core temperature to an extent that the ability to function normally is impaired. Normal core temperature is $36.5\text{--}37^{\circ}\text{C}$, and a fall below 35°C usually causes symptoms. Hypothermia is uncommon in a properly clothed, fit person, but may develop if someone is injured, or if clothing is inadequate

Wind speed mph kph		Ambient temperature ($^{\circ}\text{C}$)							
		-40	-30	-20	-10	-5	0	+5	+10
		Equivalent temperatures ($^{\circ}\text{C}$) and danger of hypothermia for a fully clothed person							
		GREAT <i>(exposed flesh may freeze)</i>			INCREASING			SMALL	
46	74	-87	-71	-54	-38	-29	-21	-13	-4
35	56	-84	-68	-52	-36	-28	-20	-12	-3
23	38	-77	-62	-49	-31	-24	-16	-9	-1
12	20	-62	-49	-36	-23	-16	-10	-3	+2
6	10	-48	-37	-26	-15	-9	-3	+1	+7
0	0	-40	-30	-20	-10	-5	0	+5	+10

Figure 25.2 *Wind chill index*

or wet. It usually develops insidiously over several hours, although it can happen within minutes if someone falls into cold water. The symptoms are similar to drunkenness: poor co-ordination, falling over, confusion. They may shiver uncontrollably, but do not always do so. They may vehemently deny that anything is wrong and refuse help. Untreated, they will eventually become comatose and die. In the field diagnosis can be difficult, but anyone whose torso feels “as cold as marble” should be treated as a cold casualty.

TABLE 25.2 FEATURES OF HYPOTHERMIA

<i>Body core temperature (°C)</i>	<i>Associated symptoms</i>
37	Normal body temperature
36	
35	Judgement may be affected; poor decision-making Feels cold, looks cold, shivering
34	Change of personality, usually withdrawn – “switches off/doesn't care” Inappropriate behaviour – may shed clothing Stumbling, falling, confused
33	Consciousness clouded, incoherent Shivering stops
32	Serious risk of cardiac arrest Body cannot restore temperature without help Limbs stiffen
31	Unconscious
30	Pulse and breathing undetectable
29	
28	Pupils become fixed and dilated
27	
26	
25	
24	Few victims recover from this temperature
23	
22	
21	
20	
19	
18	Lowest recorded temperature of survival

Experts have disagreed about the best treatment for severe hypothermia and this has led to conflicting advice in textbooks. E. L. Lloyd gives an excellent review of these controversies in his 1996 article (see References and Further Reading). However, the controversies are irrelevant to most expeditions as they are unlikely to have the types of advanced resuscitation equipment that some mountain rescue groups now carry. The aim of treatment is to restore the body heat of the victim.

TABLE 25.3 TREATMENT FOR HYPOTHERMIA

- Seek shelter
- Remove damp outer clothing
- Wrap casualty in additional dry insulation such as a sleeping bag
- Lie down and insulate from the ground

If conscious:

- Restore body heat by providing warm drinks, warming the air with a stove and sharing the body heat of unaffected rescuers
- Chemical heat pads can be helpful if they are available, but ensure that they do not cause burns
- Do not give alcohol
- Ensure casualty rests and is kept under close supervision for at least 24 hours

If unconscious or body temperature is very low: evacuate urgently, if feasible

Rescuers must be careful not to put themselves at risk by giving up too much of their own clothing. Even after body temperature has been restored the casualty may remain confused.

Severe hypothermia is most likely to be encountered following a serious accident, for instance an avalanche. All cases of severe hypothermia should be evacuated urgently. In hospital, the policy is that all cold casualties should be re-warmed, but in the mountains a more pragmatic approach is needed, particularly if there are several casualties. The Scottish Mountain Safety Forum in 1997 produced guidelines to assist with decision-making (Table 25.4).

Frostnip

In contrast to hypothermia, which usually develops quite slowly, peripheral cold injury can develop within seconds. The earliest change is termed frostnip and is a numb, waxy white patch of skin most commonly seen on the earlobe or over the cheekbone. It is painless and its onset is usually unnoticed, although some

TABLE 25.4 RECOMMENDATIONS FOR EVACUATION OF COLD INJURED

	<i>Criteria</i>	<i>Action</i>
Definitely alive	Conscious	Insulate from heat loss Rewarm Monitor regularly Evacuate
Definitely alive	Unconscious Respiration and/or pulse present	Insulate from heat loss Rewarm only once in hospital Maintain airway Evacuate in recovery position
May be alive	No respiration No circulation (1 min) Clear airway No obvious fatal injury. Temperature below 32°C	Radio/phone for medical advice with evacuation plan Rewarm only once in hospital
Definitely dead	No respiration No circulation (1 min) Airway blocked Obvious fatal injury Temperature below 32°C	Evacuate as dead

experienced polar travellers may detect a sudden burning “ping” as it develops.

Treatment

Rewarm the body part by covering it with a gloved hand or blowing warm exhaled air over the skin. *Do not rub nipped skin.* No permanent injury is done if skin is nipped and quickly rewarmed, although redness and swelling may persist for a day or two. In some Scandinavian countries, ointments are sold that it is claimed have a protective effect against cold injury. The evidence is that they are not effective and indeed may increase the risk of injury.

Frostbite

Frostbite – freezing of the underlying tissue – is the progression of the superficial injury of frostnip if it is left untreated. A frostbitten part should be thawed only if the victim can rest for a prolonged period afterwards. Although it is desirable to protect

a damaged limb, it is possible for the victim to walk to safety on a frostbitten foot, but once thawed the limb will be useless.

Treatment

- Rewarm the affected body part by putting it in clean water.
- Slowly warm the water to 40°C.
- Give strong painkillers as this process can be very painful.
- Protect body part from pressure and do not allow to refreeze.
- Cover raw areas with sterile dressings and change regularly.
- Take the tops off white blisters, but *not* blood blisters (see Auerbach, 1995).
- Give penicillin and painkillers (e.g. ibuprofen) regularly.
- Evacuate as soon as possible.

After circulation has been restored, the affected part will look red, blistered and severely swollen. Once treatment has begun, the damaged part must be protected against all forms of pressure and must not be allowed to refreeze. Severe frostbite takes months to heal, and the patient should be evacuated to a hospital used to dealing with the problem. Most doctors have seen dry gangrene associated with poor circulation; this causes death of the digit or limb from the inside. Frostbite injuries look similar, but are less serious as they are generally associated with superficial damage while the core of the limb is healthy. Unless infection develops, amputation should be undertaken only when a line of demarcation between healthy and dead tissue has become obvious. Improved scanning techniques and anti-prostaglandin drugs are improving the outlook for hospitalised patients with serious frostbite injuries.

Sunburn

Solar energy is intense in polar areas with strong reflection off the snow, and the radiation may exceed that in equatorial regions. High latitude (owing to thinning of the ozone layer) and altitude increase the risk of sunburn and a high factor sun cream should be applied liberally. Sunburn is particularly uncomfortable when rays reflected upwards off the snow burn the eyelids and underside of the chin and nostrils. Lips are particularly vulnerable to chapping and a suitable protective cream should be used.

Snowblindness

This is the term given to sunburn of the surfaces of the eye. The sensation is similar to having sand ground into the eyes. It can be extremely debilitating, being painful but more importantly causing a significant reduction in vision. In mild cases, the eye surface will heal in a few hours; however, in severe cases, where the eyelids may swell up and close, the patient may be incapacitated for several days and should rest in a darkened room or tent.



Figure 25.3 Party arriving on Tasman Glacier in New Zealand (C. Johnson)

Treatment

- Rest in a darkened room or tent.
- One dose of local anaesthetic eyedrops (e.g. amethocaine) relieves the initial discomfort, but further painkilling tablets will be required.
- Eyedrops that prevent spasm of the ciliary muscles of the pupil (e.g. tropicamide) can help, but repeated use of local anaesthetic drugs is no longer recommended.
- Chloramphenicol ointment can be used to soothe the eye, applied four times a day.

Ultraviolet light can penetrate cloud and snowblindness may develop even on overcast days. Expedition personnel should wear goggles or dark glasses with side protectors whenever they are working in bright conditions. If sunglasses are lost or damaged, an eye covering fashioned by making a couple of small horizontal slits in a sheet of card will provide an effective emergency alternative. Some experienced polar travellers have found that they are almost immune to snowblindness, but their apparent resistance should not entice newcomers to discard their eye protection.

Other hazards

Other polar hazards include the risk of suffocation or *carbon monoxide poisoning* in

snowed-in tents and snow-holes. Ventilation holes must be checked regularly to ensure that crystals of water vapour do not block them. Some polar expeditions climb high enough for *mountain sickness* to be a problem (this topic is covered in Chapter 26). Although *wildlife* in the southern hemisphere is usually friendly, the same cannot be said of grizzly and polar bears which may take an unwanted interest in your presence; seek local advice and, if recommended, take a firearm.

Medical personnel attached to government polar research groups have studied many aspects of medicine and physiology, but the results of their investigations may be difficult to obtain as they are published in specialist professional journals. It is difficult to conduct field research in extreme conditions, but there remain opportunities for an enthusiastic MO to undertake a small research project. *Man in the Antarctic* (see References and Further Reading) is a good place to start reading about polar medical research.

The major hazard of the polar environment lies in its unfamiliarity. Once the hazards have been realised and guarded against, the cleanliness, beauty and remoteness of the polar wilderness provide inexhaustible pleasure for those fortunate enough to venture into it.

Evidence base

This article was based upon information from major textbooks on the subject including those by Auerbach (1995) and Lloyd (1986), updated following a search of Medline articles for 1990–2000 using the keywords “accidental hypothermia” and “frostbite”.