AMERICAN COLLEGE OF EMERGENCY PHYSICIANS
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Expedition Medicine for the Emergency Physician

Emergency physicians are the ideal candidates to take their show on the road as tour groups tackle the Himalayas, Antarctica, and tropical jungle back country. This course will review what you need to know and take as you become the mobile health provider in extreme environments. In addition, current opportunities for such endeavors will be discussed.

- Learn to organize medical coverage for expedition groups.
- List the essential contents of a back-country medical kit.
- Recognize disorders unique to extreme environments, and discuss their treatment.

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**Part Owner: Adventure Medical Kits*

FACULTY

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Expedition Medicine for the Emergency Physician

The tendency nowadays to wander in the wilderness is delightful to see. Thousands of tired, nerve-shaken, over-civilized people are beginning to find out that going to the mountains is going home; that wilderness is a necessity. Awakening from the stupefying effects of the vice of over-industry and deadly apathy of luxury, they are trying as best they can to mix and enrich their own little ongoings with those of Nature, and to get rid of rust and disease.

John Muir

Introduction

Expedition and adventure travel has attracted a growing number of participants in recent years. Evidence of this trend can be seen in Nepal, where the number of travelers obtaining trekking permits annually has increased from 14,000 in 1976 to almost 75,000 in 1996.1 The increased demand for adventure travel has spawned a billion dollar adventure travel industry that offers treks, climbs, safaris, jungle cruises, scuba diving and sailing adventures to exotic and remote locations. They offer inexperienced "adventurers" with time and money the opportunity to be guided up Kilimanjaro, the highest peak in Africa or down the infamous Zambezi River in a remote canyon between Zambia and Zimbabwe. Many of these companies also actively recruit emergency physicians to provide medical care during the expedition.

Many adventure travelers are inadequately prepared for their trip and are naive about the associated risks. Adventure travel companies often downplay the inherent hazards of the trips they advertise in their beautiful catalogues, yet they require participants to sign extensive release from liability forms at the time of the excursion. Many of these contain capacious clauses regarding the assumption of risk, and require the client to sign an agreement which precludes them from suing, even if injury or death occurs as a result of negligence by the company[2].

Prior to the start of the expedition, the physician is usually asked to render advice on endemic diseases and other health related risks. Many elderly patients inquire about the safety of travel to moderate or high altitude with underlying heart disease or after coronary artery bypass surgery. In order to provide better advice, the physician should be familiar with the rigors and difficulty of the

activity and consider the potential environmental hazards and remoteness of the intended area of travel.

Preparing For The Trip

The following questions and issues should be resolved prior to the expedition:

1) What resources will be available both within the expedition (e.g. Gamow Bag, oxygen, IV fluids) and what will be the likely availability of outside rescue and local medical care?

2) Who is responsible (both physically and financially) for providing the medical equipment and assembling the medical kit?

3) What preexisting medical conditions do the members have?

4) A pre-trip screening history should be completed by each member of the expedition.

5) Does your malpractice insurance cover you for care that you provide on this expedition? In most cases you will need to buy a "rider" on your policy for this added protection.

6) Will you be providing medical care to the local population who live along the route of your travels?

Trip Ratings

Expeditions and Adventure travel companies often use a rating scale to gauge the difficulty of the trip to help prospective clients choose an activity appropriate for their level of conditioning and experience. Overland trips are usually graded on a difficulty scale from one to five (1 is easiest, 5 is most strenuous). The grading system is very subjective and may vary from one adventure. travel company to another; it should only be used as a general guideline. An example of a trip rating scale from one adventure travel company is shown in table 1.

Table 12

1) Easiest - Many activities are optional and involve fairly easy travel.

2) Easy to Moderate - Some activities are optional, but may involve more active travel by conventional or unconventional means (elephants, camels, sea kayaks, or 4-wheel-drive vehicles) as well as trips with short hikes of two to three hours at low elevations.

3) Moderate - More active trips involving hiking over moderate terrain, usually, but not always with vehicle support and at elevations less than 10,000 feet, or trips requiring wilderness camping.

4) Moderate to Strenuous - Hiking over steeper or more rugged terrain, longer days, or where elevations exceed 10,000 feet.

5) Most Strenuous - Hiking over steep, rugged terrain at high elevations (no vehicle support).

Whitewater river trips are usually graded in accordance with the International Scale of River Difficulty which grades rivers and rapids into classes from I to VI (Table 2)[3]. Some Western rivers in the United States use the Grand Canyon System which rates rapids on a scale from 1 to 10. Neither scale is truly an objective standard since individual and regional variations are common and the margin of difficulty for a particular rapid may differ significantly for kayaks and rafts. Important safety parameters such as water temperature, remoteness, and evacuation potential are also not taken into consideration.

TABLE 2

International Scale Of River Difficulty (abbreviated)

Class I: Easy. Fast moving water with riffles and small waves. Few obstructions, all obvious and easily missed with little training. Risk to swimmers is slight.

Class II: Novice. Straightforward rapids with wide, clear channels which are evident without scouting. Occasional maneuvering may be required. Swimmers are seldom injured and group assistance, while helpful, is seldom needed.

Class III: Intermediate. Rapids with moderate, irregular waves which may be difficult to avoid and which can swamp an open canoe. Complex maneuvers in fast current and good boat control in tight passages or around ledges are often required; large waves or strainers may be present, but are easily avoided. Injuries while swimming are rare.

Class IV: Advanced. Intense, powerful but predictable rapids requiring precise boat handling in turbulent water. Large, unavoidable waves and holes or constricted passages demanding fast maneuvers under pressure are present. A fast, reliable eddy turn may be needed to initiate maneuvers, **scout** rapids, or rest. Rapids may require "must" moves above dangerous hazards. Risk of injury to swimmers is moderate to high, and water conditions may make self-rescue difficult.

Class V: Expert. Extremely long, obstructed, or very violent rapids which expose a paddler to above average endangerment. Drops may contain large, unavoidable waves and holes or steep, congested chutes with complex, demanding routes. Rapids may continue for long distances between pools, demanding a high level of fitness. Swims are dangerous, and rescue is difficult even for experts. Proper equipment, extensive experience, and practiced rescue skills are essential for survival.

Class VI: Extreme. These runs often exemplify the extremes of difficulty, unpredictability and danger. The consequences of errors are very severe and rescue may be impossible. For teams of experts only, at favorable water levels, after close personal inspection and taking all precautions.

Morbidity and Mortality of Adventure Travel

There is a paucity of data which documents the relative risk of adventure travel. The risk of dying while trekking in Nepal over a three year period (1984 - 1987) was 15 deaths per 100,000 trekking permits, and the frequency of helicopter rescue was 75 per 100,000 trekking permits.26 The most frequent cause of death was trauma (eleven persons), followed by illness (eight persons), and **acute** mountain sickness (three persons). The availability of professional medical care by the Himalayan Rescue Association, which maintains medical clinics along the trekking trails in Nepal may have had a significant role in preventing more deaths.

The death rate in a follow-up study from mid-1987 through 1991 was 14 per 100,000 trekkers. Medical and altitude illness, however, accounted for a higher percentage of deaths, possibly reflecting a trend toward a greater number of older persons going trekking to Nepal.27

The mortality rate for the National Outdoor Leadership School (NOLS) from 1984-1989 was 0.28 per 100,000 person days, while the injury rate was 2.3 per 1,000 person days.28

Environmental Hazards

Environmental extremes such as high altitude, and cold and hot climates are important considerations for expedition physicians during travel to extreme and remote environments.

Altitude Illness

Altitude illness encompasses a spectrum of problems ranging from acute mountain sickness (AMS) to high altitude pulmonary and cerebral edema (HAPE and HACE). It is rare to experience altitude illness below 2000 meters. About 25% of travelers who live near sea level will experience AMS when visiting destinations at elevations between 2,000 and 3,000 meters. Above 3,000 meters, more than 50% of visitors will become ill.4

Acute Mountain Sickness (AMS)

Symptoms of AMS may include headache, anorexia, nausea insomnia, lassitude, dizziness, oliguria, or peripheral edema. Onset of symptoms usually begins on the second day after reaching high altitude.

Graded ascent is the surest and safest method of preventing AMS. Abrupt ascent to sleeping altitudes greater than 3000 meters should be avoided, and one should average no more than 300 meters (1000 feet) of elevation gain per day above 3000 meters. The sleeping altitude is more important than the maximum altitude reached. The decreased ventilation and relative hypoxemia that normally occurs during sleep is an important contributing factor to the development of AMS. During sleep at altitude, periodic (Cheyne-Stokes) breathing often occurs, which further lowers arterial oxygen saturation.6

Acetazolamide (Diamox), a carbonic anhydrase inhibitor, may help to prevent AMS and is also useful for treatment once AMS develops.798 Acetazolamide inhibits renal carbonic anhydrase resulting in renal excretion of bicarbonate, a metabolic acidosis, compensatory hyperventilation, and improved oxygenation.9 Acetazolamide taken

at bedtime diminishes periodic breathing and improves oxygen saturation.9 The prophylactic dose is 125 mg twice a day beginning the day of ascent, and continued for at least 48 hours after reaching the maximum altitude.

Dexamethasone is effective prophylaxis for AMS, but inhibits acclimatization.10 The dose is 4 mg four times a day beginning the day of ascent. Dexamethasone is only recommended for the prophylaxis of AMS in rescue personnel who must rapidly ascend to high altitude.

AMS is best treated by descent of at least 500 to 1000 meters, or by at least halting descent combined with rest. If symptoms progress while resting, descent is mandatory. Oxygen, if available may provide relief of symptoms. Both acetazolamide and dexamethasone can be given for moderate to severe AMS. Many adventure travel companies now carry a lightweight portable fabric hyperbaric bag (Gamow Bag) that is large enough to hold one person for the treatment of AMS. The bag is inflated by a manual air pump, and when pressurized, simulates descent. An inflation of 2 PSI is roughly equivalent to a drop in altitude of 1600 meters; the exact equivalent depends on the altitude at which the bag is used. The Gamow bag is best used in situations when immediate descent is not feasible. It should not be used as a substitute for descent.

Severe Altitude Illness: High Altitude Cerebral Edema (HACE) and High Altitude Pulmonary Edema (HAPE)

Severe altitude illness is characterized by an altered level of consciousness, ataxia, rales, or dyspnea at rest, and suggests progression from AMS to HACE or HAPE (table 3). The single most useful sign for recognizing the progression of altitude illness from mild to severe is loss of coordination. The victim tends to stagger, has trouble with balance, and is unable to walk a straight line heel to toe.

Table 35

Relative distribution of signs and symptoms in 154 Trekkers in Nepal with Acute Mountain Sickness

Severity	Percent	Symptoms
Mild	65	Headache, anorexia, nausea, malaise

Moderate	30	Headache unrelieved with analgesics, vomiting, reduced urine output
Severe	5	Altered consciousness, ataxia, rales, cyanosis, dyspnea at rest

The signs and symptoms of HACE are truncal ataxia, severe lassitude, and altered level of consciousness. Left untreated, HACE progresses to drowsiness, obtundation, coma and death.

If HACE develops, immediate descent is mandatory to prevent death. Oxygen, if available, should be administered with descent both to improve oxygenation and because HACE is often associated with HAPE. Dexamethasone should be administered in doses of four to six mg every six hours. If descent is impossible because of weather or terrain conditions, a portable hyperbaric chamber is an alternative treatment..

HAPE is a form of non-cardiogenic pulmonary edema that occurs after abrupt ascent to high altitude. The exact mechanism that causes the capillary leak in HAPE is unknown, but it is associated with a high pulmonary artery pressure, normal pulmonary capillary wedge pressure, and high protein alveolar fluid.6 Victims initially develop a dry cough, tachycardia and decreased exercise tolerance. If left untreated, the victim will develop dyspnea at rest, tachypnea, productive cough, and fulminant pulmonary edema.

Treatment of high altitude pulmonary edema consists of improving oxygenation and lowering pulmonary artery pressure, either with descent to a lower altitude or administration of supplemental oxygen. Nifedipine (30 mg slow release every 12 to 24 hours or 10 mg sublingual every 4-6 hours) reduces pulmonary vascular resistance and pulmonary artery pressure, and appears to be useful adjunctive therapy for HAPE.[11]

Who Should Not Go To Altitude: Pre-Existing Health Problems at Altitude

Coronary Artery Disease

Important circulatory changes that occur during exposure to high altitude include an increase in resting and exercise heart rate, an increase in cardiac output and velocity of cardiac contraction, and an

increase in systemic vascular resistance and systemic blood pressure.12 The sum effect of these changes is an increase in cardiac work, cardiac oxygen consumption, and coronary blood flow.[13] These changes are largely due to an increase in sympathetic activity mediated by the effect of hypoxia upon the chemoreceptors in the carotid bodies.[14] The increase in cardiac work associated with ascent to high altitude may result in an increased severity of angina, the new onset of angina, or unstable angina. Restricted activity for a few days after arrival may help to minimize or prevent these symptoms. [15]

Individuals with coronary artery disease who are asymptomatic during normal activity at sea level can usually travel to high altitude without difficulty.15 In a study of 97 elderly subjects (70 +/- 4 years) with evidence of coronary disease who traveled to Vail, Colorado (8,200 ft), no electrocardiographic changes occurred that were indicative of myocardial ischemia and no subject exhibited any change in symptoms despite normal or even moderate bouts of exertion.[16]

At present, there is no evidence to preclude an individual who has completely recovered from successful coronary artery bypass surgery from traveling to high altitude. Physicians should still caution elderly patients that symptoms of coronary insufficiency may appear or become worse with rapid ascent to high altitude and warn against overexertion.18 Anti-angina1 medications should be made available to these patients before their departure.

Systemic Hypertension

Normotensive individuals usually experience a modest rise in blood pressure during the first week or two after ascent to high altitude, and patients with hypertension at sea level may experience a further rise in blood pressure with ascent. 17 In some individuals, a marked rise in pressure may occur necessitating descent. Patients with hypertension who go to high altitude should consult their physician in advance so that appropriate preventive measures can be employed. Usually, a modest increase in their anti-hypertensive medication, low salt diet, and increased rest during the first few days of the altitude stay will suffice.[15]

Obstructive Lung Disease

Patients with chronic obstructive lung disease (COPD) are poor candidates for travel to high altitude. Many have hypoxemia, pulmonary hypertension, and sleep-disordered breathing at sea level, which can be expected to worsen on ascent to high altitude.6 Persons with sleep apnea or pulmonary hypertension in the absence of COPD, who become mildly hypoxemic at sea level may become severely hypoxemic at high altitude.

Asthma

Asthma alone is not a contraindication for ascent to high altitude. The cold and dry air at altitude may exacerbate asthma at altitude as it does at sea level. Cold or exercise-induced asthma (EIA) is thought to occur in 70% to 90% of asthmatic patients and in 25% to 35% of nonasthmatic individuals. The hyper-irritability of the airways is thought to be due to inhalation of cold and dry air which leads to bronchospasm during or after the activity[30].

When exercising in cold weather, a cloth can be worn over the mouth to decrease the temperature differential of the inspired air. Cromolyn sodium is effective in preventing EIA in many individuals when taken **before** exercise. Once exercise-induced asthma has occurred, cromolyn sodium is no longer effective. Inhaled beta2-adrenergic agonists (albuteral, terbutaline, salmeterol) are also useful drugs for **both** preventing and treating exercise-induced asthma. The long-acting beta2 agonist, salmeterol, may offer protection for prolonged physical activity, but regular long-term use may decrease the duration of the bronchoprotective effect. Montelukast (Singulair®) taken regularly can also decrease exercise-induced bronchospasm.2 5

Pregnancy

There is limited data on the safety of high altitude travel during pregnancy. There is no evidence that increased spontaneous abortion, abruptio placenta, or other such problems are related to high altitude travel.6 Studies show that women who reside permanently at high altitudes have small for gestational age babies, and a higher incidence of pregnancy-induced hypertension and preeclampsia than women who reside at sea level.[19,20] The relevance to the pregnant traveler visiting high altitude is unclear. When considering wilderness and adventure travel, pregnant women should probably

be more concerned about the remoteness from medical care should an unexpected complication develop with their pregnancy.

Sickle Cell Disease and Trait

Altitude exposure is contraindicated for individuals with sickle cell disease and may be a problem for individuals with sickle cell trait Even the altitude of pressurized aircraft (1,500 meters) may cause blood cells to sickle in individuals with sickle cell disease.21

Hypothermia

Hypothermia and Acute Mountain Sickness often ‘coexist. Temperature decreases with altitude (average of 6.5° C per 1,000 meters) and the effects of cold and hypoxia are generally additive provoking both cold injuries and altitude problems.6722 Both can cause some of the same manifestations such as ataxia, poor judgment, and an altered level of consciousness. Cold exposure induces peripheral vasoconstriction and elevation of systolic blood pressure. Cold may induce angina, bronchospasm or produce hypothermia and frostbite.

Hypothermia can be prevented by minimizing heat loss through the four heat dissipating mechanisms:

1) Radiant heat loss, which is the direct loss of heat from a warm body to a cooler environment, can be prevented by wearing protective clothing, including a hat and scarf.

2) Conductive heat loss, which occurs through direct physical contact between the body and a cooler surface, can be prevented by insulating oneself from the ground or water.

3) Convective heat loss from the wind can be prevented by wearing windproof clothing and by building an improvised shelter during a survival situation. Wrapping a garbage bag around oneself or even using your pack as a partial bivy sac can help reduce heat loss

4) Evaporative heat loss can be reduced by replacing wet clothing or by using a vapor barrier liner under your clothing or sleeping bag. Breathing through a scarf or face mask can reduce evaporative heat loss from breathing cold, dry air.

Frostbite

Frostbite is freezing of the skin and occurs in cold and windy weather conditions. Even if the temperature outdoors is not extremely cold, high winds can reduce the effective temperature to a dangerously low level. The chilling effect of air at 20 degrees Fahrenheit moving at 40 miles an hour is the same as 20-below-zero air on a still day.

On long trips it is important to drink often to prevent dehydration and to eat often to provide fuel for the body to generate heat. If the body is cold and dehydrated, it will shunt blood away from the skin, which can predispose to frostbite. Other predisposing factors are smoking, tight restrictive clothing and shoes, and contact of bare flesh with cold metal or moisture. Medical conditions which predispose an individual to frostbite include: peripheral vascular disease, congestive heart failure, diabetes, Raynaud's phenomenon, cold agglutinin disease, cryoglobulinemia, and a previous history of frostbite.

Heat Illness

Heat illness is another significant problem for adventure travelers. Although heat illness is clearly preventable, thousands of travelers continue to suffer each year, and it is the second leading cause of death in young athletes.29

Heat stress can be predicted by evaluation of the wet-bulb globe temperature (WBGT) index. Whereas a regular thermometer only measures the dry-air temperature, a wet-bulb thermometer (WBT) measures the effect of humidity on temperature. The globe thermometer measures the effect of radiant heat. Because the WBGT is complex and 70% of the value is derived from the WBT, a simple alternative in the field is to use a sling psychrometer. This lightweight and portable instrument has a thermometer with a wick surrounding the bulb attached to an aluminum frame with a hinged handle (figure 1). After the wick is moistened, the psychrometer is slung over the head for approximately 2 minutes. Air passing over the wetted thermometer bulb, cools the bulb in inverse proportion to the humidity. The WBT can then be used as a guide for recommended activity levels (See table 3)

Table 3 WET-BULB TEMPERATURE **(WBT)** AND RECOMMENDED ACTIVITY LEVELS

WBT °C	WBT °F	RECOMMENDATIONS
5.5	60	No precautions necessary
6.2-21	61-70	No precautions necessary provided adequate hydration maintained
22-24	71-75	***Unacclimatized:*** curtail exercise ***Acclimatized:*** exercise with caution. Rest periods and water breaks every 20 to 30 minutes
24.5-26	76-80	***Unacclimatized:*** Avoid hiking or sports or sun exposure; ***Acclimatized:*** Heavy to moderate work with caution.
27-30	81-85	Limited brief activity for acclimatized fit personnel only
31	88	Avoid activity and sun exposure

In addition to high temperature and humidity, other predisposing factors which increase the risk for developing heat illness while traveling include:29

- Dehydration

  The most important physiological factor contributing to heat illness is dehydration. It limits the ability of the body to sweat and to maintain vasodilatation. One indicator of adequate hydration in the field is the color of urine. Dark, yellow-colored urine indicates dehydration.
- Obesity
- Cardiovascular disease
- Fever
- Hyperactivity
  - A. Seizures
  - B. Psychosis

C. Cocaine or amphetamine intoxication

- Muscular exertion
  - A. Hard work
  - B. Athletics
- Burns (including sunburn)
- Medications:
  - A. Anticholinergic agents (antihistamines, phenothiazines, antispasmodics)
  - B. Beta-blockers, ACE inhibitors and diuretics
- Fatigue and lack of sleep

Acclimatization to Heat

Heat illness can often be avoided by taking adequate time to acclimatize to the hot environment before beginning strenuous activity. Physiologic acclimatization to a hot environment is an important adaptive response and usually requires 7-10 days to reach maximum benefit. With acclimatization, sweating is initiated at lower body temperatures, and the sweat rate may more than double (1 to 3L/hr and up to 15 liters per day). Sodium is conserved in both urine and sweat.

Hiking in the heat mandates constant fluid replenishment. Because net water absorption in the gut is about 20 ml/min or 1200 ml/hr, compensation for high sweat rates requires rest periods with reduced sweat rates and time for hydration. Thirst is a poor indicator of adequate hydration since it is not stimulated until plasma osmolarity rises 1-2% above normal. Drinking of fluids should be encouraged even though one is not thirsty.

The Extedition Medical Kit

A medical kit is one of the “ten essentials” of outdoor travel. Physicians can help their patients assemble a comprehensive medical kit and prescribe medication that might be needed during the trip. When designing a medical kit, certain prerequisites and variables should be considered. These include:

1) Medical expertise of the intended user
2) The location and environmental extremes of the destination
3) Endemic diseases
4) Duration of travel
5) Distance from definitive medical care and availability of rescue

6) Number of persons the kit will need to support
7) Preexisting illnesses
8) Weight and space limitations

The expedition medical kit should be well organized in a protective and convenient carrying case or pouch. For backpacking, trekking or hiking, a nylon or cordura organizer bag is optimal. Newer-generation bags with clear, vinyl compartments have proven superior to mesh covered pockets for protecting the components from the environment. The vinyl protects the components from dirt, moisture, and insects and prevents the items from falling out when the kit is turned on its side or upside down.

For aquatic environments, the kit should be stored in a waterproof dry bag or water-tight container, such as a Pelican@ Box. Inside, items should be sealed in resealable plastic bags since moisture will invariably make its way into any container.

Some medicines may need to be stored outside of the main kit to ensure protection from extreme temperatures. Capsules and suppositories melt when exposed to temperatures above 37°C, and many liquid medicines (e.g., insulin) become useless after freezing.

Another consideration is getting the medical kit through customs. Physicians should carry a copy of their medical license and anyone carrying narcotics or injectable medication should carry copies of their prescriptions.

Wound Management Items

- IO-20 cc irrigation syringe with an 18-gauge catheter tip for irrigating wounds.
- Povidone iodine solution USP 10% (Betadine®) to disinfect backcountry water and to sterilize wound edges; when diluted tenfold with water, can be used for wound irrigation.
- 1/4" by 4-inch wound closure strips
- Tincture of benzoin - a liquid adhesive that enhances the stickiness of wound closure strips, moleskin, or tape.
- Dermabond topical skin adhesive (2-Octyl Cyanoacrylate)
- Polysporin or double-antibiotic ointment
- Forceps or tweezers

- First-aid cleansing pads with lidocaine - these pads have a textured surface makes them ideal for scrubbing dirt and embedded objects out of abrasions.
- Antiseptic towelettes with benzalkonium chloride - Benzalkonium chloride may help to kill the rabies virus on wounds inflicted by animals.
- Surgical scrub brush - A sterile scrub brush for cleaning embedded objects and dirt from abrasions.
- Aloe vera gel - A topical anti-inflammatory gel for treating burns, frostbite, and poison oak/ivy dermatitis
- Scalpel with No. 11 blade - for draining abscesses
- Surgical gloves

Bandage Material

- **4" x 4"** sterile dressings
- Non-adherent sterile dressings
  Some examples include: **Aquaphor®**, **Xeroform®**, **Adaptic®**, **Telfa®**. Spenco 2nd Skin is an excellent alternative and provides an ideal covering for burns, blisters, abrasions and cuts.
- Gauze roller bandages or **Kling®** bandages
- Elastic roller bandage or Ace@ wrap
- Assortment of strip and knuckle adhesive bandages
- Stockinet bandage - A net style bandage particularly useful for holdings dressings in place over joints.
- **Molefoam** - A thick, padded adhesive material for protecting blisters.
- Moleskin - A thin, padded adhesive material for protecting skin from developing blisters
- l-2 inch adhesive tape and Duct Tape.

Miscellaneous Equipment

- **Sam®** Splint - A versatile and lightweight malleable, foam padded splint, adaptable for use on almost any part of the body. It can be fashioned into a cervical collar, into an arm, leg, or ankle splint.
- Hyperthermia/Hypothermia thermometer - Ideally should be able to read temperatures down to 29" C degrees and up to 42° C

- CPR Microshield® - A compact, easy-to-use, clear, flexible barrier with a one-way air valve for performing mouth-to-mouth rescue breathing. Prevents physical contact with a victim's secretions.
- Bandage scissors - Designed with a blunt tip to protect the victim while cutting through clothes, boots or bandages.
- Cotton tipped applicators - May be used to remove insects or other foreign material from the eye. Also useful to roll fluid out from beneath a blister, or to evert an eyelid to locate a foreign body.
- Plastic resealable (Zip-Lock™) bags
- Safety pins
- Accident Report Form
- Pencil

Basic Dental Kit

- Mouth mirror
- Dental floss
- Cavit® temporary filling material
- Cotton Rolls
- Zinc oxide - When mixed with eugenol this powder forms a paste which can be used as a temporary filling material or to protect a broken tooth.
- Eugenol (oil of cloves) - A dental anesthetic
- Cotton pellets

Non-Prescription Medication

- Acetaminophen (Tylenol@)
- Ibuprofen
- Diphenhydramine (Benadryl®)
- Calcium carbonate and magnesium hydroxide (Mylanta®)
- Tolnaflate (Tinactin®) or Nystatin® Antifungal Cream
- Glutose® Paste
- Loperamide (Imodium®)
- Oral rehydration salts

Environment Specific Supplies

High risk of venomous snakes

- Sawyer Extractor@
  A vacuum pump device which provides one atmosphere of negative pressure for potentially removing venom from poisonous snakebites.
- Elastic roller bandage
  To apply the pressure immobilization technique for venom sequestration.

High risk of Altitude Illness

- Oxygen
- Portable hyperbaric bag (Gamow Bag)
- Acetezolamide (Diamox) 125 mg tablets for prophylaxis, and 250 mg tablets for treatment of altitude illness
- Dexamethaxone 4 mg tablets
- Nifedipine 10-25 mg tablets

High risk of Snowblindness

- Opthalmic anesthetic (e.g., proparacaine or tetracaine 0.5%)
  To facilitate eye examination and to provide short-term analgesia
- Fluorescein stain
- Opthalmic cycloplegic (e.g., cyclopentolate 1%)
- Opthalmic. corticosteroid-antibiotic combination (e.g., Maxitrol)
- Opthalmic antibiotic drops (e.g., Tobramycin opthalmic solution 0.3%)

Hot Climate

- Hyperthermia thermometer
- Intravenous normal saline solutions and administration supplies
- Chemical ice packs
- Oral rehydration salt packets

Cold Climate

- Hypothermia (low-reading) thermometer - should be able to read down to at least 30 degrees Centigrade.
- Glutose® paste

Marine environment

- 5% acetic acid (vinegar)
- Prednisone
- Neomycin and polymyxin B sulfate and hydrocortisone otic suspension (Cortisporin® Otic Suspension)
- Scopolamine (Transderm Scop) patches for motion sickness

Tropical, Jungle or third world travel

- Ciprofloxacin 500 mg, or azithromycin 250 mg
- Loperamide 2 mg.
- Clotrimazole or betamethasone dipropionate cream (Lotrisone)
- Permethrin 5% cream and 1% shampoo.
- Sunscreen and insect repellent

For Remote or Extended Expeditions

- Stethoscope
- Pleural decompression set with one-way heimlich valve
- Foley catheter
- Airway supplies (oral or nasal airways, endotracheal and cricothyrotomy tubes)
- 1% xylocaine for anesthesia
- Intravenous solutions and tubing (six liters of normal saline)
- Needles and syringes
- Urine chemstrips
- Urine pregnancy test

Prescription Medication

Respiratory

- Beta2 agonist metered-dose inhaler and spacer (for asthma and other allergic reactions) - Salmeterol, a long-acting beta-adrenergic agonist, is recommended because it only requires twice-daily inhalation.
- Prednisone

Cardiovascular

- Nitroglycerin tablets or spray
- Aspirin
- Metoprolol (Lopressor®) 5 mg tablets

Gastrointestinal

- Prochloperazine (Compazine®) or Promethazine (Phenergan®) 25 mg suppositories
- Diphenoxylate hydrochloride and atropine sulfate (Lomotil®)
- Hydrocortisone acetate (Anusol-HC suppositories@)
- Bisacodyl 10 mg suppositories (Dulcolax®)
- Scopolamine (Transderm Scop) patches for motion sickness

Analgesics and sedatives

- Acetaminophen with oxycodone (Vicodin)
- Morphine sulfate for injection and naloxone
- Diazepam or midazolam for injection or oral solution and flumazenil
- Fentanyl oralets

Allergic Reactions

- Epinephrine 1:1000 solution, or Epi E•Z Pen® auto injector.

Antibiotics and Antifungals

- Azithromycin (Zithromax®) 250 mg capsules
  Indications: Tonsillitis, ear infections, bronchitis, pneumonia, sinusitis, traveler's diarrhea, skin infections, urethritis, pelvic infections.

- Amoxicillin Clavulanate (Augmentin®) 500 mg. tablets
  or
  Cefuroxime (Ceftin®) Or Cephalexin (Keflex®) 500 mg. tablets
  Indications: Bite wounds, skin infections, pneumonia, urinary tract infections, ear infections, bronchitis, tonsillitis and sinusitis.

- Ciprofloxacin (Cipro®) 500 mg. tablets
  Indications: Diarrhea including travelers diarrhea, pneumonia, bronchitis, urinary tract infections (urethritis, cystitis, pyelonephritis), pelvic infections, bone infections.

- Metronidazole (Flagyl®) 250 mg. tablets
  Indications: Infections with Giardia or amoebae; intra-abdominal infections including peritonitis and appendicitis, dental infections.

- Fluconazole (Diflucan) 150 mg single dose tablets
  Indications: Vaginal candidiasis

Resources

Himalayan Rescue Association, Nepal: Contact Ken Zafren, MD 10181 Curvi St., Anchorage, AK 99516; (907) 346-2333
http://www.nepalonline.net/hra or
http://www.gorge.net/hra/health.html

Health Volunteers Overseas: c/o Washington Station, P.O. Box 65157, Washington, D.C. 20035-5157; (202) 296-0928,

North Pole Expedition Physician: TCS Expeditions;
www.wwb.com/brochure/b001357.html

Remote Area Medical: 1016 Weisgarden Rd., Suite 201, Knoxville, TN 37909; (423) 579-1530 **www.usit.net/ram**