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Original Contributions

A SEVEN-YEAR EXPERIENCE IN EXPEDITION MEDICINE: THE JUNEAU ICEFIELD RESEARCH PROGRAM

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□ **Abstract—There have been relatively few attempts to document the optimal medical support for wilderness expeditions, and none of these previous reports includes physician-level providers. Here we document our experience with physician-level medical support to an annual wilderness expedition in Alaska. This report utilizes data collected from 1994 to 2000 as part of the medical response to the Juneau Icefield Research Project, an annual research expedition to the Alaskan wilderness involving up to 60 students and professors. Medical supplies and equipment were catalogued, and 7 years of medical logs were reviewed with data presented in descriptive fashion. The majority of diseases encountered included gastrointestinal illness, minor orthopedic injuries, urinary tract infections, illness related to sun exposure, and kidney stones. Several patients required evacuation by helicopter to the nearest medical facility. The logistical challenges of medical treatment in this setting are discussed. © 2003 Elsevier Inc.**

□ **Keywords—expedition medicine; Juneau Icefield Research Program; Alaska; wilderness medicine**

INTRODUCTION

Medical direction is a vital component to the success of any wilderness expedition. There have been relatively few attempts to systematically document the efficacy of various strategies regarding selection, transportation, and administration of medical equipment or the types of illnesses encountered, and wilderness medical directors generally have used cumulative experience, anecdote, and trial-and-error in designing the ideal approach to medical care for a given expedition. Although each location and activity requires that specific medical needs be anticipated, it is clear that individuals and programs with a history of successful expedition medical care have much to offer with regard to their experiences. We describe our own approach to medical direction that has been refined for over 50 years in an extreme wilderness setting. Specific equipment and strategies for its transportation and distribution are included. In addition, we document our experience in the management and treatment of medical problems encountered in this wilderness setting by our medical staff for the past 7 years. This represents an extensive cumulative experience with wilderness medicine and is the first report of physician-level care in an expedition setting.

METHODS

Design

This is a retrospective review of data collected from 1994 to 2000. Institutional review board approval was obtained.

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Setting

The Juneau Icefield Research Program (JIRP) is an expedition-style research program in the fields of geology, glaciology, geophysics, geomorphology, ecology, meteorology, hydrology, and surveying, held for 8 weeks every summer in the Juneau, Alaska and Atlin, British Columbia regions of the Juneau Icefield. The program has been in existence since 1946, and is supported by the Glaciological and Arctic Sciences Institute at the University of Idaho, the National Aeronautics and Space Administration (NASA), the U.S. Army Research Office, and the Foundation for Glacier and Environmental Research. The program is carried out as a full-scale Arctic scientific expedition, with up to 60 participants in the field each year, including undergraduate and graduate students, university professors, research scientists, and expedition support staff, resulting in two to three thousand participant-days of exposure each season.

Thirteen main stations and 17 lesser camp and research facilities are located in the field, with permanent metal-sheathed buildings containing cooking, sleeping, and communications facilities at the main field sites. Communication between camps is handled by radio, and the expedition is supported by periodic helicopter airdrops. Ground transportation consists of foot travel, skis, and over-snow vehicles.

Participants are required to undergo a preparticipation physical examination by their personal physician, with medications, allergies, and past medical history recorded on a card that is kept with each participant at all times during the expedition. Although there are no absolute medical criteria for exclusion from the program, participants are required to overland ski, climb rock and ice, travel over glacial and crevassed areas, camp in remote areas without support, and survive the Arctic environment, often with limited communication, in areas inaccessible by helicopter or snowmobile. Evacuation from the icefield generally requires helicopter extraction to Juneau, Alaska, or Atlin, British Columbia, and is dependent on weather, location, radio communication, and estimated risk to the rescuing party. Participant ages range from 18 to 80 years, and all participants are given extensive safety, communications, and first aid instruction.

Medical Response

Expedition physicians function as visiting professors for the program, and are supported by several field staff members with Emergency Medical Technician (EMT) training. Medical supplies are maintained at each main camp, and each participant carries a personal first aid kit.

Table 1. Contents of the Individual First Aid Kits Carried by Each JIRP Participant

Card with identification, emergency information, and individual medical history
10 large adhesive bandages
1 large sheet of Moleskin®
1 package of Spenco Second Skin®
1 roll of 2″ athletic tape
1 roll of 2″ gauze
6 gauze 4″ × 4″ dressings
6 gauze 2″ × 2″ dressings
1 package of butterfly bandages or steri-strips
1 large triangular bandage
3 large safety pins
1 razor blade
1 2″ compressive bandage
2 oz. betadine solution
1 tube antiseptic ointment
1 tube aloe vera
acetominophen caps
ibuprofen caps
antacids
1 pair small scissors

JIRP = Juneau Icefield Research Project

The medical supplies and physician and individual first aid kits have evolved over the history of the program in response to specific needs that arose in previous years; in addition, supplies reflecting the anticipated response to more significant illness are maintained. Supplies have been updated over the years, including newer blister and foot care, modern sunscreens, and currently used antibiotics and other medications. Physicians who accompany trail parties to remote locations carry additional medical supplies in their packs. All participants undergo a rigorous 4-day Wilderness Field Medicine Course during the early part of the program, instructed by expedition physician staff.

The program supports one or two physicians in the field for the majority of the expedition; most participating physicians are trained in Emergency Medicine or Family Medicine with specific interest in wilderness and environmental medicine. Physicians undergo specific orientation and instruction in medical issues specific to the program. Physicians are available for any significant medical issues that arise and are responsible for maintaining the camp medical supplies and their own first aid kits; in addition, expedition physicians inspect and modify recommendations for the individual first aid kits each year. Participants can approach physicians with any medical questions or issues at any time.

Table 1 lists the contents of the modular personal first aid kit carried by each participant. It is designed so that multiple kits can be combined to provide sufficient supplies for many emergency situations, and so that each individual kit is small and lightweight. Table 2 lists supplies and equipment that are available at each base

camp. These supplies are packed and stored in such a way that they can be easily loaded onto a helicopter or a snowmobile, but they are generally not taken to field stations or out with trail parties. Table 3 lists the contents of the medical kit carried by the expedition physician.

With any significant injury or illness, an expedition physician is contacted immediately via radio. When possible, the patient is transported to the base camp for evaluation; otherwise, the physician goes to the patient or scene of the accident by ski or snowmobile. Participants are generally within 2 h of a physician at all times during the expedition. Evacuation by Coast Guard helicopter requires at least 8 h to reach definitive care, weather permitting.

Data Collection

Data regarding all medical problems treated by expedition physicians were collected prospectively from 1994 to 2000 using a standardized data collection sheet. Minor problems not requiring a physician level of care or judgment, such as common colds, sunburn, blisters, mild hypothermia, minor exhaustion, mild dehydration, minor depression, and minor orthopedic injuries, were excluded. In addition, medical issues treated by the participants themselves and not reported to physicians were unable to be recorded. During the study period, there were relatively few changes in the medical supplies maintained at each camp and the physician and individual participant first aid kits. Before 1994, only anecdotal reports and radio logs exist to inventory medical problems treated as part of the program. Medical supply lists were obtained from required equipment lists sent to all participants and by careful inventory of all medical supplies available in the field.

RESULTS

All medical encounters available from 1994 to 2000 and meeting the above inclusion criteria are displayed in Table 4. These included 12 infectious disease cases, 10 traumatic injuries, 3 patients ultimately diagnosed with a kidney stone, 2 patients with abdominal pain, and an ingrown toenail. Although it is difficult to determine the exact etiology of many of these illnesses in retrospect, most can be directly or indirectly attributed to the specific demands of the expedition.

Anecdotal reports from the pre-1994 period include a dislocated shoulder that underwent closed reduction in the field in 1991 and a rollover accident of a snow vehicle in the 1980s resulting in one patient being evacuated for multiple blunt trauma.

Table 2. Medical Supplies Maintained at JIRP Base Camps

Supplies	Quantity
Module 1	
Eye supplies	
Cyclopentolate 1%, cc	2
Sulfacetamide ophth 10%, cc	15
Gentamicin ophth gtt, cc	5
Tetracaine ophth dropperette	1
Dacrose ophth solution, cc	15
Fluoroscein strips	2
Eye patches	2
Dental	
Cavit® pkg	1
Parenteral medication	
Ceftriaxone 1 g vial	2
Metoclopramide 10 mg vial	1
Ketorolac 60 mg vial	2
Epinephrine 1:1000 1 mg vial	1
3 cc syringe	1
18 ga needles	1
20 ga needle	2
25 ga needle	1
Tuberculin syringe	1
Alcohol pads	5
Antibiotics	
Clarithromycin 500 mg	10
Azithromycin dose pack	1
Ciprofloxacin 500 mg	20
Trimethoprim/sulfamethoxazole DS	10
Cephalexin 500 mg	40
Amoxicillin clavulanate 875 mg	20
Cefuroxime 250 mg	30
Gastrointestinal medications	
Promethazine 25 mg	100
Prochlorperazine 10 mg	20
Omeprazole 20 mg	25
Loperamide 2 mg	10
Other medications	
Albuterol MDI	1
Diphenhydramine 50 mg	30
Hydrocodone/acetominophen tabs	20
Aspirin 325 mg	20
Module 2	
Wound care	
Novafil® suture 4–0	6
Novafil® suture 5–0	4
Scalpel #15 blade	2
Scalpel #11 blade	1
Benzalkonium chloride towlettes	8
Sterile 7.5 gloves	1
4 × 4″ gauze pads	7
Large occlusive dressing	1
ABD pad	1
Betadine, cc	30
Skin stapler	1
Medications	
Miconazole 2%, g	15
Bacitracin/neomycin/polymyxin oint, g	14
Oxymetazoline ophth, cc	19
Clotrimazole 1%, g	15
Aloe vera gel, oz.	1
Sulfacetamide ophth, cc	15
Hydrocortisone/polymyxin/neomycin otic, vial	1
Prednisolone ophth 1%, cc	5
Desoximetasone 0.25%, g	15
Mometasone furoate 0.1% cream, g	2
Miconazole vaginal suppositories	6
Urine pregnancy test kit	3
AnaKit® (SQ epinephrine/diphenhydramine)	3

Table 2. continued

Supplies	Quantity
Wound care/miscellaneous	
Lidocaine 1% 10 cc vial	1
Lidocaine 1% 1 cc amp	3
Tetracaine ophth dropperettes	2
Dermabond®, vial	3
Super glue, vial	1
Alcohol wipes	10
Syringe 3 cc	1
Syringe 5 cc	1
Syringe 10 cc	1
27 ga needle	1
22 ga needle	1
Syringe 60 cc cath tip	1
Otoscope	1
Steri-strips, pkg	1
Thermometer	1
Medications	
Diphenhydramine 50 mg	20
Chlorpheniramine 4 mg	12
Ciprofloxacin 500 mg	29
Ciprofloxacin 250 mg	6
Azithromycin 250 mg	4
Albuterol MDI	2
Cephalexin 500 mg	15
Ibuprofen 200 mg	300
Epinephrine 1:1000 1 cc amp	1
Lidocaine 1% 2 cc amp	1
Lidocaine 1% 10 cc vial	1
Ofloxacin 200 mg	6
Ranitidine 150 mg	50
Pseudoephedrine 30 mg	12
Benzocaine/antipyrine otic, vial	3
Intravenous supplies	
Normal saline 500 cc bag	3
Intravenous start kit	2
Extension tubing set	2
Intravenous tubing set	1
18 ga angiocath	2
20 ga angiocath	3
3 cc syringe/22 ga needle	4
3 cc syringe/25 ga needle	4
10 cc syringe/21 ga needle	2
5 cc syringe	1
Miscellaneous	
Disposable heat packs	3
Benzalkonium chloride towlettes	5
Stethoscope	1
First aid manual	1
Spenco Second Skin®, package	2
Space blanket	1
Air splint, ankle	1
Sterile field	1
Foley catheter, 20 French	2
Bandage scissors	1
3″ × 12’ roll gauze	2
Kerlix® roll	2
ABD pads	2
Adhesive tape, roll	3
Silk tape, roll	1
Laceration tray	
Sterile 7.5 gloves	3
18 ga angiocath	1
60 cc Luer lock syringe	1
4 × 4″ gauze	10
Hemostats	1
Wound scissors	1
Forceps, small	1
Needle driver, small	1
Fenestrated drape	1
Additional wound care	
Chromic Gut® suture 2–0	2
Chromic Gut® suture 4–0	1
Vicryl® 2–0	2
Vicryl® 3–0	2
Vicryl® 4–0	1
Dexon® 0	2
Dermalon® 4–0	4
Dermalon® 5–0	4
Silk 3–0	1
4 × 4″ gauze	50
Kelly clamp, small	1
Needle driver, small	1
Forceps, small	1
Wound scissors	1

JIRP = Juneau Icefield Research Project; ophth = ophthalmic preparation; gtt = drops; mg = milligrams; g = grams; otic = ear preparation; SQ = subcutaneous; cc = cubic centimeters; DS = double strength; oz = ounces; MDI = metered dose inhaler; ga = gauge.

DISCUSSION

We present our experience with the medical management of a large annual expedition to the Juneau Icefield from 1994 to 2000. These data illustrate our comprehensive approach to wilderness safety, injury management, and medical supply selection. In addition, all significant medical encounters over this 7-year period are documented. Although physicians were instructed to record all significant medical encounters during the study period, the data are limited by reporting bias, and less significant encounters that still required a physician level of judgment may have been excluded. Although certain aspects of our medical experience are a reflection of the particular environment in which this expedition takes place, the general approach and types of illnesses we encountered should be generalizable to other groups. We encourage expedition physicians from other locations to share their experiences to expand the literature base regarding physician-level wilderness care.

Only a few studies in the medical literature address emergency medical care in the North American wilderness, and none includes physician-level emergency responders. Two studies from the Sequoia and Kings Canyon National Park Emergency Medical Services (EMS) describe treatment rendered during EMS calls within the two national parks. One involves eight cases of subcutaneous epinephrine administration by EMS providers over a 15-month period, and one catalogues the nature of 434 calls received over a 1-year period (1,2). Other relevant studies include a 5-year experience of the Ca-

Table 3. Medical Supplies Carried by Expedition Physician in 2000

Module 1 (Minor Care)		Module 2 (Extended Care)	
Item	Quantity	Item	Quantity
Emergency information card	1	Sterile 7.5 gloves, pair	2
SAM® splints	2	2″ cloth tape, roll	1
Steri-strips, small, package	2	3″ ACE wrap	1
Steri-strips, large, package	2	U.S. military crevats	2
2 × 2' gauze	10	60 cc Luer lock syringe	1
New Skin® liquid bandage, oz	1	Benzoin swabstick	2
1″ cloth tape, roll	1	Betadine swabstick	3
U.S. military crevat	1	Cold/hot pack	1
4 × 4″ gauze	10	Aluminum/foam back splint, inches	10
Wilderness medicine field guide	1	1 cc syringe 27 ga 1/2″ needle	2
Latex gloves, pair	3	3 cc syringe, 22 ga 1.5″ needle	2
U.S. military eye dressing kit	1	10 cc syringe	1
Moleskin®, pack	1	Disposable scalpel, #15 blade	1
Spenco Second Skin®, pack	1	5″ needle driver	1
Watergel® burn dressing	2	#10 blade for scalpel	1
Adhesive bandages, assorted sizes	20	#11 blade for scalpel	1
Army field dressing	1	0 silk suture	2
Benzalkonium chloride wipes	10	2–0 nylon suture	2
Butterfly bandages	10	4–0 nylon suture	2
Small foldable scissors	1	2–0 Dexon® suture	2
Antiseptic ointment packets	5	Skin stapler	1
Tobramycin ophth ointment, g	3.5	Small tissue forceps	1
Proparacaine ophth solution, ml	15	Small suture scissors	1
Ketorolac ophth solution, ml	5	Small curved Kelly clamp	1
Nystatin cream, g	15	Dermabond®, package	2
EMLA cream, g	5	1% lidocaine with epinephrine, cc	30
Triamcinolone cream, 1%, g	15	1% lidocaine without epinephrine, cc	50
Lidocaine ointment, 5%, g	35.44	Epinephrine, 1:1000, cc	1
		Diphenhydramine IV, mg	50
		Methylprednisolone, mg	125
		Droperidol, mg	10
		Morphine sulfate, mg	20
		Ketorolac, mg	60
		Sublingual nitroglycerin, tabs	25
		Ceftriaxone, g	3
		Albuterol MDI	1
		Ciprofloxacin, 750 mg tabs	30
		Amoxacillin clavulanate, 875 mg tabs	30
		Prochlorperazine supp, 25 mg	6
		Ranitidine 150 mg tabs	6
		Pseudoephedrine, 30 mg	10
		Prednisone, 20 mg tabs	10
		Hydrocodone/acetominophen tabs	25
		Loperamide tabs	25

nadian Forces search and rescue (SAR) technicians and a 4+ year experience of the Mt. Hood Reach and Treat backcountry paramedics (3,4). A few descriptive studies have presented injury and illness occurrence in various settings, including a report of injury and illness from eight California National Park Service (NPS) parks over a 3-year period, a 5-year study of National Outdoor Leadership School (NOLS) students and instructors, two similar studies from U.S. Outward Bound schools, and two surveys of backpackers, one in Yosemite National Park and one on the Appalachian Trail (5–9). Federiuk provides an excellent review of the epidemiological data from these studies (10).

Evidence and anecdotal experience suggest that the vast majority of wilderness medical problems are due to: 1) acute trauma, 2) environmental factors, 3) overuse, underconditioning, dehydration, or overexertion syndromes, and 4) infectious illnesses (primarily gastrointestinal, skin, and respiratory) (9,11–16). Our experience supports these findings, and our safety program, health maintenance protocols, and medical cache are designed to minimize risks in each of these categories and to provide optimal field treatment for nearly every foreseeable problem. The main indication for evacuation from JIRP was orthopedic trauma followed by gastrointestinal/genitourinary disorders. This

Table 4. Medical Problems Encountered in the JIRP 1994–2000

Medical problem/diagnosis	Treatment	Disposition
2000		
Upper respiratory infection	po azithromycin for 5 days	Resolved in 4 days
Abdominal pain/severe menstrual cramps	po analgesics, rest	Resolved in 2 days
Urinary tract infection	po ciprofloxacin and acidic juices	Resolved in 2 days
Infected foreign body (thorn) in finger	Removal under local anesthesia	Full use in 1 week
Vaginal candidiasis	Topical antifungals	Resolved in 3 days
1999		
Urinary tract infection	po ciprofloxacin and acidic juices	Resolved in 2 days
Kidney stone	IM ketorolac and po fluids	Stone did not pass in 24 hours, evacuated, did not return to program
Sprained ankle, weight bearing	Rest, ice, elevation, ibuprofen	Full use in one week
Sprained ankle, non-weight-bearing	Rest, ice, elevation, ibuprofen	Injury occurred on last day of program On crutches for 2 weeks after program
Conjunctivitis	Self-treated with boric acid contracted prior to program start	Resolved by the time reported to medical staff
Nonspecific vaginitis	Epsom salt sitz baths and rest	Resolved in 10 days
Hordeolum	Ophthalmic bacitracin and warm compresses	Resolved in 4 days
1998		
Closed fracture of index finger	Splinted and evacuated	Evacuated by helicopter, underwent Xrays and splinting, returned to program same day
Symptomatic ingrown toenail	Nail removed under local anesthesia	Asymptomatic after treatment
Ligamentous injury of knee with instability	Splinted and evacuated	Underwent surgical repair, did not return
1997		
Ankle sprain, non-weight-bearing	Rest, ice, elevation, ibuprofen	Evacuated by helicopter, underwent Xrays and splinting, returned to program in 2 weeks
3″ laceration to hand from skill saw	Wound irrigation	Evacuated by helicopter, underwent Xrays and suturing, returned in 2 days
1996		
Finger laceration with tendinous compromise	Wound irrigation	Evacuated by helicopter, underwent Xrays and suturing, returned in 2 days
Superficial cellulitis over ankle	po erythromycin	Resolved in 5 days
1995		
Abdominal pain and fever	Evacuation	Inpatient evaluation, eventual diagnosis of abdominal wall muscle tear, did not return
Kidney stone	Evacuation due to intractable pain	Inpatient treatment for pain control, eventually passed stone in hospital, did not return
Sprained ankle, non-weight-bearing	Rest, ice, elevation, ibuprofen	Evacuated for X-ray, returned, but had to rest ankle for 3 weeks
Infected puncture wound	Hot soaks and topical antibiotics	Resolved in 7 days
Sprained ankle, weight bearing	Rest and ice for two weeks	Taped for remainder of summer, but functional
Ankle fracture	Evacuated	ORIF upon evacuation, did not return
Gastroenteritis, moderate dehydration	po antidiarrheals and oral rehydration	Resolved in 2 days
1994		
Infected wound of unclear etiology	Evacuated	Returned in 2 days after local treatment and antibiotics
Kidney stone	Evacuated	Inpatient treatment for pain control, eventually Passed stone in hospital, did not return

JIRP = Juneau Icefield Research Project; po = oral; IM = intramuscular; ORIF = open reduction and internal fixation.

differs somewhat from other reports in which wound and skin infections were the primary indication for evacuation, possibly due to the presence of physician-level care at our location, decreasing the need to evacuate these patients.

The Arctic setting of JIRP presents some unique chal-

lenges and potential problems in administering medical care not described elsewhere. Our program enjoys an excellent safety record and a history of timely and appropriate medical care. Like all reputable outdoor programs, JIRP places primary emphasis on injury and illness prevention rather than treatment of avoidable problems. All participants are given strict participation criteria, including a screening physical examination and achievement of a level of fitness appropriate to the activities anticipated. Equipment lists are very specific, and include top-of-the line climbing, backpacking, skiing, and camping gear. Each participant must carry emergency medical supplies and a health information card at all times. Sun protection is critical on the icefield, and participants must carry at least two pairs of glacier glasses or goggles that provide 100% UVA and UVB protection, as well as copious quantities of high-quality sunscreen. Dehydration is a common malady among participants, and likely contributes to our relatively high incidence of urinary tract infections and kidney stones. Participants always must be able to carry two liters of potable water with their gear when away from base camp. Meticulous hand washing and food preparation is of paramount importance, especially as every meal is consumed in groups, occasionally by up to 40 participants at a time. Participants are instructed in the use of self-arrest techniques, safety roping, and crevasse travel techniques before encountering dangerous slopes or crevasse or glacier travel. Standard precautions such as the use of helmets and the buddy system are mandated at all times. Illicit substance and alcohol use has been shown to be an important factor in wilderness morbidity and mortality, and is strictly forbidden in our program (2,5,16). All participants undergo a hands-on wilderness first aid course provided by one of our expedition physicians. Our policies and procedures have been developed over decades of experience, and recent years in the program have seen very few problems related to avoidable problems such as severe hypothermia, frostbite, dehydration, sunburn, or other accidents related to safety carelessness.

Most field first aid kits are designed to treat common outdoor medical problems such as blisters, minor wounds, insect bites, and sunburn. In addition, most contain a few "just in case" items, such as dressings, cravats, signaling devices, and survival supplies. Common sense dictates that first aid supplies must be tailored to the individual participant and setting. Rarely does a prepackaged, commercially available first aid kit meet the needs of a serious outing or expedition. The supplies chosen for our medical inventory have been selected to optimize definitive treatment for minor maladies commonly encountered in JIRP and temporary treatment for more serious conditions. Essentially all medical evacuations from the Juneau icefield require a helicopter, as evacuation by skiing, climbing, or snowmobiling is generally not practical. All such evacuations are therefore subject to myriad unpredictable variables, including weather, accessibility to adequate landing zones, radio communications, and helicopter availability. Accordingly, medical staff must be prepared to provide temporary treatment for up to several days until rescue can be achieved.

We use and endorse the modular system for first aid supplies as suggested by Tek (15). Our modules have been designed both for ease of portability and by level of scope of practice by the provider who carries it. Heavier items, such as i.v. fluids, which generally are not carried in packs, and spinal immobilization and high-angle rescue gear, are maintained at all base camps in systems that are rapidly deployable.

Rescue on the icefield can be a logistical nightmare. Despite an excellent radio communications system with frequent scheduled checks between base camps and field parties, reporting an emergency to the nearest staffed base camp and alerting the camp director and physician might be delayed by several hours. If the situation requires supplies, personnel, or evacuation, the emergency response may be affected by weather, daylight, availability of snow vehicles or helicopters (as well as travel conditions and location accessibility for the same), and equipment required. Several members of the camp staff have high-angle rescue and EMT level training, and the expedition physician must be prepared to participate in all aspects of the rescue effort, including carrying medical supplies, rescue equipment, and field gear for a response that may last several days in hostile and primitive conditions. Our training and equipment is designed to optimize field care and temporize situations requiring evacuation to definitive care. We therefore include intravenous fluids, parenteral antibiotics and narcotics, and minor procedure instruments in our cache.

Notably, we currently do not include advanced airway equipment in our supplies, such as laryngoscopes and endotracheal tubes. There are several reasons for this. Airway equipment is heavy and bulky, and supplying and carrying oxygen tanks suitable for delivery of ventilation-level oxygen is a practical impossibility on the icefield. Furthermore, any participant in JIRP requiring intubation would likely have suffered respiratory compromise as a result of trauma, and would likely have a poor outcome regardless of airway intervention, due to a long delay to definitive care. Federiuk suggests that the data on advanced airway management in the wilderness do not support it as a skill required of backcountry EMS providers (10). In the study by Mt. Hood paramedics, eight patients in 114 calls over 5 years required intubation, including four requiring paralysis to complete the procedure (4). The Canadian SAR experience included

seven patients of 272 cases over 4 years who had oropharyngeal airways placed (not endotracheal tubes), none of whom the authors felt would have had an improved outcome from intubation (3). The study from the Sequoia-Kings Canyon Parkmedic program included 434 calls in a single year, none of which involved the use of that program's airway device, the esophageal obturator airway (2). Our own experience does not suggest a need for advanced airway equipment. On the other hand, interventions that have been clearly shown to be of benefit, such as the use of subcutaneous epinephrine, have been implemented in our program for a number of years (1).

The Juneau Icefield Research Program is a highly successful annual expedition that enjoys an excellent reputation for safety and high-quality medical support. Our emphasis on participant selection, safety training, and preventive care, as well as a well-equipped and well-trained medical staff, is one of the foundations of our philosophy in experiencing wilderness. It is our hope that this comprehensive approach to wilderness medicine provides a useful framework for the development of similar programs, and that other expedition physicians will likewise share their experiences to contribute to the development of the literature base on wilderness medicine.

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