ORIGINAL RESEARCH

Expedition Medicine—the Risk of Illness and Injury

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Objective.—Expeditions organized by commercial companies are becoming increasingly popular. Charity expeditions take inexperienced participants on trips all over the world, with participants being sponsored to raise funds for charitable causes. The incidence of illness or injury while participating in charity expeditions is unknown. The objective of this study is to report the incidence and severity of illness and injuries occurring on worldwide charity expeditions.

Methods.—Retrospective, observational study reviewing expedition medical reports from 232 expeditions organized by a single commercial expedition company for a 5-year period (January 1, 2004 through December 31, 2008).

Results.—Complete expedition medical reports were available for 210 (91%) trips, involving 4077 participants over 1524 expedition days. Expeditions reported a total of 1564 incidents over 42 482 participant-days in the field, including days spent traveling to the expedition site. In 1465 (94%) cases “minor” injury or illness was recorded, 79 (5%) “moderate,” and 20 (1%) “major” in severity. No deaths were reported. Gastrointestinal upset was the commonest reported minor condition and severe acute mountain sickness the commonest major condition. Overall, the incidence per 1000 participant-days of minor illness or injury was 34.48, moderate illness or injury 1.86, and major illness or injury 0.47.

Conclusion.—The risk of sustaining major injury or illness on an overseas charity expedition is low. The consequences of becoming injured or unwell in a remote environment can be serious, and appropriate medical care is required.

Key words: expedition medicine, wilderness medicine, travel

Introduction

Commercial expeditions are becoming increasingly popular, allowing previously inexperienced individuals or groups the opportunity to travel to remote environments.¹ Various charities have recognized the fund-raising potential of organizing expeditions, securing publicity, and raising funds in the process. Individuals participating in charity expeditions may be less experienced and may have lower physical fitness levels than individuals participating in other expeditions.

Commercial expeditions often attempt to improve medical care on expeditions by taking a doctor or medic on the trip.² Expedition medical staff will have varying degrees of experience. As the nature and incidence of illness and injury is not known, it is unclear whether a

doctor should accompany expeditions or whether allied health professionals may fulfill the role of expedition medic. Medical supplies taken on the expedition may depend on weight allowance, financial considerations, duration of the expedition, and location. Nevertheless, expedition insurance companies often regard the presence of an expedition medic as favorable. Although the number of legal claims against expedition medical staff is unknown, medical indemnity providers often demand high premiums to cover medical staff providing expedition coverage. This study describes the types of illnesses and injuries encountered by doctors on charity expeditions in order to better understand and define the role and the skills of an expedition medic.

The risk of illness and injury while participating in charity expeditions is largely unknown.³ Specific risks have been associated with well-publicized activities such as climbing Mount Everest^{4,5} or Kilimanjaro.⁶ However, the risk to participants in commercial expeditions, in particular, the widely publicized and available charity-

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backed trips, is unknown. Expedition medical reports, which detail illnesses and injuries sustained on trips, are rarely produced. This study quantifies the incidence and nature of illnesses and injuries sustained on a wide range of charity expeditions across the world.

The objective of this study was to examine the incidence of medical incidents reported from charity expeditions across the world and reported by a single expedition company.

Methods

We examined the expedition and medical reports for charity expeditions organized by Across the Divide (ATD) Expeditions based in the United Kingdom. ATD has been organizing charity expeditions since 1997 and runs up to 40 overseas trips, of varying activity and duration, annually. All ATD trips are accompanied by an independent expedition medic or doctor who produces a detailed expedition medical report, allowing accurate evaluation of illness, injury, and the role of the expedition medical staff. ATD Directors or employees have no input into the reporting process.

A retrospective case review was performed of all ATD expeditions leaving the UK from January 1, 2004 to December 31, 2008, inclusive. The type, destination, duration, and number of participants on each expedition were recorded. We only examined all expeditions organized by ATD. These included trekking, road cycling, rafting, dog sledding, mountain biking, and kayaking activities. Altitude expeditions were classified as those above 4000 m. Where available, expedition medical reports were obtained for each trip. Details of the expedition medic were obtained and whether they were a doctor, nurse, paramedic, or first aider was noted. All expedition medical records and casualty log sheets were individually examined. Patient medical records from subsequent primary health care and hospital visits were not examined. A classification system was devised, and medical reports reviewed by both authors.

Injuries and illnesses were categorized according to body system and severity.³ Minor injury or illness was defined as that which allowed uninterrupted participation with the expedition; moderate illness/injury resulted in 1 day or more away from the main expedition or required local hospital assessment; major illness/injury included any life-threatening condition, the need for immediate evacuation, or an incident resulting in death. Our aim was to develop a system that would provide meaningful categorization of illnesses and injuries sustained on charity expeditions.

We classified specific conditions as follows: “Gastro-intestinal” included all episodes of diarrhea and/or vom-

iting without surgical cause; “Infectious disease” included any other form of infection; “Respiratory” included incidents involving asthma, airways disease, or cough, without a clear infectious source; “General medical” included headaches, insomnia, exhaustion not related to heat and general malaise, or endocrine disorders; “General surgical” included abscesses and suspected intraabdominal pathology; “Isolated soft tissue injury” included all wounds and muscular pains; “Foot complaints” included blisters, athlete’s foot, trench foot, and any isolated foot complaint; “Fracture” included any confirmed bone fracture; “Altitude” included all symptoms relating to acute mountain sickness, including high altitude cerebral and pulmonary edema; “Sun/heat” included heat stroke and heat exhaustion; “Cold” included hypothermia, frostnip and frost bite; “Eye” included specific eye infections such as conjunctivitis.

The number of medical interventions performed by expedition doctors was recorded, with “medical” defined as the use of United Kingdom prescription-only medications, surgical intervention, or the reduction or manipulation of limbs.

Results

During the study period 232 expeditions took place. The altitude of expeditions ranged from sea-level to 5600 m. Expedition duration ranged from 3 days to 3 weeks. Expeditions went to 27 different countries and included desert, polar, tropical, and mountainous regions. A summary of expeditions is given in Table 1. All ATD expedition participants completed a detailed medical questionnaire, which was reviewed by the expedition doctor before the participant was allowed to accompany the group. All participants were deemed of sound health to partake in the designated expedition. The overall participant age range was 17 to 69 years, and 47% were female.

Complete expedition medical reports were available from 210 (91%) expeditions. These represented 4077 participants and occupied 1524 expedition days. Twenty expeditions reported no medical issues. The other expeditions reported a total of 1564 incidents over 42 482 participant-days in the field. In total, 1464 (94%) were classified as “minor,” 79 (5%) “moderate,” and 21 (1%) “major” in severity. All incidents are shown together in Table 2.

All trips had a designated expedition doctor (either from Primary Care, Emergency Medicine, or Anaesthesiology) who had previous experience in prehospital care and had completed a 4-day expedition medicine course. Three trips had nurses, and 5 trips had paramedics assisting the doctor.

Table 1. Summary of expeditions surveyed ($n = 210$) and medical incidents encountered by severity

Type	Number of trips	Countries	Duration (days)	Total participants	Severity of illness/injury			Commonest type of medical incident
					Minor	Moderate	Major	
Trekking (< 4000 m)	120	Argentina, Borneo, Brazil, Chile, China, Cuba, Costa Rica, Ecuador, India, Kenya, Mexico, Morocco, Namibia, Nepal, Peru, South Africa, Vietnam	5–14	3603	701	48	6	1. Gastrointestinal upset (49%) 2. Isolated soft tissue injury (24%) 3. Minor foot complaints (18%)
Trekking (> 4000 m)	50	Borneo, Chile, India, Kenya, Peru, Nepal	10–22	1385	355	20	12	1. Minor altitude symptoms (55%) 2. Gastrointestinal upset (31%) 3. Isolated soft tissue injury (12%)
Cycling	20	Cambodia, China, Costa Rica, Morocco, Namibia, South Africa, Vietnam	7–15	662	216	5	1	1. Gastrointestinal upset (41%) 2. Isolated soft tissue injury (40%) 3. Heat related (9%)
Kayaking/rafting	12	Borneo, Costa Rica	8–13	426	140	4	1	1. Isolated soft tissue injury (39%) 2. Gastrointestinal upset (38%) 3. Insect bites/stings (12%)
Dog sledding	16	Norway	7–9	179	52	2	1	1. Gastrointestinal upset (35%) 2. Isolated soft tissue injury (33%) 3. Cold related (28%)

Please note several expeditions included more than one activity type and are therefore included in more than one category.

MINOR ILLNESS OR INJURY

In total, 1464 minor medical incidents were reported. Gastrointestinal upset was the most common minor ailment encountered on expeditions, causing 449 (65%) of the 690 reported medical complaints.

Other minor complaints included mild altitude symptoms, reported by 17% of participants on altitude expeditions. Other environmental problems encountered were sunburn and heat exhaustion ($n = 73$, 5%), frostbite and mild hypothermia ($n = 15$, 1%).

Soft tissue injuries, excluding fractures or dislocations, accounted for 14% of reported minor incidents. There was a higher number of abrasions, lacerations, and bruises on expeditions involving mountain biking compared to other expedition activities. Simple falls resulting in isolated soft tissue injuries were common across all expeditions (as shown in Table 1).

General medical issues and minor infections accounted for 13% of minor incidents. Respiratory problems, mainly exacerbations of asthma, were common ($n = 46$). There were no reported cases of malaria during expeditions to tropical regions ($n = 43$), although it was not reported how many participants took antimalarial prophylaxis. Other infections encountered included cellulitis ($n = 20$), conjunctivitis ($n = 19$), and urinary tract infections ($n = 19$).

Feet and blister problems were encountered ($n = 117$, 8%), with a high incidence on trekking expeditions. General surgical conditions ($n = 5$), dental problems ($n = 15$), and eye complaints ($n = 48$) accounted for the remainder of minor conditions requiring medical attention.

There were 16 reported psychiatric incidents, 13 exacerbations of previously diagnosed depressive illness, 1 case of acute psychosis, and 2 cases of hysteria.

Table 2. Medical incidents by category occurring on charity expeditions

Category	Subcategory	Number of incidents	Incident total per category	Incidence per 1000 participant-days
Medical	Gastrointestinal	449	690 (44%)	16.2
	General medical	110		
	Infectious disease	65		
	Respiratory	46		
	Psychiatric	16		
	Cardiac	4		
Orthopedic	Isolated soft tissue injury	247	386 (25%)	9.1
	Foot complaints	136		
	Fractures	3		
Environmental	Altitude	266	353 (23%)	8.3
	Sun/heat	74		
	Cold	13		
Surgical	Eyes	48	68 (4%)	1.6
	Dental	15		
	General surgical	5		
Fauna	Insect	63	67 (4%)	1.6
	Animal	4		
TOTAL		1564		

MODERATE ILLNESS OR INJURY

The majority of injuries classified as “moderate” resulted from musculoskeletal injuries ($n = 40$), usually to the ankle or knee, that resulted in the participant being unable to walk unaided.

Twenty participants suffered symptoms of acute mountain sickness (AMS), without signs of high altitude cerebral or pulmonary edema. One participant required prolonged hospital outpatient follow-up for frostbitten fingers, but no surgical intervention was required.

MAJOR ILLNESS OR INJURY

There were no deaths reported on any of the expeditions we surveyed. Twenty-one cases were defined as major illness or injury, as shown in Table 3. All serious incidents required the participant to be evacuated immediately from the expedition. Medical evacuations were performed by helicopter, horseback, four-wheel-drive vehicle, and stretchers carried on foot. The highest proportion of these was due to severe AMS with signs of cerebral or pulmonary edema ($n = 11$). Overall, AMS was observed more often on trips with routes above 4000 m in altitude, compared to expeditions lower than 4000 m. A high incidence of traumatic injuries was seen on biking expeditions, compared to other activities (Table 1).

All of the serious fractures and dislocations ($n = 3$, all of the ankle) were sustained while trekking or cycling in

the mountains. One closed ankle fracture required reduction in the field using morphine and midazolam. One traumatic head injury occurred following a fall from a bike but did not require surgical or critical care intervention. One participant developed a suspected acute coronary syndrome while trekking and needed local hospital admission. Other treks saw isolated cases of splenic infarction (diagnosed at a local hospital), septicemia of unknown origin, anaphylaxis to a bee sting, and a severe case of periorbital cellulitis. One participant, with no previous psychiatric history in a nonmalaria region, developed an acute psychosis requiring a pro-

Table 3. Serious medical incidents encountered on expeditions

Major injury/illness	Number
Acute mountain sickness with signs of high altitude cerebral/pulmonary oedema	11
Fractures/dislocations (all of fibula/ankle) requiring immediate evacuation/surgery	3
Traumatic head injury	1
Acute coronary syndrome	1
Splenic infarction	1
Septicemia	1
Anaphylaxis	1
Per-orbital cellulitis with suspected intracranial involvement	1
Acute psychosis	1

longed stay in the host country before she could safely fly home to the UK.

Two participants required local hospital assessment for stab wounds received during an altercation with members of the local community in Cuba. The injuries were not found to be life-threatening. One road traffic collision was reported during the study period. Three expedition participants were in the vehicle, and all received blunt injuries to the head, torso, and abdomen, none of whom required surgery, nor were the injuries life-threatening.

One participant, aged 62, died from sudden cardiac death within 1 week of completing the expedition. His death was thought to be unrelated to recent travel, and he had not reported any symptoms during the expedition.

In total, 249 medical interventions were performed by expedition doctors. The majority of these involved the prescription of antibiotics ($n = 167$) or wound suturing ($n = 74$). All cases of major illness/injury had immediate input from the expedition doctor.

Overall, the incidence per 1000 participant-days of minor illness/injury was 34.48, moderate illness/injury 1.86, and major illness/injury 0.47.

Discussion

This study demonstrates the risk of illness or injury while participating in the examined activities during charity expeditions is low. In terms of numbers of expedition participants, this is the largest study published to date on the risks of participating in a charity expedition. The overall risk we have shown is similar to other published studies (overall medical incident rate of 6.4 per 1000 participant days),^{3,7} given the limitations of comparing studies involving different expedition types.

We specifically chose charity expeditions as this is a defined group of participants from the general public, possibly less experienced and possibly more likely to sustain injury or become unwell. We chose ATD expeditions as, in contrast to other expedition companies, a detailed medical reporting system exists, allowing us access to accurate expedition medical details. It is often difficult to establish the severity of the expedition medical incident, and previous studies have not made a distinction between trivial conditions, which may not even be expedition-related, and serious illness or injury.

We found gastrointestinal upset to be the commonest reported medical incident. This has previously been identified^{8,9} and highlights the need to observe strict hygiene and hand-washing procedures while on expedition. In the majority of cases, oral rehydration was effective, but 5 participants required rehydration with intravenous fluids. Travelers' gastroenteritis can rapidly spread through a

large group of people living in close proximity and cause significant problems for an expedition if not identified and managed correctly. A high proportion of isolated soft tissue injuries was noted on cycling expeditions, sustained when participants fell from bicycles.

Severe AMS accounted for the largest proportion of serious medical incidents. In comparison to other studies, our reported rate of severe AMS is low.^{7,10} The ascent profile of all ATD expeditions above 4000 m is very conservative, and the threshold for descent should a participant experience altitude symptoms is low. Early intervention from the ATD expedition doctor in ordering immediate descent at the onset of symptoms may have been important. No expedition participants were prescribed prophylactic altitude medication or advised to take it, but all ATD expedition medical packs are stocked with acetazolamide, dexamethasone, and oxygen, thus enabling immediate treatment of severe AMS. It is unknown whether participants took altitude prophylaxis of their own accord.

In contrast to previous studies,^{3,10} we found the reporting rate of medical incidents on expeditions to be high. Previous studies have reported high proportions (up to 26%³) of expeditions having no reported medical problems. It is possible that trivial medical conditions have previously gone unlogged by expeditions lacking rigorous medical reporting. Where detailed medical reporting of all incidents appears to have been in place, we found a similar incidence of illness and injury,¹¹ given the constraints described below.

Comparing studies on expedition medicine is problematic as different types of expedition are associated with varying degrees of risk. For example, comparing high-altitude mountaineering with low-level trekking is difficult. In contrast to previous studies,^{3,12} no deaths were reported in our series. Several studies have attempted to quantify the risk of death for specific activities such as summiting Everest,¹³ overwintering in Antarctica,¹⁴ and Himalayan trekking.¹⁵ None of the expeditions we surveyed went to Everest or Antarctica, but several involved high-altitude Himalayan trips.

A previous similar study, which included high-altitude mountaineering and expeditions of longer duration than our study, found a higher number of "serious" incidents reported from expeditions on which a doctor was present³ (up to 5% with a total medical incident rate of 6.4 per 1000 man days). All of the expeditions in our study had a doctor present, and the quality of incident reporting was high. The expedition medical log appeared detailed for all trips we reviewed.

Expedition doctors need to be experienced and prepared for all eventualities.¹⁶ Ideally, they should have previous experience in emergency and prehospital care,

expedition medicine, and the ability to operate effectively in remote environments. There is not yet a minimum qualification for expedition medics. We found expedition doctors intervened on 249 occasions, although, arguably, some of these tasks could have been accomplished by a trained, competent paramedical practitioner. We did not undertake a specific analysis of interventions performed. The presence of an experienced expedition medic may have made the charity expeditions safer, resulting in a low rate of major incidents and no reported deaths. A specific medical qualification may not be as necessary as experience, training, and the capacity to deal with complex medical problems in a remote environment.

Preparation for expeditions is important to minimize the overall risk of serious medical incidents occurring. All ATD expeditions take a medical rucksack with equipment and pharmaceuticals to deal with the majority of prehospital emergencies and primary care needs. This planning and equipment provision may have contributed to the low reported rates of moderate and major medical incidents.

This study has several limitations. Not all expedition medical reports were available for each trip during the study period; however, a reasonable proportion (> 90%) were available. It is possible that when no medical issues were encountered, no report was submitted. Data may have been incomplete on the expedition medical reports, and different diagnoses may have given for similar conditions by different expedition doctors. We were not aware of any deaths or serious incidents occurring on expeditions for which we did not receive expedition medical reports and did not feel ATD had selectively provided us with reports. In 2006, electronic reporting was introduced, and nearly all expedition medical reports were available from this time forward. Overall, we had an acceptable rate of medical report availability. We have studied charity expeditions which only account for a small proportion of the total number of expeditions taking place each year. Other expeditions or commercial expedition companies may have different results. Expeditions to high mountain summits, such as Everest, or involving other adventurous activities are likely to report higher rates of injury due to the higher risk associated with these activities.

This study has several implications. Doctors or expedition medics need to have a broad range of skills and equipment to deal with a large range of medical issues. Future research is warranted in this field to determine the optimum skill set of expedition medical staff for different types of expedition. Standardized reporting of expedition medical incidents with a defined minimum dataset would enable more accurate comparison between expe-

ditions. Insurance policy makers should be aware that participating in a charity expedition is a low-risk activity and set premiums for participants and accompanying expedition medics accordingly.

Conclusions

We report one of the largest published series on the risks of illness and injury while participating in overseas charity expeditions. The findings suggest that well-organized charity expeditions are safe. Overall, the incidence per 1000 participant-days of minor illness or injury was 34.48, moderate illness or injury 1.86, and major illness or injury 0.47.

Competing Financial Interests

No authors received funding or reimbursement for this study.

Ethical Approval

Ethical permission for the study was obtained from the University of Edinburgh Student Ethics Committee.

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