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ORIGINAL RESEARCH

Trends in Skin and Soft Tissue-Related Injuries in NOLS Wilderness Expeditions from 1984 to 2012

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Objective.—Wilderness expeditions inevitably involve risk to participants. Understanding of expedition-related illnesses and injuries allows institutions and individuals to develop strategies to mitigate risk. We describe findings and trends in soft tissue injuries, the second-most common type of injury, among participants in the National Outdoor Leadership School expeditions from 1984 to 2012.

Methods.—Injuries and illnesses sustained by students and staff have been recorded continuously since 1984 in the extensive National Outdoor Leadership School database. We performed a retrospective analysis of incidence of soft tissue injuries in this population. Data before 1996 were standardized in order to make use of the entire dataset.

Results.—Of 9734 total reported incidents, 2151 (22%) were soft tissue related, 707 (33%) of which required evacuation. The sex distribution of incidents was similar to the sex distribution of participants. The largest incidence of soft tissue injuries occurred independent of activity (711 incidents, 33%). The most commonly associated activities were hiking (528 incidents, 25%), camping (301 incidents, 14%), and cooking (205 incidents, 10%). Over the study period, rates of injury declined overall and in every individual category except cooking.

Conclusions.—Over this 28-year period, the incidence of soft tissue injuries associated with the most common activities decreased. Incidence of activity-independent injuries did not change significantly, but reported severity decreased. These data provide unique insights to help improve wilderness risk management for institutions and individuals and suggest areas in which educational efforts may further reduce risk.

Keywords: expedition medicine, wilderness medicine, infection, injury, illness, evacuation

Introduction

Annually in the United States, almost 40 million people with varying degrees of experience enjoy outdoor pursuits such as hiking and camping.[1] The National Outdoor Leadership School (NOLS), headquartered in Lander, Wyoming, has been a popular source of outdoor experiential education since its founding in 1965. NOLS teaches technical outdoor leadership skills, environmental ethics, and leadership on multiweek wilderness expeditions on 5 continents, ranging from sea-level water courses like sea kayaking and sailing to high-altitude mountaineering. NOLS has collected illness and injury data for its expedition participants since 1984, amassing an extensive database that encompasses 3.7 million participant days. Given the wide range of activities and geography and the great size of this database, analysis of these data promises significant potential utility to schools, organizations, and individuals planning outdoor activities. Existing literature on injuries and illnesses sustained while participating in outdoor activities is limited, and most studies are of relatively narrow scope, examining, for example, only skiing,[2] sea kayaking,[3,4] or sailing.[5] One broader study suggests that soft tissue injuries such as contusions and lacerations are the second most common type of wilderness injury after

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athletic injuries such as fractures and sprains.[6] We have therefore focused our analysis on soft tissue injuries, which we hypothesized to be a leading cause of injury among NOLS participants and which would have been positively affected by improved screening and training protocols put into place at NOLS over the past 3 decades.

Methods

This is a retrospective review of incidents reported by NOLS staff over the years 1984 to 2012, encompassing all NOLS expeditions worldwide during that time period. The term "incident" refers to events directly affecting the health, safety, and welfare of NOLS students and staff. Events may be accidental, intentional, or an outcome of the inherent risks of participating in an outdoor expedition.[7] The term does not indicate severity. Reportable incidents were required to meet one or more of the following criteria: 1) injury requires more than simple first aid, such as applying a clean dressing or supportive elastic bandage; 2) injury needs follow-up care or prescription medications; 3) injury interferes with active participation for a period of 12 hours, beginning the next day; or 4) injury necessitates evacuation. A strong institutional emphasis is placed on accurate and timely reporting of all expedition incidents. Incidents are voluntarily reported by NOLS staff, and a database of incidents is maintained by the risk-management director. Methods to ensure accurate capture of any field injury include a standardized process of precourse briefings before field deployment, required daily field journaling of events by instructors, written accounting of all medication and supply usage, and both written and verbal end-of-course debriefings. The iterative nature of this practice helps ensure accurate data capture.

In this study, we analyzed trends in soft tissue–related incidents at NOLS. Incidents affecting soft tissues include lacerations, puncture wounds, contusions, burns, rashes, infections, and blisters. Incidents are divided into categories by the type of activity (eg, hiking or camping) or type of complaint (eg, cellulitis or ear infection). Because of differences in the number of participants and the lengths of programs over time, rates were calculated per 1000 person days (1 person day is equivalent to 1 person on a course for 1 day).

Data collected from 1984 to 2012 were used for this analysis. NOLS data collection was standardized starting in 1996. Small subsegments of this database (typically over 3 years and drawn from 1996–2012) have been analyzed previously, with recommendations that a larger analysis be pursued. We reviewed the primary records before 1996 and standardized them for consistency with the more recent data. By expanding the period of time to include these data, over 1 million additional total person days of valid data could be used in our analysis, increasing the database total to just over 3.7 million total person days.

Incidents were summarized by type of activity, and incident rates were calculated as number per 1000 person-years. Poisson regression models were used to test the trends over time. All statistical analyses were conducted using SAS version 9.4 (The SAS Institute, Cary, NC). A 2-sided P value of .05 or less was considered as statistically significant.

Results

GLOBAL TRENDS

From 1984 to 2012, of 9734 total reported incidents, 2151 (22%) were soft tissue related. Of these, 707 (33%) were severe enough to require evacuation. These included 5 bear attacks; many lacerations large enough to require stitches, including one caused by a crocodile bite; and blisters and other infections preventing weight bearing in the affected extremities. In contrast, 2927 (30%) were athletic injuries, which comprised the largest category of incidents. Overall, 1301 (61%) of the soft tissue–related incidents affected male subjects, who also comprised 63% (446) of evacuations. These values closely paralleled the overall sex distribution of course participants. In almost every individual category, with the exception of horseback riding and swimming, incidents involving male subjects were more frequent than those involving female subjects, but distribution by sex within each category was quite similar to the sex distribution of participants overall.

Infections and rashes were the most common type of soft tissue incident reported (711 incidents, 33%). These complaints were not related to the activity during which the injury was sustained. Fungal infections such as tinea corporis and candida, polymorphic light eruption (commonly known as "sun bumps"), cellulitis, and insect- and plant-related rashes were common examples. Lacerations, punctures, and contusions (528 incidents, 25%) were the second most common injury type, most of which were associated with hiking. Commonly reported injuries included trips over boulders or branches, falls down slopes or into ravines, and accidental blunt trauma to the head or extremities from overhanging branches and rocks.

Analysis of the trends over time reveals a statistically significant decrease in the rates of incidents and evacuations over the past 30 years. The difference in the actual incident rate is small, however, having decreased from