Selected Abstracts from the Wilderness Medical Society's 2015 Summer Scientific Conference

Reliance on Technology Among Climbers on Mount Rainier

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Objective.—Thousands of people set out daily to climb the world's highest mountains in hopes of summiting. Although many 3000-m summits are accessible in favorable weather, conditions may turn calamitous quickly, requiring practiced navigation or rescue. Owing to the portability and low cost of many technological devices, many climbers have eschewed map and compass navigation. We sought to evaluate climbers' reliance on technologic devices, as well as their effectiveness and reliability for rescue.

Methods.—This survey study evaluated a convenience sample of climbers and hikers who arrived at Camp Muir, Mount Rainier (10,188 feet). Investigators ascended on 6 separate dates to the study site to collect data. The primary outcome evaluated was the percentage of climbers relying on a technologic device for rescue.

Results.—Two hundred forty-four of 308 climbers (79%) brought some technologic means for rescue. However, only 133 (43%) had a nontechnological backup plan in event of device failure. Therefore, 57% relied solely on the functioning of their devices in a rescue situation. Of the 102 climbers who relied solely on a cell phone as their means of rescue, 49 (48%) had service at the time of the survey. Thirty-three of 308 (11%) reported that they had required a technologic means of rescue in the past, most commonly an avalanche beacon ($n = 13$). For the 24 rescue devices that failed, the most common reasons were dead batteries in global positioning satellite equipment and lack of cell phone service.

Conclusions.—Reliance on technological devices is becoming commonplace among climbers on Mount Rainier and largely replacing map and compass orienteering. The lack of reliable service for these devices as well as their failures among climbers who have had to use a rescue device in the past is, however, alarming.

Altitude Illness on Mt. Rainier—Incidence and Climbers' Cognizance

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Objective.—Thousands of people set out daily to climb the world's highest mountains in hopes of summiting. However, altitude illness accounts for many aborted or failed summit attempts. Annually, more than 10,000 climbers attempt to summit Mount Rainier, although many develop signs and symptoms of altitude illness, thus hindering their climbs. Acute mountain sickness (AMS) is largely preventable; therefore, we evaluated prevalence of AMS among climbers as well as their understanding of the signs and treatment of AMS.

Methods.—This survey study evaluated a convenience sample of climbers and hikers who arrived at Camp Muir, Mount Rainier (10,188 feet). The study was conducted between August 2010 and August 2012. Investigators ascended on 6 separate dates to the study site to collect data. The primary outcome was incidence of AMS according to Lake Louise criteria. Climbers also were evaluated on the percentage of correct answers on a 3-question multiple-choice test regarding the signs, symptoms, and treatment of AMS, high altitude cerebral edema, and high altitude pulmonary edema.

Results.—Three hundred eight climbers participated in the study, of whom 32 did not indicate presence or absence of headache and thus were excluded from evaluation of AMS. Sixty-eight (25%) of the remaining climbers met the criteria for AMS. Forty-eight multiple question tests were incomplete and therefore not analyzed. Of the remaining 260 tests, 112 people (43%) correctly answered the 3

questions. Seventy-eight climbers (36%) could not report a single correct treatment option for AMS.

Conclusions.—Since data were first recorded in 1853, the number of climbers visiting Mount Rainier has steadily increased. However, the understanding of altitude illnesses is lacking, despite a high prevalence of AMS. A greater understanding of AMS, its identification and management, and preventive measures would benefit this population.

Civilian Helicopter Search and Rescue Accidents in the United States: 1980 Through 2013

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Objective.—Helicopters are commonly used in search and rescue operations, and accidents have occurred during helicopter search and rescue (HSAR) missions. The purpose of this study is to determine whether the civilian (ie, neither Department of Defense nor Department of Homeland Security) HSAR accident rate in the United States can be established and if any common contributing factors can be identified.

Methods.—Searches of the National Transportation Safety Board aviation accident database, the records of major search and rescue and air medical organizations, and the medical and professional literature for reports of HSAR accidents were conducted.

Results.—A total of 47 civilian HSAR accidents were identified during the study period. Of these, 43% (20 of 47) involved fatal injuries, compared with 19% (1390 of 7221) for US general helicopter aviation accidents, and 40% (105 of 260) for US helicopter emergency medical services accidents during the same period. Accidents occurring at night had a higher percentage of fatalities, 67% (8 of 12), than did those occurring during daylight, 33% (12 of 35). The majority of accidents occurred under visual meteorological conditions, but all 3 accidents occurring under instrument meteorological conditions resulted in fatal injuries. The total number of HSAR missions conducted annually could not be established.

Conclusions.—Although the overall number of HSAR accidents in the United States is small, the percentage of fatal outcomes from HSAR accidents is more than twice that for general helicopter aviation accidents, and is comparable to that seen in helicopter emergency medical services operations. Accidents occurring during darkness or under instrument meteorological conditions had a higher percentage of fatalities. A limitation of this study is that the total number of HSAR missions conducted annually in the United States could not be established, so an overall accident rate cannot be calculated. Further study could help to improve the safety of flight in the HSAR environment.

Impact of Previous Concussion on Helmet Use and Risk Compensation

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Objective.—Previous studies have evaluated helmet use and risk compensation in alpine skiing and snowboarding. The impact of previous concussion (PC) related to skiing/snowboarding injuries and subsequent helmet usage or subjective risk compensation behavior has not been explicitly studied. There is evidence that helmet use reduces head injury risk, but the effect on concussion risk is inconclusive. The purpose of this study is to determine whether risk compensation while skiing/snowboarding is correlated with a history of concussion and whether risk compensation with helmet use could be contributing to more concussions in skiers and snowboarders.

Methods.—This was a descriptive cross-sectional survey of persons aged 18 to 65 years who were interviewed on the mountain during their ski/snowboarding day at Park City Mountain Resort (2014–2015 season).

Participants completed a 24-question survey conducted by a single trained interviewer regarding helmet use, risk-taking behaviors, and subjective risk compensation while wearing a helmet.

Results.—In all, 938 participants (305 women, 633 men) completed the survey, 75% of whom were skiers, 25% snowboarders; 672 of 938 participants (71%) reported always wearing a helmet. Regarding concussions, 168 of 938 (18%) reported a PC from skiing or snowboarding; of those, 40% were snowboarders. Among participants without terrain park use, 23% of snowboarders versus 10% of skiers reported PC ($\chi^2 [1, n = 596] = 11.22, P = .001$). Among participants who spent at least some time in a terrain park, 35% of snowboarders versus 23% of skiers reported PC ($\chi^2 [1, n = 342] = 5.83, P = .016$). Only 5% of those who reported a PC never wear a helmet. When comparing participants with PC and those without, participants with PC were more likely to subjectively compensate risk-taking behavior when wearing a helmet (odds ratio 1.94, 95% CI: 0.93 to 0.96, $P = .001$). However, subjective risk compensation did not correlate with answers to follow-up questions designed to specify risk compensation.

Conclusions.—Our results suggest that, although persons with PC also report subjective risk compensation while wearing a helmet, this may affect terrain park use but may not affect their choices of terrain outside of the terrain park.

Epidemiology of the Pennsic Wars 2007–2013: A Medieval Mass Gathering Event

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Objective.—The Pennsic War is an annual 2-week event involving >10,000 participants of all ages who gather in western Pennsylvania to camp and to recreate medieval events, including full-scale battles with medieval weaponry. There is 24-hour, 7 days a week emergency medical services coverage, with a physician present during daylight hours. The closest community hospital is 30 minutes by ambulance. The objective of this study is to examine the epidemiology of an outdoor mass gathering event to as a lesson for future preparedness and response to medical emergencies at similar events.

Methods.—This is a retrospective cross-sectional chart review of patients who registered at the first aid tent during the 2007–2013 Pennsic Wars. Inclusion criteria included any patient who had data recorded into the triage log. Missing data from incomplete entries were categorized as unknown. Variables included age, sex, chief complaint, interventions and medications provided, and disposition. Data were abstracted from these triage logs by a single researcher for statistical analysis.

Results.—There were 1141 recorded visits during the 7-year study period. Dermatologic complaints were the most frequent (35%) and commonly reported as rash, insect bite, or soft-tissue wound. Musculoskeletal (16.9%), neurologic (10%), and gastrointestinal (7.3%) complaints were the next most common. The most common interventions recorded were bandaging/splinting, cardiac monitoring/electrocardiogram, and wound closure. The most common medications dispensed included normal saline ($n = 131$), Zofran ($n = 66$), and Benadryl ($n = 57$). Most patients, 86.2%, were treated and released, whereas 4.2% were evacuated to an emergency department (9% missing data).

Conclusions.—Most presentations were not life-threatening and required only basic wound care or therapeutic measures. However, there were cases of long-bone fracture, spine injury, and overdose that required intubation. The wilderness medical provider should have a definitive stabilization and evacuation plan for the infrequent but true emergencies. Understanding the incidence and distribution of medical emergencies also aids future planning and preparation of wilderness endeavors.

Bridging the Gap: Introducing Undergraduate Students to Wilderness and Emergency Medicine

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Objective.—Premedical-profession students across the country are a growing demographic for participation in wilderness and outdoor education activities and constitute a significant portion of the demand for free-standing wilderness medicine (WM) courses (eg, first aid, first responder). Yet, these courses often do not include education on how to pursue career opportunities in the health professions. To bridge this gap, we designed a 2-week course at the CU School of Medicine focusing on both basic backcountry medical training and exposure to and mentorship in health careers. The course had 2 major aims: first, students learned basic WM care, which included patient assessment, evaluation, stabilization, and management; second, participants gained meaningful exposure to core medical lectures, hands-on scenarios, ultrasonography, physician shadowing, admissions processes, and discussions on a wide range of healthcare-related careers.

Methods.—Surveys were distributed daily to evaluate topic relevancy, presentation quality, and overall enjoyment of material. Evaluations were distributed after the course to gauge how much students learned about emergency medicine (EM), WM, and various medical professions. Finally, students recorded their most liked and disliked areas of the course.

Results.—On average, 30 students attended each course. They reported significant gains in knowledge related to EM (9.5 of 10) and WM (9.6 of 10). In addition, they reported gaining understanding about the practice and profession of medicine (8.4 of 10). Interestingly, students rated lecture-based and hands-on activities equally, but noted that shadowing emergency medical services and emergency physicians were particularly valuable experiences.

Conclusions.—This novel educational approach influences premedical students through instruction in both hospital medicine and WM while simultaneously shaping their outlook on and ability to pursue a career in medicine. The success of these courses demonstrates a strong market demand for premedical education, portending a significant growth area for WM education as a whole.

The Effect of Helmet Cameras on Risk-Taking Behavior Among Mountain Bikers

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Objective.—The use of helmet cameras by outdoor and adventure sport enthusiasts has increased drastically. Whether their use influences the behavior of the users has not been studied. This study aimed to examine the effects of helmet camera use on mountain bikers' behavior.

Methods.—This is a prospective experimental study involving 35 local mountain bikers. Subjects rode a beginner-level course (a loop with multiple avoidable obstacles) 3 times. For the first ride, the subjects wore no camera; for the second and third rides, they wore a helmet camera. During the rides wearing the camera, subjects were told the camera was off for 1 ride and on for the other. Subjects were randomly assigned the ride during which they were told the camera was on. However, the camera filmed both rides. Data were collected from helmet camera video footage of the second and third rides and from surveys. All statistical analysis was performed using R GUI, and all statistical tests were conducted at the $\alpha = 0.05$ level.

Results.—Parametric paired t tests suggest a statistical difference in the time to complete the course between riders using a helmet camera and riders not using a helmet camera. The average time to complete the course for all riders was 224.50 (33.23) seconds while using the helmet camera, and 230.60 (34.35) seconds while not using the helmet camera. Twenty riders attempted the same number of obstacles, 6 attempted fewer obstacles, and 8 rode more obstacles while wearing the helmet camera compared with those not using a camera. No statistical differences were detected in the number of obstacles attempted across all riders or across different ability levels.

Conclusions.—On average, subjects using a helmet camera completed the course faster than subjects without a helmet camera but were no more likely to attempt more technical features of the course. Overall, these results do not show a significant increase in risk-taking behavior among subjects using a helmet camera.