had no effect on incidence. Most JMT backpackers follow standard backcountry hygiene recommendations.

Conclusions.—JMT backpackers have comparatively lower risk of experiencing diarrhea than other major long-distance backpacking routes in the United States. Diarrhea incidence is unaffected by backpacker demographics or hygiene compliance regularity on the JMT.

Iloprost With and Without rt-PA: Treatment of 131 Cases of Severe Frostbite

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Introduction.—Both rt-PA and iloprost (prostacyclin) are effective treatments for severe frostbite, but it is unclear if using them in combination is more effective.

Objective.—To evaluate combined treatment with rt-PA and iloprost in severe frostbite, compared with other therapies.

Methods.—Retrospective case review of 131 patients with severe frostbite. Patients without contraindication or severe trauma were managed with rapid rewarming (38°C bath water immersion + aspirin IV [250mg] + buflomedil IV [400 mg, aliphatic vasodilator] during 1 hour. Then 41 patients received daily treatment of aspirin and buflomedil (TT-A); 58 received aspirin and IV iloprost 2 ng/6 h (prostacyclin) (TT-B); and 20 received aspirin, IV tPA (100 mg, first day only) and iloprost (TT-C). Twelve patients did not receive any treatment (TT-D). The final level of amputation was measured 3 to 8 days later on bone scanning.

Results.—For grade 3 frostbite, 100% of the patients required amputation in TT-D (4 of 4 patients), as did 62.5% with TT-A (10 of 16 patients), 4.9% with TT-B (2 of 41 patients) ($P < .01$), and 27.3% with TT-C (3 of 11 patients) ($P < .03$). For grade 4, 100% needed amputation in TT-D (3 of 3 patients), 100% in TT-A (4 of 4 patients), 66.7% TT-B (4 of 6 patients) ($P < .001$) and 44.4% with TT-C (4 of 9 patients) ($P < .03$). Of 407 digits, 183 frozen fingers lead to 22 amputations (TT-A 49%, TT-B 0%, TT-C 2%, TT-D 49%), and 224 frozen toes lead to 25 amputations (TT-A 34%, TT-B 0%; TT-C 4%, TT-D 62%). Analysis showed that tPA was effective up to 12 hours and iloprost up to 48 hours.

Conclusion.—The efficacy of iloprost was significantly higher than buflomedil or no treatment. The addition of rt-PA to prostacycline seems to improve the prognosis only of stage 4 frostbite and only when the delay between rewarming and treatment was less than 12 hours.

Search and Rescue (SAR) and Fatalities in Mount Rainier National Park (MORA) 2010-2015: Location and Altitude Data May Enhance SAR Training and Preventative Search and Rescue (PSAR)

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Introduction.—Visits to our national parks number in the millions each year. Despite efforts by search and rescue (SAR) personnel to aid visitors, fatalities do occur. Mount Rainier National Park (MORA) encompasses 236,381 acres (956.60 km² [369.35 miles²]) and is centered around the stratovolcano Mount Rainier (4,392 m [14,411 feet]).

Objectives.—To provide an initial source of reference in the medical literature describing publicly available data on SAR and fatalities in MORA and to quantify location and altitude data regarding fatalities that required SAR activation in MORA to enhance SAR preparedness and PSAR activity.

Methods.—A retrospective review of a National Park Service publicly available database.

Results.—Between January 2010 and September 2015, 239 SARs and 41 fatalities occurred in MORA. Fatalities occurred in 22 defined locations, with 3 fatality locations unknown. Not all fatalities involved SAR. Thirty-two fatalities (78%) were related to activity of 24 SARs (10%), and 9 fatalities (12%) were unrelated to SAR activity. Location of the 32 SAR-related fatalities was concentrated in 18 defined locations with 2 fatality locations unknown. Seven

locations had more than one SAR-related fatality, yet only 2 individual SARs were related to more than one fatality. Thirteen SAR-related fatalities occurred at very high altitude (>3500 m [>11482 feet]), 12 at high altitude (1500–3500 m [4921–11,482 feet]), and 7 at low altitude (<1500 m [<4921 feet]). SAR-related fatalities occurred at a mean elevation of 2645 m (8679 feet), SD 1225 m (4022 feet), and interquartiles 1584 m, 2853 m, and 3825 m (Q1 5200 feet, Q2 9362 feet, Q3 12,550 feet).

Conclusions.—Between 2010 and 2015, 10% of SAR operations within MORA involved fatalities, and 78% of these SARs were located at high or very high altitude. These SAR operations and fatalities were located in distinct areas within MORA. SAR training and PSAR operations may benefit from quantified location and altitude-specific data.

Epidemiology of Mountain Climbing Injuries Presenting to Emergency Departments in the United States from 2012 to 2014

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Introduction.—There is currently a paucity of literature describing the burden and severity of mountain climbing-related injuries presenting to the emergency department.

Objective.—To determine the epidemiology of mountain climbing injuries presenting to US emergency departments.

Methods.—The Consumer Product Safety Commission's National Electronic Injury Surveillance System (NEISS) is a weighted database that provides a national probability sample of participating hospitals and allows estimation of product-related injuries treated in emergency departments in the United States. The NEISS database was queried for the period January 1, 2012 through December 31, 2014 for product code 1258: "Mountain climbing (activity, apparel or equipment)." The results were analyzed for diagnosis, sex, race, anatomic location of the injury, size of the hospital, and disposition.

Results.—The NEISS database provided 367 representative unique cases, resulting in an estimated 14,147 visits nationally during the 3-year period. The patients were predominantly male (65.0%) and white (72.5%), with an average age of 27.6 years. The largest percentage, 34.8% (4922), was seen in small hospitals. Disposition from the ED was discharge in 88.3%, admission in 7.7%, and transfer to another facility in 3.2%. The most common diagnoses were fracture (4008, 28.3%), strain or sprain (3574, 25.3%), and contusions/abrasions (1658, 11.7%). Internal organ injury (611, 4.3%) was less common. The lower extremities were commonly injured, including the ankle (2909, 20.6%), foot (1553, 11.0%), and lower leg (1361, 9.6%). The head (1496, 10.6%) was also a frequently injured body site.

Conclusions.—Musculoskeletal injuries commonly were observed in association with products coded as mountain-climbing related. The majority was discharged from the emergency department. Injuries predominately involved the lower extremities; however, 10.6% of patients had an injury to the head. Preventive strategies should focus on lower extremity protection and encourage the use of helmets.

Epidemiology of Scuba Diving-Related Injuries Presenting to the Emergency Department Between 2012 and 2014

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Introduction.—Scuba diving injuries not reported to the Diver Alert Network are poorly described in the literature and the current burden of injury is unknown.

Objective.—To describe injury patterns observed nationally and influence future efforts aimed at developing countermeasures and training to better address the current burden of injury among scuba divers.

Methods.—The Consumer Product Safety Commission's National Electronic Injury Surveillance System (NEISS) is a weighted database that provides a national probability sample of participating hospitals that allows for estimation of product-related injuries treated in emergency departments in the United States.

The dataset was queried for all cases under product code 1275: "Scuba diving (activity, apparel or equipment)" between January 1, 2012 and December 31, 2014. These data then were analyzed to provide a descriptive analysis of the epidemiology of scuba diving-related injuries.

Results.—The NEISS representative dataset produced 122 unique cases that resulted in an estimated total national injury burden over this 3-year period of 4151 cases. The most common injury diagnosis (2188, 52.7%) was coded as "other." Musculoskeletal-related injuries were noted in 1072 (26%) cases, 2439 (58.7%) patients were discharged, and 861 (20.7%) were treated and transferred to another facility. Similar numbers of patients presented to small, medium, and very large facilities.

Conclusions.—Scuba diving injuries present to emergency departments of all sizes, and providers at small- and medium-sized facilities need to be prepared to treat these patients. The injuries identified included many musculoskeletal injuries that commonly occur with moving heavy equipment in a wet environment. Future safety initiatives aimed at the diving community should provide additional focus on the safe movement of equipment and increase awareness of the risks posed by the wet environment.

Exercise in Inversions: A Pilot Study of PM_{2.5} Air Pollution Effects on Pulmonary Function and Aerobic Performance

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Introduction.—Winter thermal inversions occurring in geographical regions confined by mountains can trap air pollutants, leading to the accumulation of small particulate matter (PM_{2.5}). Despite an association between respiratory hospital admissions and elevated PM_{2.5} levels, many people continue to exercise outdoors during inversions.

Objective.—To compare pulmonary function and exercise performance during periods of low and high ambient PM_{2.5} concentrations.

Methods.—Forced vital capacity (FVC) and forced expiratory volume in 1 sec (FEV1) were measured outdoors before and after 2 running time trials of 3200 m. One run was performed with low PM_{2.5} concentration (<12.0 µg/m³), and the other trial was conducted during "yellow" or "orange" air quality alert days (PM_{2.5} ≥ 12.0 µg/m³). Additionally, a 10-cm visual analog scale (VAS) assessment administered postexercise was used to quantify subjective ratings of respiratory discomfort during the run.

Results.—The PM_{2.5} differential between trials was ≥18 µg/m³ for 10 volunteers. Despite feeling significantly more respiratory discomfort during the bad air trial (VAS: 2.9 ± 1.8 vs 4.6 ± 1.8 cm; *P* = .044), the differences in 3200 m run time (834.4 ± 94.4 seconds vs 847.4 ± 104.0 seconds; *P* = .261) and immediate postexercise heart rate (188.4 ± 8.1 beats/min vs 186.0 ± 7.4 beats/min; *P* = .328) were not significant between trials. Furthermore, the difference in postexercise FVC was not significantly different (*P* = 0.846) between the low PM_{2.5} (4.86 ± 1.00 L) and high PM_{2.5} (4.84 ± 0.95 L) conditions. Similarly, the difference in postexercise FEV1 was not significant (*P* = .750) between trials (4.22 ± 0.89 L vs 4.23 ± 0.85 L).

Conclusions.—Neither run time nor pulmonary function were adversely affected by high ambient PM_{2.5}. These parameters might not be sensitive to the negative health consequences of acute air pollution exposure.

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Accuracy of Acute Kidney Injury Measurements in Multistage Ultramarathon Runners

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Introduction.—Acute kidney injury (AKI) is common among endurance runners. Current practice to diagnose AKI when baseline serum values are unavailable uses an age-based estimation of glomerular filtration rate (GFR) and the Modification of Diet in Renal Disease (MDRD) equation for back-calculation of

baseline creatinine (Cr). However, the accuracy of this practice in a cohort of healthy runners is unknown.

Objective.—To evaluate the accuracy of the age-based GFR and MDRD equation in ultramarathoners.

Methods.—A multisite prospective analysis from participants in the 155-mile (250-km) Racing the Planet multistage ultramarathons in the Sahara, Gobi, and Atacama Deserts. Baseline creatinine (Cr) measurements were taken prior to race start and compared with estimated Cr using age-based GFR and MDRD.

Results.—Forty-eight study participants (27% women, age 39.3 ± 10.3 years) were analyzed with all racers combined as a single cohort. Age-based estimated baseline GFR was 95.9 ± 5.8, and the corresponding Cr was 0.88 ± 0.1 by MDRD. Measured Cr was 0.99 (± 0.2) at race start, with a corresponding baseline GFR calculated via the MDRD equation of 86.1 (± 14.6) and a candidate healthy population equation of 107.1 ± 9.3. Age-based GFR with back-calculation of Cr by MDRD underestimates measured Cr by 9% (*P* < .001), while back-calculation of Cr by a candidate healthy population overestimates measured Cr by 27% (*P* < .001). Correlation between estimated baseline GFR and MDRD-based GFR was low (*r* = .1). Correlation between estimated baseline GFR and the healthy population equation GFR was higher (*r* = .43).

Conclusions.—Analysis of the accepted age-based GFR and MDRD equations resulted in an underestimation of baseline Cr, leading to an overestimation of subsequent AKI. Additional studies are needed to create a more accurate estimation for baseline renal function, and this method should consider using the healthy population equation for a more accurate estimation of disease.

Blood Pressure and High Altitude: An Observational Cohort Study of Hypertensive and Nonhypertensive Himalayan Trekkers in Nepal

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Background.—Hypertension is the most common cardiovascular disease among those recreating at high altitude. Previous studies with smaller, more homogenous participant pools have demonstrated increases, decreases, and no change in blood pressure (BP). We sought to characterize how BP changes with altitude on both a population-wide and individual level in normotensive (NTN) and hypertensive (HTN) trekkers in Nepal.

Methods.—Trekkers in the Solukhumbu Valley of Nepal, aged 18 years and older, were recruited at 2860 m. They reported demographic information, medical history, and medications. Resting BP was recorded at 2860 m, 3400 m, and 4300 m on ascent and descent. Responses were compared between NTN and HTN subjects and across altitudes.

Results.—We enrolled 604 NTN and 60 self-reported HTN trekkers. At 2860 m, mean systolic BPs (SBP) in NTN and HTN trekkers were elevated relative to self-reported home measurements (*n* = 303, mean difference = 9 mm Hg [95% CI 5-13], *P* < .05). Mean SBP did not differ between altitudes on ascent or descent