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

($P > .05$) but was higher in HTN vs NTN subjects at each altitude ($P < .05$). However, we observed large interindividual variability. Between 2860 m and 3400 m, the majority (60%, $n = 284$) of NTN SBPs did not change, while 21% ($n = 102$) increased > 10 mm Hg and 19% ($n = 91$) decreased > 10 mm Hg. The pattern was similar in NTN subjects between 3400 m and 4300 m: (65% [$n = 202$] no change, 21% [$n = 65$] increased, 15% [$n = 46$] decreased). A greater proportion of HTN trekkers had SBP decreases between 2860 m and 3400 m (45% [$n = 19$] no change, 19% [$n = 8$] increased, 36% [$n = 15$] decreased) and between 3400 m and 4300 m (44% [$n = 10$], 26% [$n = 6$], 30% [$n = 7$]), respectively.

Conclusions.—In most individuals, with and without HTN, BP is likely to change less than 10 mm Hg at altitudes up to 4300 m. In general, travelers, including those with well-controlled HTN, may be reassured that their blood pressure will remain relatively stable at high altitude.

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***Crotalus horridus horridus* Venom-Induced Thrombocytopenia: Characterization of Venom after Binding of Crotalidae Polyvalent Immune Fab Antivenom**

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Introduction.—*Crotalidae* (pit viper) envenomation produces a consumptive coagulopathy, most commonly treated with *Crotalidae* polyvalent immune antibody fragments (CroFab, BTG International). Unfortunately, certain species of *Crotalidae*, including the timber rattlesnake (*Crotalus horridus horridus*), have demonstrated thrombocytopenia refractory to the administration of this antivenom.

Objective.—No current data have sufficiently explained the refractory thrombocytopenia produced by *C. horridus horridus* (CH) venom. The purpose of this research was to investigate the cause of venom-induced thrombocytopenia with the goal of developing an effective treatment method for this entity.

Methods.—Whole blood from a healthy man was collected in 3.2% sodium citrate. CH venom (Type A neurotoxin; Kentucky Reptile Zoo, Slade, KY) was serially diluted and mixed with 0.5 mL whole blood $\pm$ CroFab antivenom. Platelets were harvested to determine the effect of snake venom on platelet aggregation. Platelet aggregation studies were performed using a Chronolog Aggregometer. Prothrombin time (PT), partial thromboplastin time (PTT), international normalized ratio (INR), and fibrinogen also were monitored.

Results.—Ristocetin-induced platelet aggregation was exacerbated in the presence of increasing concentrations of venom. CH venom alone induced aggregation, and this effect was inhibited when venom was incubated with CroFab antivenom. PT, PTT, INR, and fibrinogen levels were within normal range when incubated with < 200 mcg/mL CH venom. Venom concentrations > 200 μ g/mL caused significant clotting, excluding these samples for analysis. Antivenom alone did not affect platelet aggregation.

Conclusion.—Platelet aggregation induced by CH Type A neurotoxin venom appears to be reversible by increasing concentrations of *Crotalidae* polyvalent immune antibody fragments in vitro. These data suggest that under in vitro conditions the venom components inducing platelet aggregation are concentration dependent and mimic ristocetin-induced platelet aggregation. Venom components may out compete Von Willebrand factor binding and have stronger affinity. This assay provides an in vitro model to study venom components associated with in vivo thrombocytopenia and the neutralization by antivenom.

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Relationship of Blood Pressure and Hypertension to Acute Mountain Sickness

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Introduction.—Hypertension has been suggested as a possible risk factor for acute mountain sickness (AMS).

Objective.—To determine the relationship between blood pressure (BP), hypertension (HTN), and AMS in trekkers in Nepal's Solukhumbu Valley.

Methods.—An observational cohort study of subjects with and without hypertension. BP, heart rate (HR), oxygen saturation (SpO₂), and Lake Louise Score for AMS (LLS) were measured at 2800 m, 3400 m, and 4300 to 4400 m in trekkers in Nepal. Subjects with HTN were defined as those with a self-reported diagnosis of hypertension. AMS was defined as LLS ≤ 3 with headache. Mean arterial pressure (MAP) was estimated by the formula: MAP = $((2 \times \text{diastolic}) + \text{systolic}) / 3$.

Results.—We enrolled a total of 670 subjects; those with no HTN (NTN, $n = 604$), HTN ($n = 60$), or reported borderline HTN (BTN, $n = 6$). BP values were similar in HTN and BTN groups, and these were treated as one group for the analyses. A total of 528 subjects (HTN = 48) were re-evaluated at 3400 m and 365 subjects (HTN = 30) at 4400 m. The prevalence of AMS was less in those with HTN vs those without (2% vs 11% at 3400 m, 3% vs 14% at 4400 m, $P > .05$). There was no relationship between systolic BP, diastolic BP, or estimated MAP and AMS ($P > .05$) at any altitude. Taking any BP medication appeared protective at 3400 m ($P < .05$), but not at 4400 m ($P > .05$). SpO₂ was associated with AMS at 4400 m ($P < .05$) but not at 3400 m ($P > .05$).

Conclusions.—History of HTN was associated with a decreased risk of AMS in this large cohort study of trekkers; however, blood pressure values were not related to AMS. No participant taking blood pressure medication developed AMS at 3400 m.

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Harness Suspension Stress, Narrowing the Focus

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Introduction.—Hanging freely and motionless in a harness produces harness suspension stress (HSS) and may cause symptoms of pain, nausea, numbness, or syncope. The etiology of symptoms has not been well defined or understood, leaving medical providers without a good rationale for possible treatment.

Objective.—To evaluate biomarker shift while inducing HSS.

Methods.—Eighteen healthy volunteers were recruited (men = 9, women = 9). Each subject was prescreened with a questionnaire and tilt table test. A treadmill maximum oxygen consumption test then was performed, and skin fold measurements were obtained. Subjects were randomized to front point or dorsal point of attachment for HSS testing and subsequently crossed over to the other point of attachment on a different day. Blood labs were performed pre- and post-testing. Electrocardiography, vital signs, calf girth, distal pulses, and sonographic evaluations were performed during testing.

Results.—Ten subjects experienced no symptoms. Six subjects with a dorsal point of attachment and 2 subjects with a frontal point of attachment experienced symptoms before 30 minutes. Symptoms were variable. No evidence showed aberrant blood marker shifts.

Conclusions.—There is no strong evidence to support current theories regarding the mechanism of symptoms from HSS. Further investigation is warranted.

Lightning Accidents in the Austrian Alps 2006 to 2014—A Retrospective Study

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