60 minutes while asleep. Baseline demographic data were obtained on arrival at 2860 m and 24h-ABPM measured between 2860 to 3440 m and 3440 to 4400 m. Hypertensive subjects were defined by self-reported diagnosis of hypertension (HTN). Acute mountain sickness was measured by Lake Louise Score (LLS).

Results.—Eight subjects were enrolled, 4 with pre-existing treated HTN. Data were insufficient or incomplete for 2 subjects with HTN. Between 2860 and 3400 m, the 4 normotensive subjects (NTN) had the expected decrease in BP during sleep. Mean arterial pressure (MAP) decreased from an average of 95 mm Hg (95% CI, 89.76–100.24 mm Hg) while awake to 82.5 mm Hg (95% CI, 74.72–90.28 mm Hg). The 2 with HTN had an increase in BP from awake hours (95.5 mm Hg [95% CI, 84.81–106.11 mm Hg]) to sleep (112.5 mm Hg [95% CI, 100.48–124.52 mm Hg]). The observed pattern in awake vs sleeping BP was similar between 3440 and 4400 m, ($N = 4$, 3 NTN, 1 HTN). The NTN had an average awake MAP of 94.67 mm Hg (95% CI, 90.1–99.24 mm Hg) that decreased to 86 mm Hg (95% CI, 74.03–97.97 mm Hg) and the HTN subject had an increase from awake MAP (90 mm Hg) to sleep MAP (106 mm Hg). No subject developed AMS at any altitude. No differences in heart rate, maximum or minimum BP, or number of BPs above normal were found between NTN and HTN groups at altitude.

Conclusions.—These findings suggest that those with baseline HTN may have an increase in BP while sleeping compared with NTN individuals at high altitude. The clinical significance of these findings remains to be studied.

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The Effect of Riociguat on Gas Exchange, Exercise Performance, and Pulmonary Artery Pressure During Acute Altitude Exposure

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Introduction.—Impairment of exercise performance during altitude exposure results in hypoxemia and decreased oxygen delivery to exercising muscles. Hypoxic pulmonary vasoconstriction (HPV) and ventilation/perfusion (V_A/Q) mismatch further contribute to hypoxemia. Therefore, if pharmacologic blockade could attenuate HPV, then V_A/Q matching, arterial PO_2 , and exercise performance might improve. The nitric oxide (NO) pathway has been targeted in this context with sildenafil, but NO is limited at high altitude, which may explain the variable effectiveness of this approach. Riociguat is a soluble guanylate cyclase stimulator that does not require NO for its action.

Objective.—To examine the acute effect of riociguat on pulmonary artery pressure, arterial oxygenation, and exercise performance at 15,000 feet simulated altitude.

Methods.—Subjects instrumented with radial and pulmonary artery (PA) catheters performed incremental exercise tests on a bicycle ergometer at a simulated altitude of 15,000 feet before and after administration of 1 mg riociguat. The following parameters were measured: mean and PA pressures, pulmonary vascular resistance (PVR), systemic vascular resistance (SVR), heart rate (HR), cardiac output, arterial and mixed venous O_2 saturation, alveolar-arterial PO_2 difference, oxygen consumption (VO_2), and arterial O_2 delivery (DO_2). Statistical analysis was performed using a generalized estimating equation model, and the effect of riociguat on outcome was examined, accounting for exercise impact.

Results.—Preliminary results ($N = 11$ subjects) demonstrated decreased PVR ($P = .014$), while DO_2 and cardiac output were increased ($P < .01$) at rest and at 50 W of exercise intensity after administration of riociguat. There was no statistically significant effect on mean arterial or PA pressures, arterial O_2 saturation, alveolar-arterial PO_2 difference, or VO_2 .

Conclusion.—We conclude that at 15,000 feet simulated altitude, a one-time dose of 1 mg riociguat appears to decrease pulmonary vascular resistance

while increasing peripheral O_2 delivery and cardiac output at rest and low exercise levels.

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The Influence of Snow Density on O_2 and CO_2 Levels in Subjects Breathing into an Artificial Airpocket

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Introduction.—Survival time in an avalanche depends on factors such as patency of the airway and the volume of an airpocket. It also was suspected that the characteristics of snow, especially snow density, affects the development of hypoxia and hypercapnia.

Objective.—To evaluate the influence of snow density on the development of hypoxia and hypercapnia in subjects breathing into an artificial airpocket.

Methods.—Twelve male healthy subjects breathed through an airtight face mask and 40-cm tube into an artificial airpocket of 4 L. Every subject performed 3 tests on different days with variable snow densities (range 155–481 kg/m³). Symptoms, gas, and cardiovascular parameters were monitored for up to 30 minutes. Tests were interrupted at $SpO_2 < 75\%$. Snow density was measured around the airpocket. A scatterplot of rate of CO_2 decrease and O_2 increase in the airpocket per snow density revealed 2 clusters (snow density $\leq$ or > 250 kg/m³) that were confirmed by a 2-step cluster analysis. The second cluster then was divided by the median of about 400 kg/m³ into 2 subgroups. Test duration was analyzed by means of Kaplan-Meier estimator and log-rank test.

Results.—Eighteen of 36 test subjects completed the test duration of 30 minutes. Test duration was different in the 3 groups of snow density ($P < .05$) and was shorter in the highest density group than in the other 2 groups ($P < .05$). Test duration in the lowest and middle snow density groups was not different ($P > .05$).

Conclusion.—Snow density > 250 kg/m³ was positively correlated with difference from baseline to maximum value of CO_2 and negatively correlated with difference from baseline to minimum value of O_2 levels. Unexpectedly, lower densities showed a different behavior on CO_2 levels that could affect survival in avalanche-buried victims.

Burial Duration and Airpocket Explain Avalanche Survival Patterns in Austria

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Introduction.—An avalanche survival curve is a graphical representation of the cumulative survival probability during complete avalanche burial as a function of time. Thus far, survival patterns have been calculated using data from Switzerland and Canada.

Objective.—To calculate an avalanche survival curve using data from Austria.

Methods.—The analysis included avalanche accidents between 2005 and 2006 and 2012 and 2013 in Austria involving completely buried victims (ie, burial of the head and chest) in open terrain with known outcome at hospital discharge (survived or did not survive). Extrication and survival curves were calculated using the Turnbull algorithm, as in previous studies.

Results.—Three hundred thirty-three completely buried victims were included. Median time to extrication was 15 minutes (25th to 75th quartile: 5–50 minutes). Overall survival was 59%. The survival curve showed a rapid

initial drop in survival probability and a second drop to 18% between 20 and 40 minutes burial, where an inflection point exists and the curve levels off. Victims with an airpocket were more likely to survive compared with those without, especially for victims buried >15 minutes.

Conclusion.—The Austrian survival curve resembles previously published curves and suggests that underlying survival patterns are reproducible. The results are in accordance with current recommendations for management of avalanche victims and serve as a reminder that expedient companion rescue is critical for survival. For the first time an airpocket was shown to be a positive prognostic factor for survival.

Medical and Logistical Challenges of the Longest Cave Rescue: A Case Report

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Introduction.—Trauma care in cave rescue is a unique situation in wilderness medicine with extremely long prehospital time. Environmental and logistical factors limit therapeutic options and transport and also can influence survival and outcome.

Objective.—To describe trauma care during the longest cave rescue reported to date.

Methods.—Case report of a 53-year-old male patient with a severe head injury at a depth of about 1000 m from the cave entrance in Bavaria, Germany.

Results.—Search and rescue (SAR) operation required 12 days until evacuation. SAR activation was delayed because of the location of the accident, and it required several days to recruit experienced cave rescuers and medical teams. More than 700 rescuers were involved, including 7 physicians from 5 different countries. Basic first aid was performed by companions in the acute phase and prevented the patient, who sustained a severe traumatic brain injury, from developing severe hypoxia. Thereafter, professional medical care was limited to continuous monitoring and basic therapeutic measures by medical personnel because of the extremely confined space in the cave and long evacuation time. At 6-month follow-up, the patient had recovered completely and resumed his job.

Conclusion.—First aid education and training and international collaboration of cave rescue teams play an important role in cave accidents. However, trauma care often relies on expert knowledge and is not yet evidence-based practice.

A Review of Search and Rescue Operations in Slovenia

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Introduction.—Adventure recreation in wilderness areas across the world has continually increased in popularity in recent years. In response, more intensive study has been devoted to analyze and compare search and rescue programs. Furthermore, less emphasis has been put on rescue programs in smaller European countries with rich histories of mountain travel and rescue, where development of rescue systems is ongoing.

Objective.—To document trends in professional mountain rescue operations performed in Slovenia from 2011 to 2015.

Methods.—This study is a retrospective case series which uses information detailing rescue and recovery operations. Data were obtained from the Slovenian National Mountain Rescue Association. This study reports longitudinal trends in numbers of rescues and compares numbers of both on-foot and helicopter-supported rescues. We also compared data on causes of activation of search and rescue and interventions requiring use of a helicopter in 2015 and the severity of injuries requiring evacuation.

Results.—Altogether there were 434 mountain rescue operations in 2015. Among those involved, 206 (42%) were injured, 176 (36%) did not require

treatment, 48 (10%) were due to illness, and 40 (8%) were found dead. The most frequent type of injury was lower extremity, and the most frequent cause of illness was exhaustion. One hundred ninety interventions (44%) used a helicopter. Of these, 49% were injured, 29% required no medical treatment, 15% were ill, and 7% of the patients were found dead.

Conclusions.—The number of reported rescues preformed in the 5-year study period did not vary significantly despite increases in total mountain rescues throughout previous decades. A notable number of operations in the past year required the use of a helicopter, and the majority were the result of an injured patient. This study will help provide an understanding of incidents that arise in the Slovenian mountains and the response rescue services provided.

How Effective Is a Dental Skills Workshop in Improving the Knowledge and Confidence of Medical Students and Residents in Management of Dental Emergencies?

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Introduction.—Millions of people experience dental trauma while participating in wilderness activities. Many physicians and medical students report rarely having had any education in this field. The purpose of this study was to evaluate the effect of a 3-hour hands-on workshop for medical students and residents on their pre- and postcourse knowledge and confidence in managing dental emergencies.

Materials and Methods.—A 1-hour lecture followed by four 20-minute “hands-on” skill stations on dental mannequins was administered to a group of medical students and residents. Pre- and postworkshop questionnaire surveys were conducted.

Results.—There was a significant increase in the percent of lecture attendees who responded correctly to 3 of the 4 knowledge questions ($P < .005$). Confidence in various statements about treating dental emergencies was significantly different after the lecture for 8 of the 9 statements. At baseline, the majority disagreed with statements implying confidence in handling various aspects of dental emergencies. At follow-up, there was an apparent trend toward confidence.

Conclusion.—Our findings suggest that dental education is minimal during undergraduate and graduate medical training. Our interactive workshop appeared to be effective in increasing the knowledge and self-reported confidence of medical practitioners in handling dental emergencies. Based on findings from this workshop, it seems there is a need for additional dental education during medical school, especially with regard to managing dental emergencies, dental anesthesia, and dental nomenclature.

Battlefield Analgesia and Adherence to TCCC Guidelines: A Quality Assurance Analysis

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Introduction.—Previous studies have demonstrated low rates of prehospital analgesia and adherence to Tactical Combat Casualty Care (TCCC) guidelines in the Joint Theater combat setting. The reasons for this remain unclear. We seek to expand on previous reports by evaluating a larger prehospital data set and seek associations with various factors associated with analgesia or lack of analgesia administration.

Methods.—This was part of an approved quality assurance project to evaluate adherence to TCCC guidelines across multiple modalities. Data were obtained using the Prehospital Trauma Registry (PHTR). The PHTR was in existence from January 2013 through September 2014. This database obtained data from TCCC cards, DD 1380 forms, and after-action reports (AAR) to provide real-time feedback to units on prehospital medical care.

Results.—Note that this is a preliminary analysis; full analysis will be available for the conference. During the PHTR's existence, 705 patient