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ORIGINAL RESEARCH

Medical Knowledge and Preparedness of Climbers on Colorado's 14,000-Foot Peaks

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Objective.—To assess the medical knowledge and preparedness of mountain climbers on Colorado's 14,000-foot peaks and to compare differences in knowledge and preparedness based on demographics, training, and difficulty of the climb.

Methods.—Mountain climbers from 11 14,000-foot peaks in Colorado were surveyed at the time of summiting. These peaks represented every major mountain range and class of difficulty in Colorado. Marijuana use and demographic information including age, gender, state of residence, and income level was collected in the survey. In addition, participants were scored on medical knowledge and preparedness using a novel assessment tool. Scores were then compared and statistically analyzed.

Results.—Mountain climbers scored 2.84 ± 1.25 and 3.92 ± 1.20 out of 6.00 on medical knowledge and preparedness, respectively. Medical training was shown to be the only significant predictor of medical knowledge, whereas age, race, income, and group status were all shown to be significant predictors of preparedness. It was shown that 9.4% of participants were using marijuana. Only 25% of individuals climbing class 3 mountains elected to wear helmets.

Conclusions.—Most mountain climbers had no formal wilderness medicine training and did worse on the medical knowledge assessment than those who did have training. Consistent with previous studies, participants performed poorly on the medical knowledge assessment. As such, ways to improve wilderness medical knowledge among outdoor recreationalists should be sought. The low rate of helmet use on Colorado's technical peaks represents an important area for education and injury prevention.

Key words: mountaineering, hiking, injury prevention, Colorado, preparedness, helmets, education, marijuana

Introduction

Every year, around 500,000 people climb 1 of Colorado's 14,000-foot peaks.[1] From 2010 to 2013, 28 fatalities were reported on these mountains. These deaths occurred across the spectrum of nontechnical and technical mountain classes.[2,3] Although fatalities on Colorado's 14,000-foot peaks are rare, injuries are common.[4–6] As more people take to the hills, it is likely that rates of accidents will also increase.[7] Similarly, as mountain climbing popularity grows, more novices are traveling to the Colorado high country for recreation.[1] These novice climbers represent a vulnerable population because of a lack of experience in a potentially dangerous environment.

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Climbing mountains presents certain objective hazards such as storms, lightning, rock fall, icefall, avalanche, and potentially dangerous exposure. Equipment failure is also responsible for some adverse outcomes. However, the largest cause of injury and death on the mountains of North America is human error.[8] Improper conditioning, mental lapses, group disharmony, poor planning, and lack of knowledge can all contribute to human error.[8] Importantly, most of these variables are preventable with appropriate preparation and training. These errors also put potential rescuers at risk.

Data concerning number and cost of search and rescue (SAR) operations on Colorado 14,000-foot peaks are not currently available. However, data from the Heggie et al study on SAR operations in U.S. National Parks indicated that 15,535 rescues took place between 2003 and 2006.[9] Of these, 5607 (36%) took place on similar terrain to that found on Colorado's high peaks with an estimated cost of US $5.9 million.[9] A personal interview

with Glen Kraapz, a mission coordinator for Summit County Rescue Group (September 2015) revealed the following: In Summit County, Colorado, alone, 92 SAR operations were conducted in 2014. Five of these were performed on Quandary Peak (14,265 feet), a popular hike just south of Breckenridge. In 2012 this mountain saw 10 SARs.

Evacuation times from a Colorado wilderness area can vary from hours to days.[5,6] Because of rapidly changing weather patterns and mountainous terrain, transporting patients to definitive medical care takes considerably longer and is logistically more complex than in urban areas.[6,8] As a result, simple medical problems may become medical emergencies. Accordingly, a reasonable medical knowledge base and proper preparedness are paramount for both the prevention and treatment of injuries and illness in a wilderness environment. Therefore, promoting wilderness medicine education and the need to continually revisit such a curriculum was an important aspect of this study.

Colorado 14,000-foot peaks are ideal study locations because they attract a large and diverse group of people. Currently, there are no formal data on how many climbers of Colorado 14,000-foot peaks are medically prepared and possess basic yet essential emergency medical knowledge. Likewise, data concerning medical knowledge and preparedness of outdoor recreationalists in the medical literature are limited.[10–14]

The authors hypothesized that mountain climbers on Colorado's 14,000-foot peaks would be unprepared for their ascent and lack knowledge about both wilderness medicine and the proper response to injuries. The authors further hypothesized that helmet use on mountains with rockfall potential would be low, particularly on peaks with easy access.

Methods

This was a cross-sectional convenience sample in which mountain climbers were surveyed from 11 different peaks at the time of their summit. There are approximately 55 mountains over 14,000 feet (4267 m) in Colorado, spread geographically over 8880 square miles (23,000 km^2).[1,3] These peaks can be found in 6 different mountain ranges, including the Front, Ten Mile, Sawatch, Sangre de Cristo, Elk, and San Juan ranges. Mountains can be categorized into different classes based on the technical difficulty of the easiest route of ascent; Class 1 and 2 are a hike, 3 is a scramble, and 4 and 5 are technical climbs.[1,3] Peaks of any given class often have more difficult routes, including some with fifth class climbing.[3] Route taken was not specified in the survey. Summits from each range and technical class were randomly selected as survey sites. Torreys Peak, San Luis Mountain, Mt. Lincoln, Sunshine Peak, Mt. Elbert, Longs Peak, Kit Karson Peak, Wetterhorn Mountain, Capital Peak, North Maroon Peak, and Little Bear Peak were selected as survey sites.[3]

Surveys were offered to every climber $\geq$18 years old reaching the summit on a given day between 0800 and 1300 hours. Days with favorable weather were chosen to maximize climber volume, summit success, and researcher safety. Each peak was surveyed for 1 day. Surveys were administered between July and September of both 2013 and 2014. These dates represent the mountaineering season in Colorado, a time when the greatest number of climbers can be found on a given peak.[1]

The survey was a single page and divided into 3 sections. The first section collected demographic and personal characteristics including age; sex; race; medical training; income; state of residence; occupation; and status as a group leader, group member, or solitary climber. Those who identified as "healthcare professionals" included physicians, nurses, respiratory therapists, and other professions involved directly in patient care. The second section contained 6 questions intended to score an individual's general knowledge of wilderness medicine with specific emphasis on mountaineering injuries and illnesses. The questions dealt with dehydration, high altitude cerebral edema, splinting injuries, scene safety, normal pulse and respiratory rates, and shock due to hypovolemia (Table 1). Topics were chosen in accordance with The American Red Cross Wilderness and Remote First Aid manual and would serve as essential course topics for any accredited 16-hour wilderness first aid course.[15] The Lindsey et al study, which outlined minimum course topics for a Wilderness First Responder, was also used to further validate question selection.[16] The third section assessed preparedness and included questions on helmet and sunscreen use, clothing, first aid supplies carried, knowledge of the local rescue group, a self-assessment of physical fitness, and proper itinerary sharing. The latter question asked whether the group or individual left his or her itinerary

Table 1. Medical knowledge questions

Name 3 symptoms of dehydration?
What are 3 symptoms of high altitude cerebral edema?
What must be checked before and after splinting an injury?
Most important thing to check first at any accident scene?
Normal resting pulse and respiratory rate ranges?
Three things you can do for someone in shock from blood loss on the mountain?

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