

Examination of accident data as part of the risk management process allows administrators and field staff to make better-informed decisions about actual program risks. Trend data can justify policy changes, changes in the level of training or experience for staff as well as change program location or activity. Accident data when shared as an industry can help identify industry wide or localized trends, add to the collective body of knowledge and shape industry standards.

There have been numerous papers, reports and studies focusing on accident data from various outdoor adventure pursuits. For example, The National Outdoor Leadership School (NOLS) has published overviews of its incident profiles because “an organization that understands its risk management history is better able to identify if and when changes in risk management methods are necessary” (p. 174, Leemon and Schimelpfenig, 2003). The report identifies the most common types of injuries and illnesses among NOLS course participants, rates for injury, illness, evacuation and fatalities. Athletic and soft tissue injuries continue to be the most common type of injury, while gastrointestinal problems the most commonly reported illness (Leemon and Schimelpfenig, 2003). A 2007 study (Capps) reviewed organizational accident data from a five year period and also found athletic and soft tissue injuries to be the most common followed by infection. Capps also found that students were more likely to be injured than staff at a ratio of 9:1. Ela (2004) examined wilderness search and rescue in New Hampshire, focusing on demographics, type of injury, environmental factors and fatalities. Results indicated that middle-aged men who had become lost or had lower extremity musculoskeletal injuries, caused the most search and rescue incidents in New Hampshire to be initiated.

An Austrian study of helicopter rescues in the Alps compared two three-year periods from 1998-2003 to look for trends in injury data (Kaufmann, Moser, and Lederer, 2006). The study found an increase in incidents due to greater participation in mountain sports, but a significant decrease in the number of life-threatening incidents, with two-thirds of the incidents involving tourists.

Other studies have focused on a specific demographic factor. Demographics present an interesting way to look at subgroups of incidents. Twombly and Schussman (1995) surveyed participants of an Outward Bound backpacking course to examine the role of gender with injury and illness. Findings indicated that women experienced a higher rate of injury than men. The study also found that injury reporting by men was somewhat dependent on the gender make up of the leader pair. A study looking at risk factors for incidents taking place at summer camp found that campers reported more injuries than did staff and those campers participating in advanced backpacking and advanced canoeing trips were most prone to injury (Elliot, Elliot, and Bixby, 2003).

Type of Activity has been a common study factor. The American Alpine Club (2002) has kept and published accident data annually in *Accidents in North American Mountaineering* since 1951. Tables compare accident factors including terrain, immediate and contributory causes, age, experience level, time of year, ascent or descent and type of injury. Contributions to the annual report include significant injury or rescue only, and as a result, fatalities account for over 20 percent of incidents reported (American Alpine Club, 2002). The American Alpine Club’s accident analyses also show that contrary to other areas of the world known for mountaineering, more accidents occur during the ascent than the descent in North America. American Whitewater

(2007) keeps a similar accident database to the American Alpine Club's database. The database dates back to 1974 with accident reports compiled by year for all whitewater related incidents including kayaking, canoeing and rafting. The American Whitewater database contains significant injury or fatality reports only; resulting in the majority of reports filed involving a fatality. Common causes of death included foot entrapment and drowning due to undercut rocks. Fiore's (2003) review of rafting and kayaking compared injuries between the two activities. The paper included injury and fatality rates, as well as acute and chronic injury types. The study reported that kayakers had higher injury and fatality rates than rafters and were more likely to sustain chronic injury as a result of participation. A study published in 2008 looked at the injury distribution among indoor and outdoor rock climbers in the United Kingdom. Approximately fifty percent of the climbers reported at least one injury in the previous twelve month period.(Asghar, Jones, and Llewellyn). The primary three injury categories for climbers were overuse injuries, acute climbing injuries as a result of a fall, and acute injuries caused by strenuous climbing moves. Climbing injuries occurred at both indoor and outdoor locations, and factors associated with injury included climbing frequency and technical difficulty. Mountain biking was the activity focus for an injury literature review by Kronisch and Pfeiffer in 2002. The review showed that a significant percentage of riders were prone to overuse injuries, and that most severe traumatic injuries were caused by sudden deceleration followed by a forward crash over the handlebars. Significant factors contributing to mountain biking injuries included terrain, amount of time spent riding, equipment failure, rider error and gender. The most common mountain bike injuries overall were abrasions and contusions, followed by fractures, with the clavicle being the most common fractured bone. A telemark skiing study obtained information on injury frequency and type, participant habits, demographics and equipment (Tuggy, 1996). Injury rates showed women and less experienced skiers to be more prone to injury and that telemark skiers had less severe injuries than alpine skiers. Equipment also played a factor in injury rates. Hiking lava fields in Hawaii was the focus of an injury study looking at the roles of experience, behavior, preparedness and demographics (Heggie and Heggie, 2004). The study found soft tissue injuries to the lower extremities and dehydration were common and that inexperience was the most significant contributing factor responsible for injury.

An in-line skater study focused almost entirely on equipment used by skaters and how that impacted injury data (Osberg and Stiles, 2001). The study found men had a higher injury rate than women and that in general not enough skaters wore protective equipment, especially helmets.

Fatalities data also draw interest and are the focus of several studies. An examination of deaths on challenge courses over a 14-year period found two main causes; falls from height (5 fatalities) and sudden cardiac arrest (10 fatalities) (Welch and Ryan, 2002). All but one of the fatalities from falls involved a staff member. All of the sudden cardiac arrests were in men; age 33 to 60 years old. A California wilderness area study also found that men accounted for 78 percent of the deaths in the study, with cause of death: heart disease, drowning, or a fall from height (Montalvo, Wingard, Bracker, and Davidson, 1998). Researchers in Arizona found that fifty percent of 100 wilderness mortalities in the Pima County study involved alcohol as a contributing factor in the incident (usually resulting in drowning or a fall from height) (Goodman, Iserson, and Strich, 2001).

These studies all present descriptive data about the sample examined as part of the study. This information presents a useful overview of accidents, however the ability to generalize the information to other areas or populations is limited because studies are scattered and

inconsistent. The two areas of adventure recreation with the most research completed are climbing and boating (canoeing, kayaking, and rafting). The studies would be additionally useful if model and theory testing was completed as part of the study or if results were compared with results of similar studies.

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