



## Editorial

## Snowsport trauma and safety: A systems approach for research on the assessment and prevention of snowsports injuries



Snowsports, like alpine skiing and snowboarding, are described as occurring within a complex system [1] that includes the participants, equipment, and environment. Each of these components is important when considering the management strategies necessary to reduce the risk and severity of injury in snowsports. The injury mitigation strategies may be applied to different stages of an injury event (that is, before, during, or after an injury event) [2]. For more than 5 decades international, interdisciplinary organisations like the *International Society for Snowsports Safety* (ISSS) and the *International Society for Ski Traumatology and Medicine of Winter Sport* (SITEMSH) have been meeting to discuss their members' research in each of these areas, with the goals of understanding the factors related to injury and reducing injury likelihood and severity.

ISSS and SITEMSH have a long history of providing meaningful epidemiological data, using these data to guide injury mitigation strategies, and assessing the impact on injury rates. For example, the longest prospective, case-controlled study on snowsports injury (the Sugarbush study conducted at Sugarbush Resort, Vermont, USA [3]) provided ACL injury data and binding release data over a 40 year span. The principal investigators and others in the snowsports safety community (ISSS and SITEMSH) used that data to provide ACL injury prevention strategies that included suggested behaviour changes, attitude changes, and engineering solutions [4,5]. As technology improved and the snowsports industry evolved, so has the research — more recent research has addressed new disciplines, such as snowboarding, and the use and efficacy of personal protective equipment (PPE), such as wrist guards and helmets [6–8].

Drawing upon a systems perspective, modern snowsports research reflects the 'journey' of the participants to the snow and their participation on the snow. This latest Special Issue of the *Journal of Science and Medicine in Sport Plus* (JSaMS+) continues the tradition of interdisciplinary research to address how to reduce and/or migrate injuries in snowsports. In examining the participant element of the snowsports system, there has been significant research on the motivation and behaviour. Motivation for participation in snowsports is important for providing injury mitigation practices; from the beginning of the 'journey', Dickson et al. [9] suggest that snowsports may help participants not lose their proprioception at the same rate as in other physical activities, which may help reduce the risk of falls, and thus injury risk. Further in the participant category, Happ et al. [10] explores the behaviours and attitudes of ski tourers who choose to participate beyond resort boundaries, and thus outside the limit of resorts' risk management strategies and support.

Protective equipment and design are additional, important elements of the snowsports system that can have a significant impact and need to be examined before the 'journey.' For example, PPE design needs to be

examined to ensure it is designed properly for use and protection. To this end, Leslie et al. [11] report on a wrist surrogate that was developed to provide more life-like laboratory testing of wrist guard designs. Also, resort-level equipment used for risk management was examined by Dorsemaine et al. [12]; in this work, padding used for marking or protecting manmade objects, such as lift towers and snowmaking equipment, is examined and new research areas are proposed.

Moving along the chain, several articles in this special issue of JSaMS+ look at protective equipment use and efficacy at the moment of the injury event, which is often a fall. Helmet use has grown as a common PPE used in snowsports both in-bounds and in the backcountry. Niemann et al. [13] reflect upon the evolution on helmet use in Switzerland over two decades. To prevent falls while being transported up the slope, snowsports participants often use restraint bars on chairlifts that are typically lowered manually by riders. Determining the use rates of these devices is at the intersection of the participant and equipment elements of the snowsports system. Harley et al. [14] discusses their research on when and who are most likely to choose to use this protective equipment.

The fun begins as one descends the mountain. While descending the slope it is the responsibility of an individual snowsports participant to control his or her speed and course to avoid other people and objects. Participant speed also influences the energy attenuation requirements for protective equipment (both personal and protective equipment used by resort areas) to be effective. Stepan et al. [15] explores speed data collected over more 15 years in the USA, a time when helmet usage was increasing. As mentioned above, resorts often use padding as protective equipment to minimise the likelihood or severity of injury in modest (typically low-speed) impacts. At the more micro level of a person's participation, Siefert et al. [16] explore the physiological response of two different turn ski transition methods. A physiological response is important as fatigue has long been known to be a risk factor for injury [17]. As Siefert et al. note, this research is also important given the declining fitness of many snowsports participants and the increased speed of lifts (and thus reduced recovery time).

At the moment of impact when an injury event may occur, Dorsemaine et al. [18] explores the efficacy of padding and suggests further areas of study needed to improve safety. Likewise, Bailly et al. [19] investigates head accelerations during head impacts that are relevant to head injury research and future helmet design.

This body of research demonstrates the breadth of interdisciplinary research that is necessary to address injury prevention and mitigation across the visitor's journey and within the complex system that is snowsports. As with previous volumes, the scientific findings of these manuscripts add to the knowledge base of snowsports injury prevention

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and apply to other recreational sports and activities. Despite the wide range and volume of work in the past volumes from the ISSS, there is no topic in snowsports safety that has been solved completely and many are not represented in this volume.

Thank you to all the authors, reviewers, and the staff at JSaMS+ for their contributions to this Special Issue. ISSS and SITEMSH will continue to support research on snowsports safety and are excited to see further safety improvements from the global community of researchers in this field.

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