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# Increased patterns of risky behaviours among helmet wearers in skiing and snowboarding

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ABSTRACT

*Background:* There has been an ongoing debate as to whether wearing helmets in skiing and snowboarding increases the risk tolerance of participants.
*Objective:* To investigate the roles of demographic and personality variables, and helmet usage in predicting risk taking behaviours in a cross-sectional sample of intermediate and proficient skiers and snowboarders.
*Methods:* Risk taking in skiing was measured using a validated 10-item self-report measure which was designated as the outcome variable in a three step hierarchical regression. Independent predictors included age, sex, education, sport, ability, helmet usage, and personality traits that have been associated with risk taking: impulsivity and sensation seeking.
*Results:* In the final regression model, helmet use significantly predicted variance in risk taking (standardized $\beta = .10$, $p = .024$), and the relationship remained after accounting for variance due to demographic variables and general trait measures. The partial relationship between risk taking and sex, ability, impulsivity, and sensation seeking were also significant ($p < .05$).
*Conclusion:* High sensation seeking, high impulsivity, male sex, and proficiency were associated with increased patterns of risky behaviours in skiers and snowboarders, and after accounting for these factors, helmet use was a significant predictor of risk taking. The relationship between helmet use and risk taking was modest suggesting that the costs of increased risk taking is not likely to outweigh the protective benefits of a helmet.



## 1. Introduction

Skiing and snowboarding are considered high-risk sports because there is an inherent danger of severe injury or death (Creyer et al., 2003). Participants experience variable terrain and weather conditions, high speeds, and obstacles including other participants and structures (e.g., trees, fences, poles), all increasing the chance of a severe injury. In particular, head injuries are a major risk factor in skiing and snowboarding, accounting for approximately 18–27% of all injuries (Sulheim et al., 2006; Wasden et al., 2009) and rates of .09–.46 per 1000 participant days (Hagel et al., 2004). Helmet use, which has increased in the last decade (Bianchi et al., 2011), significantly decreases the severity of head injury without increasing the severity of neck injury (Russell et al., 2010).

While helmet use decreases injury severity, some researchers have proposed that participants take more risks while wearing protective gear, although the findings are mixed (Hagel et al., 2005; Ruedl et al., 2010, 2012; Ruzic and Tudor, 2011; Scott et al., 2007). The risk compensation hypothesis suggests that individuals may adjust their risk tolerance to compensate for the additional protective effects of the helmet (Thompson et al., 2001). Ruzic and Tudor (2011) compared a risk index based on skiing style between helmet and non-helmet wearing skiers and reported support for the risk compensation hypothesis. Conversely, Scott et al. (2007) reported a lack of support for the risk compensation hypothesis based on single item outcomes such as perceived speed or degree of challenge when wearing or not wearing a helmet. Similarly, Ruedl et al. (2010) found that helmet use was not predictive of risky behaviour. Hagel et al. (2005) compared injury characteristics and severity among helmet and non-helmet wearing skiers and snowboarders and found no support for risk compensation, in fact they reported greater injury severity among non-wearers. A

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more recent study by Ruedl et al. (2012) explored risk compensation using a validated measure of sensation seeking, a personality trait that involves the seeking of intense sensations, and the willingness to take risks in pursuit of these sensations (Zuckerman, 1994). Although helmet use was not predictive of self-reported risk taking, those who reported that they would be willing to take more risks while wearing a helmet (compared to while not wearing a helmet) and those who labelled themselves as risk takers scored higher on sensation seeking (Ruedl et al., 2012). The latter finding is not surprising given that individuals participating in high-risk sports and other risky activities consistently report higher scores on measures of sensation seeking compared to low-risk participants or controls (reviewed in Bardo et al., 2007; Goma-I-Freixanet et al., 2012; Kalichman et al., 2003; Zuckerman and Kuhlman, 2000). While findings for the risk compensation hypothesis are mixed, other characteristics were consistently associated with risk taking including being male, younger, and skilled at the sport (Ruedl et al., 2010, 2012; Ruzic and Tudor, 2011). It may also be important to consider personality variables (i.e., sensation seeking) in addition to demographic variables when investigating risk taking in sport, and to employ multi-item, validated measures to quantify risk taking.

The aims of this study were two-fold. To investigate the roles of demographic and personality variables, and helmet usage in predicting risk taking behaviours in skiing and snowboarding and to compare injury frequency between helmet users and non-users. We measured risk taking using the contextual sensation seeking questionnaire for skiing (CSSQ-S); a multi-item instrument that is specific to skiing and snowboarding and provides a way to quantify patterns of risky behaviour in these sports. The CSSQ-S has shown incremental validity in predicting injury among proficient skiers and snowboarders (Thomson et al., 2012). We hypothesized that helmet use in the current sample would predict patterns of riskier ski behaviours (as defined by higher CSSQ-S scores).

## 2. Material and methods

### 2.1. Participants

Skiers and snowboarders between 19 and 40 years of age ($n$ = 229: 114 males, 115 females; mean age = 27.1 (SD = 4.8) years) of intermediate ability or better participated in this study. Beginner and novice skiers were excluded from the present study to ensure that all participants had the physical ability to carry out the behaviours described in the CSSQ-S (the ski questionnaire). Participants were recruited individually from ski resort cafeterias and surrounding shops by one of the authors (CT) in Lake Louise, Alberta and Whistler, British Columbia using convenience sampling. There were no incentives offered in exchange for participation. All participants provided informed consent, and the study was reviewed and approved by the university Research Ethics Board.

### 2.2. Measures

#### 2.2.1. Demographic and sport information

Skiing and snowboarding ability was self-assessed by participants (choice of: beginner, novice, intermediate, advanced, expert) where intermediate was defined as the ability to ski/ride runs classified as a 'blue square' (the standard North American notation for 'mid-level') or harder. In addition to the self-rating, participants provided an estimate of time spent on each level of piste (e.g., green circle = beginner, blue square = intermediate, black diamond = expert) on an average day. This provided a crude screen for mismatched ability and piste choice. An expert skier should be less likely to spend a majority of his/her time on beginner green circle pistes. In this sample, all participants' ($n$ = 229) self-reported ability was consistent with reported time (at least 50%) on a piste at the same level. In addition to sport ability, participants provided information about the following demographics: age (19–24 years; 25–30 years; 31–40 years), sex, sport (skiing or snowboarding), education (high school; undergraduate or college; graduate), and helmet use (yes, no).

#### 2.2.2. Global sensation seeking

Participants completed the full Zuckerman–Kuhlman Personality Questionnaire (ZKPQ), a 99-item true or false inventory that assesses five dimensions of personality: impulsive-sensation-seeking (ImpSS), aggression/hostility, sociability, neurotism/anxiety, and activity (Zuckerman et al., 1993). We included only the ImpSS in the present analyses as sensation seeking is commonly associated with participation in high risk sports (Goma-I-Freixanet et al., 2012), and other risk taking behaviour (Bardo et al., 2007; Zuckerman and Kuhlman, 2000). The ImpSS contains a total of 19 items, but may also be divided into the impulsivity factor (Imp, eight items) which measures lack of planning and forethought, and the sensation seeking factor (SS, 11 items) which measures the desire to seek out new and thrilling experiences and the willingness to take risks (Zuckerman et al., 1993). Unlike other commonly used sensation seeking scales, the item content contains no potentially confounding references to sport (Zuckerman, 2007), making the ImpSS a more suitable scale for measuring global sensation seeking in an athletic population. Included in the full ZKPQ, is an infrequency subscale which serves as a measure of social desirability. High scores on infrequency were excluded as per ZKPQ criteria (Zuckerman et al., 1993). In this study, scores derived from the ImpSS demonstrated acceptable internal consistency (Cronbach's alpha = .82).

#### 2.2.3. Contextual sensation seeking scale for skiing (CSSQ-S)

Sensation seeking in the specific context of skiing and snowboarding was assessed using the CSSQ-S, a tool developed to measure patterns of sensation seeking and risk taking behaviours in skiers and snowboarders. The CSSQ-S is a 10-item Likert scale anchored by 1 (strongly disagree) and 5 (strongly agree) and sample items include "I like to ski/ride fast" and "I like to go down runs that I have never been down before." Data derived from the CSSQ-S demonstrated high internal consistency ($\alpha$ = .88), high re-test reliability $r(31)$ = .94, and correlated highly with a peer-rated version $r(145)$ = .82 (Thomson et al., 2012). In this study, scores derived from the CSSQ-S demonstrated high internal consistency (Cronbach's alpha = .89).

#### 2.2.4. Ski related injuries

Injury prevalence was measured by two self-report items: (a) number of ski-related injuries sustained during the past season (choice format: 0, 1, 2, >3); and (b) number of ski-related injuries sustained over the last three seasons (open-ended format). Self-report data are comparable to data obtained by other means (e.g., emergency room reports) when researchers are interested in frequency (and not the nature and severity) of an injury (Gabbe et al., 2003; Valuri et al., 2005). Participants were instructed to include only injuries that impaired skiing or snowboarding ability for at least one day (a commonly used definition in injury epidemiology; Goldberg et al., 2007; Nicholl et al., 1995).

### 2.3. Data analysis

We used a 3-step hierarchical regression with demographic variables entered at step 1 (age, sex, education, ability, sport), helmet use at step 2, and personality (Imp, SS) at step 3 to determine which predictors were significant for estimating