Who takes risks in high-risk sport? The role of Alexithymia

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Abstract

People who have difficulty identifying and describing their emotions are more likely to seek out the experience of emotions in the high-risk domain. This is because the high-risk domain provides the experience of more easily identifiable emotions (e.g., fear). However, the continued search for intense emotion may lead such individuals to take further risks within this domain, which in turn would lead to a greater likelihood of experiencing accidents. Across three studies, we provide the first evidence in support of this view. Study 1 (n = 762) revealed that alexithymia was associated with greater risk taking and a greater propensity to experience accidents and close calls. In Study 2 (n = 332) and Study 3 (n = 356) these relationships were confirmed via additional bootstrapped mediation models. The predictive role of alexithymia remained when controlling for sensation seeking (Study 1) and anhedonia (Study 2 & Study 3).
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Fear… and the state between survival and death are such strong experiences that we want them again and again. We become addicted. Strangely, we strive to come back safely and being back, we seek to return, once more, to danger. *Reinhold Messner*

(Coffey, 2005, p. 7)

There is currently a lack of consensus regarding a suitable descriptive moniker for sports that include skydiving, rock climbing, and white water kayaking. Indeed, such sports have been labeled as *adventure, alternative, extreme, lifestyle or risk-taking* (e.g., Brymer, 2010; Castanier, Le Scanff, & Woodman, 2011; Kerr & Houge Mackenzie, 2012; West & Allin, 2010). For the purpose of this research, we choose the term “high-risk sport” which is defined as “all sports where you have to reckon with the possibility of serious injury or death as an inherent part of the activity” (Breivik, 1999, p.10). Of note is that such activities can be performed in environments where the danger is viewed as relatively sanitized (e.g., Grade 1 kayaking) but the sport itself would still be considered high-risk, as the person who progresses within that sport will progress toward greater danger (e.g., more dangerous rivers).

Recent research demonstrates that one participatory goal for certain high-risk sport participants, be it conscious or not, is to experience and to enhance a sense of emotion regulation in everyday life (Barlow, Hardy, & Woodman, 2013; Woodman, Cazenave, & Le Scanff, 2008). Emotion regulation is the term used to characterize the diverse processes involved in initiating, maintaining, and modulating the intensity, type, or duration of emotions (Gross & Thompson, 2007; Thompson, 1994). Emotion regulation refers to actions that influence “which emotions we have, when we have them, and how we experience and express them” (Gross, 2002, p. 282). A growing body of research has provided evidence that participation in high-risk sport reflects a means of emotion self-regulation (Barlow et al., 2013; Cazenave, Le Scanff, & Woodman, 2007; Levenson, 1990; Shapiro, Siegel, Scovill, &
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Hays, 1998; Taylor & Hamilton, 1997; Woodman et al., 2008; Woodman, Hardy, Barlow, & Le Scanff, 2010; Woodman, Huggins, Le Scanff, & Cazenave, 2009).

**Risk taking in high-risk sport.** Individual differences exist in how participants approach, control, and modulate the risks that are inherent within the high-risk sport domain (Barlow et al., 2013; Castanier, Le Scanff, & Woodman, 2010b; Taylor, Gould, Hardy, Woodman & LaCaille, 2006). For example, Woodman et al. (2013) demonstrated that high-risk sport participants might engage in precautionary behaviors in order to minimize risk and might maximize their exposure to risk via deliberate risk taking behaviors (see also Paquette, Lacourse, & Bergeron, 2009). Emotion regulation, a foundation of the present study, appears to be a fruitful framework from which to understand the motives for adopting differing risk taking behaviors (Castanier, Le Scanff, & Woodman, 2010a).

**Alexithymia.** A specific emotion regulation difficulty that is of particular theoretical interest in relation to risk taking behaviors is Alexithymia; a stable trait (Luminet, Rokbani, Ogez, & Jadoulle, 2007) that is characterized by difficulties in differentiating one’s feelings and expressing them in words (Taylor, Bagby, & Parker, 1999). Alexithymic individuals can appear to lack feelings altogether because of their inability to express their emotions and their difficulty in understanding or realizing their own emotions. Furthermore, alexithymic people’s inability to interpret their own emotional signals can often have a profoundly disruptive effect on their personal lives, with poor emotional communication frequently hampering interpersonal relationships (Taylor et al., 1999). For individuals with emotion regulation difficulties, there are broadly two different options: The first is that they might let their emotion regulation difficulties take hold and thus adopt destructive behavior patterns or reach a stage of clinical depression (Pierson, Le Houezec, Fossaert, Dubal, & Jouvent, 1999). For example, high levels of alexithymia are associated with substance abuse and alcohol dependency (Evren et al., 2008; Loas, Otmani, Lecercle, & Jouvent, 2000; Sifneos, 1996;
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Uzun, Ates, Cansever, & Ozsahin, 2003). The second option is for the alexithymic individual to react by pursuing more adaptive behaviors as a compensatory strategy (Pierson et al., 1999; Taylor & Hamilton, 1997). Indeed, high-risk sport has been shown to be an attractive and effective compensatory strategy for the alexithymic individual (Woodman et al., 2008).

The alexithymic individual’s difficulty with the experience and interpretation of emotion is such that the source, valence, and intensity of emotions evoked in everyday life may be confusing and unclear (Cisler, Olatunji, Feldner, & Forsyth, 2010). In other words, in everyday life, alexithymic people are unable to identify the specific origin of their emotion, express it, or control it effectively (Woodman et al., 2010). A specific attraction of the high-risk domain is that it enables such individuals to move from experiencing non-specific, ambiguous and internal emotions (e.g., anxiety) to experiencing specific and intense emotions (e.g., fear), which are attached to an objective danger (cf. Castanier et al., 2011; Fenichel, 1939; Sadock & Sadock, 2007). Such an emotional experience may be particularly attractive to the alexithymic individual because emotions concerned with externalized relatively objective threats are more readily identifiable and require explicit emotion regulation (Gyurak, Gross, & Etkin, 2011; Koole & Rothermund, 2011). Thus, alexithymic people may experience emotion in the high-risk domain in a way that is perceived as not readily available to them in everyday life (Woodman et al., 2010). For example, Dean Potter¹, whose rock climbing, BASE jumping, and high-lining accomplishments have become some of the most celebrated of their kind in the extreme sports community, stated, “I just want emotions rushing through me that normally aren’t there in everyday life . . . the feeling totally overwhelms me… I wish I could find that without risking my life but right now it’s the only way I know how to find it” (Soldinger, 2010).

¹ We are not suggesting that Dean Potter is an alexithymic individual.
Emotional acclimatization. The emotional experience of the high-risk domain may be so attractive to the alexithymic individual that the desire to repeat the experience becomes somewhat addictive (cf. Franken, Zijlstra, & Muris, 2006). However, simply repeating the same high-risk activity will, over time, reduce the engendered intensity of the emotional experience of participating (Franken et al., 2006; Pierson et al., 1999) and consequently likely diminish the emotion regulation benefit to the alexithymic individual. Specifically, the emotion regulation benefit is a consequence of experiencing distinct, unambiguous, intense emotion: the type that is perceived as not being readily available in everyday life. If the engendered emotion (of the high-risk domain) becomes normative, and thus by definition does not significantly differ from that experienced in everyday life, the (emotion regulation) benefit will be lost (Solomon, 1980). Such an emotional-acclimatization cycle is similar to that of the pharmacological-acclimatization experienced by the substance abuser. Namely, when frequently administered, the hedonic value of drugs (e.g., cocaine) is decreased as the user’s reward set-point shifts in order to maintain physiological homeostasis (Ahmed & Koob, 1998). Thus, to gain a renewed ‘high’ the drug user must increase the dose of the drug and, as a consequence, increase the associated risk of the drug taking behavior (Franken et al., 2006).

Maintaining emotional intensity. In order to maintain an ongoing emotion regulation benefit of participation, the alexithymic individual will likely seek out a continued sense of emotional intensity during participation in order to experience the distinct identifiable emotions associated with engagement (e.g., fear). One way that emotional intensity can be influenced is via an individual’s specific attitude to risk within the high-risk domain. Indeed, attitudes to risk within the high-risk domain have been shown to vary considerably (Woodman et al., 2013). Specifically, many high-risk sport participants engage with the express desire to minimize and control the dangers inherent in the high-risk domain.
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by exhibiting precautionary behaviors (e.g., Pain & Pain, 2005). Indeed, mastery (e.g., Slanger & Rudestam, 1997), flow (e.g., Houge Mackenzie, Hodge, & Boves, 2011) and a sense of control over the dangers inherent in the high-risk domain (Barlow et al., 2013) may be a central motive for certain high-risk sport participants’ engagement with their activity. Conversely, other participants “view risk as desirable rather than a thing to be minimized” (Celsi, Rose, & Leigh, 1993, p. 16). Such individuals appear purposefully to increase their exposure to danger by engaging deliberately in additional risk taking behaviors whilst participating in high-risk sport (e.g., Llewellyn & Sanchez, 2008; Slanger & Rudestam, 1997; Woodman et al., 2013). An example of such behavior is a mountaineer who purposefully ascends a snow gully despite the existence of a less dangerous alternate route and in the knowledge that the chosen snow gully has a known high probability of avalanche.

According to the present theoretical framework, high-risk sport participants with alexithymic tendencies will engage in deliberate risk taking behaviors and minimize precautionary behaviors with the aim of experiencing emotional intensity from their participation. Indeed, precautionary behaviors would attenuate the in situ experience of intense emotion (Campos, Frankel, & Camras, 2004) and would enable participants to experience less fear during participation (Kerr & Houge Mackenzie, 2014). As the alexithymic high-risk sport participant seeks an emotion regulation experience, he/she will likely deploy only the perceived minimum requisite precautionary behaviors for participation (cf. Barlow et al., 2013). Minimizing precautionary behaviors and increasing deliberate risk taking behaviors serve to increase both the unpredictability and potential for physical harm that is inherent within the activity (Merrick et al., 2004; Pickett et al., 2006; Turner, McClure, & Pirozzo, 2004); the likelihood for accidents and close calls is thus increased (see Woodman et al., 2013).
Hypothesis. Given the strong theoretical link between alexithymia and risk taking, and the established relationship between risk taking and accidents/close calls, we hypothesize that alexithymia will predict risk taking behaviors (both deliberate risk taking, positively – and precautionary behaviors, negatively), which in turn will lead to a greater propensity to experience accidents and close calls in the high-risk domain. Thus, the relationship between alexithymia and accidents will be mediated by risk taking behaviors (see Figure 1).

Study 1

Measuring accidents and close calls. Woodman et al. (2013) argued that the measurement of risk taking outcomes should not be limited to the measure of accidents. Specifically, individuals who deliberately expose themselves to danger may repeatedly experience life-threatening “close calls” yet largely avoid accidents and injury. Close calls are incidents that come very close to resulting in an accident but fail to materialize into that negative outcome. As such, close calls are largely the same as an accident except for the outcome. It can be argued that close calls (compared to accidents) are a somewhat more refined measure of the potential outcome of risk taking behaviors, as they account for other less controllable variables (e.g., serendipitous events; Woodman et al., 2013). However, there is currently no measure of accidents and close calls in the sport literature and observing accidents and close calls in the high-risk domain has both practical and ethical limitations. Consequently, to date, researchers have measured participants’ accidents and close calls via recall of, for example, the mean number of annual accidents resulting in acute injuries (Woodman et al., 2013). However, such a measure is not without its limitations (van Mechelen, Hlobil, & Kemper, 1992), especially since injury and accident recall is not always very accurate, even over a 12-month period (Gabbe, Finch, Bennell, & Wajswelner, 2003; Jenkins, Earle-Richardson, Slingerland, & May, 2002). As such, we sought to develop a self-report measure of accidents and close calls in the high-risk sport domain. Although we
acknowledge that self-report shares similar limitations to the recall methodology (Paulhus & Vazire, 2007) it was deemed advantageous for this line of research. This is because a self-report measure can be administered conveniently to a large sample, provides phenomenological data, and importantly could be utilized as an informant measure in future research. Thus, one of the first aims of the present study is to propose and develop a self-report measure the Accidents and Close Calls in Sport Inventory (ACCSI).

**Sensation Seeking.** The main aim of Study 1 was to test the hypothesized mediation model presented in Figure 1. Additionally, we sought to ensure that the mediation model could not be discounted on the grounds of a sensation seeking explanation. This is because one could argue that risk taking behaviors might be triggered by the express aim of attaining “sensation rewards” during participation (Zuckerman, 2007, p. 13). That is, sensation seekers may forgo certain precautionary behaviors, and engage in deliberate risk taking behaviors, in an effort to maximize thrilling sensations while participating (see Barlow et al., 2013). Given that sensation seeking has been shown to be a significant predictor of risk taking and injuries (Kern et al., 2013), sensation seeking propensity provides a potential source of confound in the present study. As such, it was deemed necessary to control for variations in sensation seeking within the present mediation models.

**Method**

**Participants.** The original sample comprised 762 traditional rock climbers aged 18 or above. Traditional climbing refers to outdoor roped climbing where the lead climber utilizes self-placed protection in the rock to arrest any potential fall. A lack of high-risk sport experience and skill is associated with a decreased awareness of uncontrollable dangers and a decreased accuracy in differentiating risky behaviors (Celsi et al., 1993). Indeed, inexperienced participants are more likely to engage in deliberate risk taking behaviors (Ogilvie, 1974) leading to accidents and close calls (cf. Kontos, 2004). Thus, we excluded
participants who reported that they were a ‘beginner’ or who had fewer than three years’ traditional rock climbing experience \((n = 49)\). Participants were recruited via internet advertisements placed on international rock climbing forums (e.g., ukclimbing.co.uk, rockclimbing.com, 8a.nu). Once data screening procedures had been applied to identify spurious data (e.g., block-answering) the final sample comprised 690 individuals (598 men, 92 women; \(M_{\text{age}} = 32.05, SD = 11.85\)). Demographic data revealed a sample that was largely experienced \((M_{\text{years' participation}} = 11.06, SD = 7.66)\), competent \((M_{\text{technical climbing ability}} = \text{HVS}^2)\), and participated frequently (frequency of participation: \(\geq\) weekly, \(n = 510\); \(\geq\) twice monthly, \(n = 106\); \(\geq\) monthly, \(n = 38\); \(\geq\) every 2 months, \(n = 21\); \(\geq\) twice annually, \(n = 11\); \(\leq\) annually, \(n = 4\)).

**Measures**

**Toronto Alexithymia Scale (TAS-20).** The TAS-20 (Bagby, Parker & Taylor, 1994) comprises 20 items that assess three aspects of the alexithymia construct: *Difficulty identifying feelings* (e.g., I am often confused about what emotion I am feeling); *Difficulty describing feelings* (e.g., It is difficult for me to find the right words for my feelings); *Externally oriented thoughts* (e.g., I prefer to analyze my problems rather than just describe them). Items are rated on a five-point Likert scale ranging from 1 (*Strongly disagree*) to 5 (*Strongly agree*). The three subscales are combined to produce a total alexithymia score (high scores equate to high alexithymia) with a sample norm mean of 45.57 \((SD = 11.35)\) and internal reliability coefficients ranging from 0.73 to 0.84 for the total score (Parker, Taylor & Bagby, 2003). All reliability scores from the present study are presented in Table 2.

**The Risk Taking Inventory (RTI).** The RTI (Woodman et al., 2013) measures risk taking behaviors in high-risk sport and comprises seven items across two orthogonal factors: *deliberate risk taking* (e.g., I deliberately put myself in danger) and *precautionary behaviors*

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2 The British adjectival grading system for climbing was used. HVS is an abbreviation for ‘Hard Very Severe’
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(e.g., I take time to check for potential hazards), measured on a five-point Likert scale ranging from 1 (Never) to 5 (Always). Woodman et al. (2013) reported composite reliability scores from 0.64 to 0.78 for deliberate risk taking and 0.64 to 0.71 for precautionary behaviors.

**Accidents and Close Calls in Sport Inventory (ACCSI).** The ACCSI was specifically developed for the present study (see Table 1). The initial measure comprised two proposed four-item factors: accidents (e.g. “My decisions in this activity lead to accidents”) and close calls (e.g. “I experience close calls when participating in my sport”) in the high-risk sport domain, measured using a seven-point Likert scale from 1 (Never) to 7 (Always).

**Brief Sensation Seeking Scale (BSSS).** The BSSS (Hoyle, Stephenson, Palmgreen, Puzzles, & Donohew, 2002) is a brief version of Zuckerman's (1979) Sensation Seeking Scale measuring four dimensions of sensation seeking on a five-point Likert scale ranging from 1 (Strongly disagree) to 5 (Strongly agree). The four dimensions, each comprising two items, are: Experience Seeking (e.g., I would like to explore strange places); Boredom Susceptibility (e.g., I get restless when I spend too much time at home); Disinhibition (e.g., I like wild parties); Thrill and Adventure Seeking (e.g., I like to do frightening things). These four dimensions are combined to provide a total sensation seeking score. The internal reliability coefficients range from 0.74 to 0.76 for the total score (Hoyle et al., 2002).

**Procedure.** Participants completed the survey online after recruitment adverts had led them to a webpage providing details of the research, a confidentiality agreement, and a notification that proceeding to the next webpage was an expression of informed consent to participate. If participants chose to continue, they completed demographic data followed by the TAS-20, RTI, ACCSI, and BSSS. The whole procedure took approximately 20 minutes.

**Results**

and represents an advanced level of technical ability.
Development of the Accidents and Close Calls in Sport Inventory. The Accidents and Close Calls in Sport Inventory (ACCSI) data were analyzed using confirmatory factor analysis (CFA) partially in an exploratory fashion. Continuous variable CFA methods were deemed appropriate since the ordered-categorical data comprised 7 categories (Rhemtulla, Brosseau-Liard, & Savalei, 2012). Prelis (Jöreskog & Sörbom, 2006) was used to generate a covariance matrix and Lisrel 8.8 (Jöreskog & Sörbom, 2006) was used to test the models. A model was considered a good fit to the data if the Comparative Fit Index (CFI, Bentler, 1990) and the Non-Normed Fit Index (NNFI, Tucker & Lewis, 1973) were greater than or equal to .95; the Root Mean Square Error of Approximation (RMSEA, Bentler, 1990) was less than or equal to .06; the Standardized Root Mean Square Residual (SRMR, Bentler, 1990) was less than or equal to .08; and the Satorra–Bentler (S-B) $\chi^2$/df ratio was less than 2.00.

Initially, the proposed two-factor eight-item model was examined in order to ensure each item was a good indicator of the underlying latent variable (Jöreskog, 1993). The data fit the model adequately ($S-B \chi^2 (19) = 150.94; \text{CFI} = .97; \text{NNFI} = .95; \text{RMSEA} = .12; \text{SRMR} = .048; \chi^2$/df = 7.94). However, examination of standardized residuals, factor loadings, and modification indices for Theta-delta revealed a single item as a problem residual. The item was a poor indicator of the underlying factor and was removed (Jöreskog, 1993), which reduced the number of items from four to three for the accidents subscale. This removal significantly improved the fit of the model to the data, and testing the two-factor seven-item full-model revealed a good fit (see Table 1) and acceptable alpha reliability levels (see Table 2). As the factor–factor correlation was moderately high (.71), we conducted a Satorra and Bentler (2001) scaled difference $\chi^2$ test ($S-B \chi^2_{\text{diff}})$ on the two-factor model and a respecified single-factor model. This test supported the discriminant validity of accidents and close calls factors ($S-B \chi^2_{\text{diff}} (1) = 114.45, p < .001$).
Preliminary analysis. It is well established that risk taking propensity is greater in men compared to women (Byrnes, Miller, & Schafer, 1999). In the present study, no significant difference between men and woman was evidenced for precautionary behaviors ($t_{688} = 1.23; p = .11$). However, independent samples $t$ test revealed that men scored significantly higher than women on deliberate risk taking ($t_{688} = 4.43; p < .001$), close calls ($t_{688} = 3.08; p < .01$), sensation seeking ($t_{688} = 3.80; p < .001$) and alexithymia ($t_{688} = 2.43; p < .01$), and the accidents difference approached significance ($t_{688} = 1.56; p = .06$).

Consequently, all variables in this study, and the subsequent studies reported in this manuscript, were standardized within sexes before further analysis.

Mediation models. All mediation analyses were conducted using an SPSS macro designed and developed by Hayes (2013) using 5,000 bootstrap samples. A mediation effect was deemed significant if the upper and lower 95% Confidence Interval limits of the size of the indirect path did not include zero. In line with recommendations by Preacher and Kelley (2011) two different effect sizes are reported: the unstandardized indirect effect ($ab$) and the kappa-squared ($\kappa^2$) effect. The advantages of $\kappa^2$, detailed in Preacher and Kelley (2011), are that it is standardized, insensitive to sample size, and on an interpretable metric (0 to 1).

As hypothesized, alexithymia significantly predicted deliberate risk taking (DRT; $a$ path), accidents ($c'$ path), and close calls ($c'$ path). Additionally, DRT significantly predicted accidents ($b$ path) and close calls ($b$ path; see Table 3). As hypothesized, DRT significantly mediated the relationship between alexithymia and both accidents and close calls, generating small to medium $\kappa^2$ effect sizes. The models explained 10.6% and 22.5% of the variance in accidents and close calls, respectively. Although the $\kappa^2$ analyses provided some evidence for mediation, precautionary behaviors largely did not significantly mediate the relationship between alexithymia and either accidents or close calls (see Table 3).
Sensation seeking. Sensation seeking was negatively correlated with precautionary behaviors and positively correlated with deliberate risk taking, accidents, close calls, and alexithymia (see Table 2). However, when sensation seeking was entered into the mediation model as a covariate, DRT continued to significantly mediate the relationship between alexithymia and both accidents ($b = .020; \text{CI} = .004-.042$) and close calls ($b = .031; \text{CI} = .004-.063$).

Age. Age was significantly positively correlated with precautionary behaviors (.16) and significantly negatively correlated with deliberate risk taking (-.21), close calls (-.14), alexithymia (-.14), and sensation seeking (-.39). However, when age was entered into the mediation model as a covariate, DRT continued to mediate significantly the relationship between alexithymia and both accidents ($b = .042; \text{CI} = .016-.073$) and close calls ($b = .052; \text{CI} = .020-.088$).

Discussion

The primary aim of Study 1 was to test the hypothesis that alexithymia would be associated with greater risk taking, which in turn would result in a greater propensity to experience accidents and close calls. Study 1 provided strong evidence for the mediating role of deliberate risk taking in the relationship between alexithymia and accidents and close calls. Furthermore, the role of alexithymia could not be explained by sensation seeking (cf. Zuckerman, 2007). The role of precautionary behaviors was somewhat less clear. Certainly, the findings from Study 1 warrant replication for two principal reasons: First, there was some incongruence between the unstandardized effect and the kappa-squared ($\kappa^2$) effects for precautionary behaviors with some analyses revealing a mediation effect and others revealing no such effect (see Table 3), which requires clarification. Second, the results of Study 1 warrant extending to populations beyond rock climbers to participants of other high-risk sports. This extension is for the purposes of generalizability but also because the exclusive
participation of rock climbers may have contributed to the mixed precautionary behaviors findings. Indeed, there is an element of precautionary behavior that is considered an integral part of rock climbing (e.g., checking one’s harness is correctly secured prior to climbing).

Thus, the aim of Study 2 was to re-examine the alexithymia and accidents/close calls relationship with a sample drawn from a variety of high-risk sports. We hypothesized that risk taking (deliberate risk taking and precautionary behaviors) would mediate this relationship.

We also sought to explore an alternative explanation for the role of alexithymia in risk taking by including anhedonia as a covariate in the mediation model. Anhedonia is the loss of self-reported pleasure and individuals high in anhedonia only feel pleasure in the most intense of hedonic environments (Volkow, Fowler, & Wang, 2003). Participants of some high-risk sports such as skydiving – activities that provide a “sensation reward” (Zuckerman, 2007, p.13) or hedonic experience (Franken et al., 2006) – have been shown to demonstrate elevated anhedonia (Pierson et al., 1999). For such individuals, the experience of chronic under-arousal in everyday life may motivate them to seek sources of intense stimulation with a view to increase their arousal to a hedonic point (Eysenck & Eysenck, 1978). Purposefully seeking out intense hedonic sensations may be understood as a compensatory strategy for the anhedonic individual’s basal arousal deficit (Carton, Jouvent, Bungener, & Widlöcher, 1992).

In line with the sensation seeking argument presented in Study 1, anhedonic individuals may forgo certain precautionary behaviors, and may engage in further purposeful risk taking behaviors, in an effort to maximize hedonic sensations while participating (see Franken et al., 2006). Since these risk taking behaviors would likely also lead to an increased incidence of both accidents and close calls, anhedonia provides a potential source of confound in the previous analyses. Although they are conceptually distinct, anhedonia and alexithymia have a degree of commonality insomuch as they reflect a state of emotion dysregulation (Loas,
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Fremaux, & Boyer, 1997). Given the strong theoretical link between anhedonia and alexithymia and between anhedonia and risk-taking, we aimed to test whether the alexithymia – risk-taking relationship would hold when controlling for anhedonia in the present mediation model.

**Study 2**

**Method**

**Participants.** The sample comprised 332 new participants. Checking the email addresses of all participants across all three studies revealed that participants across the three studies participated in one study and in one study only. In the present study participants engaged in a variety of high-risk sports (e.g., downhill mountain biking, rock climbing, skydiving, white water kayaking) and were recruited via internet advertisements placed on international sporting forums (e.g., dropzone.com, newschoolers.com). The inclusion criteria (i.e., minimum of 18 years of age, a minimum of 3 years’ participation in the individual’s main high-risk sport and not self-classified as a beginner) mirrored those of Study 1. Data screening, as used in Study 1, removed five participants. The final sample comprised 327 individuals (292 men, 35 women; \( M_{age} = 35.43, SD = 12.92 \)). Demographic data revealed that participants were largely experienced (\( M_{years' participation} = 15.74, SD = 11.22 \)), competent (intermediate, \( n = 49 \); advanced, \( n = 166 \); expert, \( n = 112 \)) and regularly engaged in their chosen high-risk sport (frequency of participation: \( \geq \) weekly, \( n = 183 \); \( \geq \) twice monthly, \( n = 84 \); \( \geq \) monthly, \( n = 39 \); \( \geq \) every 2 months, \( n = 13 \); \( \geq \) twice annually, \( n = 7 \); \( \leq \) annually, \( n = 1 \)).

**Measures.** We administered the RTI, TAS-20, and ACCSI, as in Study 1.

**Snaith-Hamilton Anhedonia Pleasure Scale (SHAPS).** The SHAPS (Snaith et al., 1995) was produced to assess an individual’s hedonic capacity using 14 items concerning a variety of subjects: hobbies, family, appearance and food/drink (e.g., “I would find pleasure in my hobbies and past times”). Responses were scored on a four-point Likert scale from 1
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(Strongly agree) to 4 (Strongly disagree) with high scores representing high levels of anhedonia. Nakonezny, Carmody, Morris, Kurian, and Trivedi (2010) reported an alpha reliability coefficient of 0.91.

**Procedure.** The online presentation of the inventories mimicked that of Study 1, with the additional inclusion of the SHAPS, and took approximately 25 minutes to complete.

**Results**

**ACCSI model fit.** An adequate fit for the two-factor, seven-item ACCSI model was confirmed (see Table 1). The factor–factor correlation was .88. Satorra–Bentler scaled difference $\chi^2$ test again supported the discriminant validity of the two factors ($S-B \chi^2_{\text{diff}}(1) = 8.75, p < .01$).

**Mediation models.** As hypothesized, and confirming the findings from Study 1, deliberate risk taking (DRT) significantly mediated the relationship between alexithymia and both accidents and close calls (see Table 3), generating small to medium $\kappa^2$ effect sizes. The models explained 18.0% and 26.1% of the variance in accidents and close calls, respectively. As expected, alexithymia significantly positively predicted DRT ($a$ path), accidents ($c'$ path), and close calls ($c'$ path). Additionally, DRT significantly positively predicted accidents ($b$ path) and close calls ($b$ path; see Table 3).

As hypothesized, and clarifying the ambiguous finding in Study 1, precautionary behaviors (PB) significantly mediated the relationship between alexithymia and both accidents and close calls although the generated $\kappa^2$ effect sizes were small. The models explained 8.8% and 9.1% of the variance in accidents and close calls, respectively. As expected, alexithymia significantly negatively predicted PB ($a$ path), and positively predicted accidents ($c'$ path), and close calls ($c'$ path). Additionally, PB significantly negatively predicted accidents ($b$ path) and close calls ($b$ path; see Table 3).
Anhedonia. Anhedonia significantly positively correlated with alexithymia and significantly negatively correlated with PB. Anhedonia was not significantly correlated with either DRT, accidents, or close calls (see Table 2). When anhedonia was entered into the mediation model as a covariate, DRT continued to significantly mediate the relationship between alexithymia and both accidents ($b = .081, CI = .038-.140$) and close calls ($b = .101, CI = .047-.162$). Additionally, PB continued to significantly mediate the relationship between alexithymia and both accidents ($b = .025; CI = .002-.072$) and close calls ($b = .022; CI = .003-.062$).

Discussion

As hypothesized, both deliberate risk taking and precautionary behaviors emerged as significant mediators in the relationship between alexithymia and accidents/close calls. Clarifying the results from Study 1, this mediation effect was consistent across the unstandardized and kappa-squared effects. Anhedonia did not significantly reduce the mediating effect of either deliberate risk taking or precautionary behaviors in the relationship between alexithymia and accidents/close calls. Given the degree of ambiguity of the results in Study 1 and the clarity of the results in Study 2, the aim of Study 3 is to confirm the alexithymia – risk taking – accidents/close calls model.

Study 3

Method

Participants. The sample comprised 356 new participants. As in Study 2, participants engaged in a variety of high-risk sports (e.g., hang gliding, mountaineering, surfing) and were recruited using internet adverts on major international sporting fora. Data screening, as used in Study 1 and Study 2, removed 15 participants. The final sample comprised 341 individuals (271 men, 70 women; $M_{\text{age}} = 37.10, SD = 14.20; M_{\text{years' participation}} = 12.70, SD = 11.90$).
Demographic data revealed that participants’ experience, ability, and frequency of participation in their chosen sport, closely resembled those revealed in Study 2.

**Measures and procedures.** The procedure was the same as in Study 2.

**Results**

**ACCSI model fit.** A good fit for the two-factor, seven-item ACCSI model was further confirmed (see Table 1). The factor–factor correlation was .85. Satorra–Bentler scaled difference $\chi^2$ test again supported the discriminant validity of the two factors ($S-B \chi^2_{diff}(1) = 8.75, p < .01$).

**Mediation models.** Deliberate risk taking (DRT) significantly mediated the relationship between alexithymia and both accidents and close calls (see Table 3), generating medium $\kappa^2$ effect sizes. The models explained 32.4% and 41.5% of the variance in accidents and close calls, respectively. As expected, alexithymia significantly positively predicted DRT ($a$ path), accidents ($c'$ path), and close calls ($c'$ path). Additionally, DRT significantly positively predicted accidents ($b$ path) and close calls ($b$ path; see Table 3).

Confirming the finding in Study 2, and in line with the hypothesis, precautionary behaviors (PB) significantly mediated the relationship between alexithymia and both accidents and close calls, generating small $\kappa^2$ effect sizes. The models explained 16.5% and 17.5% of the variance in accidents and close calls, respectively. As expected, alexithymia significantly negatively predicted PB ($a$ path), and positively predicted accidents ($c'$ path), and close calls ($c'$ path). Additionally, PB significantly negatively predicted accidents ($b$ path) and close calls ($b$ path; see Table 3).

**Anhedonia.** As in Study 2, anhedonia was significantly negatively correlated with PB and significantly positively correlated with alexithymia. Again, no significant correlation was revealed for either DRT or close calls although, in the present study, anhedonia was significantly correlated with accidents (see Table 2). Confirming the Study 2 finding, when
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anhedonia was entered into the mediation model as a covariate, DRT continued to mediate significantly the relationship between alexithymia and both accidents ($b = .159$, CI = .010-.231) and close calls ($b = .182$, CI = .117-.256). Additionally, PB continued to mediate significantly the relationship between alexithymia and both accidents ($b = .080$; CI = .036-.153) and close calls ($b = .074$; CI = .036-.126).

Discussion

As in Study 2 both deliberate risk taking and precautionary behaviors emerged as significant mediators of the relationship between alexithymia and accidents/close calls. Additionally, the models could not be explained by anhedonia.

General Discussion

The aim of the present studies was to test the relationship between alexithymia, risk taking, and accidents and close calls. Results consistently revealed that both deliberate risk taking and precautionary behaviors mediated the alexithymia – accidents/close calls relationship. Furthermore, we developed a two-factor measure of accidents and close calls in sport, which consistently fit the data well and evidenced preliminary concurrent validity.

Unlike merely observing correlations between variables, the present mediation analyses enable tentative causal inferences to be made (Preacher & Hayes, 2008). Specifically, one could argue that the present results provide support for alexithymia causally influencing risk taking behaviors, which in turn lead to the incidence of accidents and close calls. The direction of this sequential pathway is made all the more likely by the nature of the independent variable because alexithymia is widely considered a stable personality trait (Bagby et al., 1994; Luminet et al., 2007; Mikolajczak & Luminet, 2006; Salminen, Saarijärvi, Aärelä, & Tamminen, 1994). However, more research is required before this theoretically derived sequential position can be validated, as even stable personality traits are not set in stone (Roberts, Walton, & Viechtbauer, 2006). Although a definitive conclusion
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regarding causation would be premature, the alternative explanations are theoretically more
tenuous. Specifically, it is difficult to contend theoretically that risk taking, or indeed the
experience of accidents within a high-risk domain, would lead to elevated alexithymia.
Furthermore, it would be equally contentious to argue theoretically that the experience of
accidents in the high-risk domain might result in an increase in risk taking behaviors. Rather,
one would more easily argue for the opposite effect, as the experience of an accident would likely decrease, not increase, the propensity to take risks. Despite the strength of the
theoretical position regarding the sequence of the mediation model, there remains a need for
further research to confirm (or otherwise) that position.

As discussed previously, it could be argued that it is either sensation seeking or
anhedonia that lead to greater risk taking behaviors in the high-risk domain. Indeed, both
sensation seeking (Study 1) and anhedonia (Study 2 and Study 3) are associated with
decreased precautionary behaviors, and sensation seeking is associated with increased
deliberate risk taking. However, the present analyses suggest that such an argument would be
ill-founded, as it was indeed alexithymia that consistently emerged a significant predictor of
risk taking behaviors when controlling for both sensation seeking and anhedonia. That being
said, future research would do well to explore additional variables that may significantly
contribute to the present mediation model (e.g., escape from self-awareness; Castanier et al.,
2011; Taylor & Hamilton, 1997).

Across the three studies, both the deliberate risk taking and precautionary behavior
mediation models demonstrated small to medium effect sizes with both accidents and close
calls. We prefer to avoid an inflexible interpretation of effect size based solely on arbitrary
benchmarks (cf. Preacher & Kelley, 2011) and rather prefer to emphasize that the relatively
modest effect sizes may have substantive practical importance (cf. Snyder & Lawson, 1993).
Specifically, in the context of dangerous environments, people will die if they enter the high-
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risk sport domain and completely fail to display any precautionary behaviors whilst
simultaneously maximizing deliberate risk taking behaviors. In other words, it can be argued
here that small effect sizes could have very meaningful real-life connotations.

The clear relationship between alexithymia and accidents/close calls has considerable
practical implications with regard to accident and injury prevention, which is a growing area
of research given the escalation of litigation costs associated with injuries (Hébert-Losier &
Holmberg, 2013). Indeed, the use of alexithymia as a construct to predict risk taking
behaviors could be useful in the identification of potentially dangerous participants -
dangerous to themselves, to other participants, or both. It is indeed likely that most instructors
and group leaders would welcome any such information. However, further research is
required to establish if the alexithymia – risk-taking relationship might be extended beyond
the population of experienced, competent, and adult high-risk sport participants studied in the
present study. As the high-risk sport participants’ group-mean levels of alexithymia were
comparable to those of sample norms, it would be worth testing whether the present model
could be extended to other risk-taking domains within sport and exercise (e.g., drug taking,
overtraining) or indeed to risk taking environments beyond sport (e.g., industrial and
financial risks, crime).

The present theoretical framework suggests that the alexithymic individual actively
seeks out intense emotion, such as fear, via the high-risk domain. Of course, individuals may
actively initiate, experience, and subsequently control intense emotion such as fear (Fenichel,
1939; Woodman et al., 2010) such that fear is not actively experienced to any great degree
during the activity. Indeed, research suggests that certain high-risk sport participants perceive
they can control their fear in the high-risk domain (Barlow et al., 2013; Celsi et al., 1993);
even experiencing a perceived temporary “freedom from fear” (Lester, 2004, p. 91). This is
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evidenced by Laberge\(^3\) (2003), a specialist solo\(^4\) rock climber, who said, “While climbing solo, you experience moments of intense stress and you manage to dominate them” (p. 33).

Previous research (e.g., Barlow et al., 2013; Woodman et al., 2010) has proposed that participation in high-risk sport may offer an adaptive form of compensation for individuals with emotional difficulties. That is, such participation might be deemed emotionally adaptive compared to relatively destructive behavioral patterns such as substance abuse (Pierson et al., 1999). However, the present findings suggest that such a dichotomous adaptive-maladaptive categorization may be somewhat simplistic. Indeed, the data consistently revealed that alexithymia leads to a greater vulnerability to maladaptive outcomes – accidents – in what has previously been considered an adaptive activity. Any adaptive outcome may be experienced in the form of an emotion regulation benefit transferred from the high-risk domain back into everyday life (Barlow et al., 2013). Specifically, the perceived ability to deal effectively with the intense emotions in the high-risk domain (e.g., fear) may provide the alexithymic individual with an enhanced, albeit temporary, sense of emotion regulation in everyday life following the activity (Barlow et al., 2013; Woodman et al., 2009). Any such benefits are of course likely enjoyed only to the extent that the person survives any misdemeanors in the high-risk domain. In the specific context of the high-risk domain, particularly for those with emotional difficulties, Nietzsche (1889/1998) was very probably quite correct: “whatever does not kill me makes me stronger” (p. 58).

It could be argued that a limitation of the present studies is the self-report nature of the ACCSI. That is, participants’ responses may have suffered from biases, such as a self-deception bias or an impression management bias (Gravetter & Forzano, 2012). Previous research suggests that such inherent weaknesses of self-report methods may be somewhat attenuated in the present sample. Specifically, high-risk sport participants do not significantly

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\(^3\) We are not suggesting that Laberge is an alexithymic individual.
differ from controls regarding impression management (Barlow et al., 2013) and their self-report responses, pertaining to their own risk taking behaviors, significantly correlate with the same self-report measures from an informant (Woodman et al., 2013). Furthermore, that the ACCSI consistently showed good model-fit across three studies considerably mitigates this limitation. We argue that a primary advantage of employing a self-report inventory is that each individual – even an individual with emotional regulation difficulties – is in a unique position of self-knowledge and self-awareness (Gravetter & Forzano, 2012). An alternative method would have been to ask participants to recall their accidents and close calls in a retrospective design. However, such methods are also reliant on self-report (see Gravetter & Forzano, 2012) and are not always very accurate even over a 12-month period (Gabbe, Finch, Bennell, & Wajswelner, 2003; Jenkins, Earle-Richardson, Slingerland, & May, 2002). Thus, recording accidents and close calls in a prospective design, with the use of diary data for example, would somewhat mitigate this limitation and is therefore an important direction for future research.

In summary, the present set of studies demonstrates that alexithymia leads to a propensity to adopt greater risk taking behaviors, which in turn increases the likelihood of an accident or a close call in the high-risk domain. The alexithymic individual may deem the risk of physical harm as an acceptable – or indeed necessary – evil to derive the emotion regulation benefit that is craved in the high-risk domain, and we urge researchers to consider more fully and widely the emotion regulation motives that might be associated with risk taking in sport and exercise environments more globally.

4 Rock climbing without the protection of a rope.
References


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Table 1.

Item-factor loadings and full-model fit indices for the Accidents and Close Calls in Sport Inventory (ACCSI) in Study 1, Study 2 and Study 3.

<table>
<thead>
<tr>
<th>Accidents and Close Calls in Sport Inventory</th>
<th>Study 1</th>
<th>Study 2</th>
<th>Study 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Close Calls</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(1) I experience close calls when participating in my sport</td>
<td>.80</td>
<td>.80</td>
<td>.88</td>
</tr>
<tr>
<td>(3) I find myself in situations that lead to near misses</td>
<td>.85</td>
<td>.84</td>
<td>.91</td>
</tr>
<tr>
<td>(5) During participation in my sport I narrowly avoid accidents</td>
<td>.77</td>
<td>.73</td>
<td>.81</td>
</tr>
<tr>
<td>(7) I feel lucky not to have been involved in an accident when finishing a day of participation in my sport</td>
<td>.31</td>
<td>.39</td>
<td>.34</td>
</tr>
<tr>
<td><strong>Accidents</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) I am involved in accidents when participating in my sport</td>
<td>.84</td>
<td>.82</td>
<td>.90</td>
</tr>
<tr>
<td>(4) My decisions in this activity lead to accidents</td>
<td>.70</td>
<td>.78</td>
<td>.72</td>
</tr>
<tr>
<td>(6) I sustain injuries as a result of accidents</td>
<td>.68</td>
<td>.71</td>
<td>.72</td>
</tr>
<tr>
<td><strong>Two-factor full-model fit indices</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>( S-B \chi^2 ) (13)</td>
<td>23.10</td>
<td>52.10</td>
<td>30.47</td>
</tr>
<tr>
<td>CFI</td>
<td>.99</td>
<td>.98</td>
<td>.99</td>
</tr>
<tr>
<td>NNFI</td>
<td>.99</td>
<td>.97</td>
<td>.99</td>
</tr>
<tr>
<td>RMSEA</td>
<td>.04</td>
<td>.11</td>
<td>.09</td>
</tr>
<tr>
<td>SRMR</td>
<td>.03</td>
<td>.04</td>
<td>.03</td>
</tr>
<tr>
<td>( \chi^2/df )</td>
<td>1.78</td>
<td>4.01</td>
<td>2.34</td>
</tr>
</tbody>
</table>

*Note.* The wording for the item stem was “Please respond concerning your common experiences in high-risk sport.” Item numbers (in parentheses) represent the item-order that was presented to the participants. \( S-B = \) Satorra-Bentler; CFI = Comparative Fit Index; NNFI = Non-Normed Fit Index; RMSEA = Root Mean Square Error of Approximation; SRMR = Standardized Root Mean Residual.
### Table 2.
Correlations between alexithymia, deliberate risk taking, precautionary behaviors, accidents, close calls, sensation seeking, and anhedonia in Study 1, Study 2, and Study 3.

<table>
<thead>
<tr>
<th></th>
<th>Deliberate risk taking</th>
<th>Precautionary behaviors</th>
<th>Alexithymia</th>
<th>Accidents</th>
<th>Close calls</th>
<th>Sensation seeking</th>
<th>Anhedonia</th>
<th>Age</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1 Deliberate risk taking</strong></td>
<td>0.65</td>
<td>-0.12**</td>
<td>0.15**</td>
<td>0.31***</td>
<td>0.46***</td>
<td>0.45***</td>
<td>-</td>
<td>-21***</td>
</tr>
<tr>
<td><strong>2 Precautionary behaviors</strong></td>
<td>0.72</td>
<td>-0.12**</td>
<td>0.22***</td>
<td>0.40***</td>
<td>0.49***</td>
<td>-</td>
<td>0.02</td>
<td>-20***</td>
</tr>
<tr>
<td><strong>3 Alexithymia</strong></td>
<td>0.80</td>
<td>-0.34***</td>
<td>-0.31**</td>
<td>0.54***</td>
<td>0.62***</td>
<td>-</td>
<td>0.06</td>
<td>-19***</td>
</tr>
<tr>
<td><strong>4 Accidents</strong></td>
<td>0.72</td>
<td>-0.23***</td>
<td>0.31**</td>
<td>-0.02</td>
<td>-0.09**</td>
<td>-20***</td>
<td>-</td>
<td>16***</td>
</tr>
<tr>
<td><strong>5 Close calls</strong></td>
<td>0.81</td>
<td>-0.16***</td>
<td>-0.22***</td>
<td>0.32***</td>
<td>-0.13**</td>
<td>-0.18***</td>
<td>-0.14**</td>
<td>14***</td>
</tr>
<tr>
<td><strong>6 Sensation seeking</strong></td>
<td>0.79</td>
<td>0.53***</td>
<td>0.23**</td>
<td>0.00</td>
<td>-0.76</td>
<td>-</td>
<td>-0.07</td>
<td>-</td>
</tr>
<tr>
<td><strong>7 Anhedonia</strong></td>
<td>0.84</td>
<td>0.36***</td>
<td>-</td>
<td>-0.30***</td>
<td>-0.18**</td>
<td>-</td>
<td>-0.10**</td>
<td>-</td>
</tr>
<tr>
<td><strong>8 Age</strong></td>
<td>6.06 (2.22)</td>
<td>11.00 (3.64)</td>
<td>29.04 (5.28)</td>
<td>-</td>
<td>32.05 (11.85)</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. A maximum of three values are presented in each cell of the table: Top = Study 1; Middle = Study 2; Bottom = Study 3. Where no value is present, indicated by a dash, this relationship was not measured in the particular study. Deliberate risk taking and precautionary behaviors = factor scores on Woodman et al.’s (2013) Risk Taking Inventory; Alexithymia = total score on Bagby et al.’s (1994) Toronto Alexithymia Scale 20; Accidents and Close calls = factor total scores on the new Accidents and Close Calls Inventory; Sensation seeking = total score on Hoyle et al.’s (2002) Brief Sensation Seeking Scale; Anhedonia = total score on Snaith et al.’s (1995) Snaith-Hamilton Anhedonia Pleasure Scale. Coefficient alphas are on the diagonal.

*p < .05, **p < .01, ***p < .001
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Table 3.

The relationship between Alexithymia and accidents and close calls as mediated by risk taking behaviors in Study 1, Study 2 and Study 3.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th>M</th>
<th>Y</th>
<th>Indirect effect</th>
<th>Kappa squared</th>
<th>a path</th>
<th>b path</th>
<th>c’ path</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>b</td>
<td>LLCI</td>
<td>ULCI</td>
<td>b</td>
<td>t</td>
<td>b</td>
</tr>
<tr>
<td>Study 1</td>
<td>DRT</td>
<td>Accidents</td>
<td>.04</td>
<td>.021</td>
<td>.071</td>
<td>.04</td>
<td>.020</td>
<td>.070</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Close calls</td>
<td>.06</td>
<td>.031</td>
<td>.101</td>
<td>.07</td>
<td>.033</td>
<td>.102</td>
</tr>
<tr>
<td></td>
<td>PB</td>
<td>Accidents</td>
<td>-.00</td>
<td>-.022</td>
<td>.016</td>
<td>.00</td>
<td>.000</td>
<td>.009</td>
</tr>
<tr>
<td></td>
<td>PB</td>
<td>Close calls</td>
<td>.01</td>
<td>-.007</td>
<td>.033</td>
<td>.01</td>
<td>.001</td>
<td>.031</td>
</tr>
<tr>
<td>Study 2</td>
<td>DRT</td>
<td>Accidents</td>
<td>.08</td>
<td>.036</td>
<td>.134</td>
<td>.08</td>
<td>.037</td>
<td>.129</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Close calls</td>
<td>.10</td>
<td>.042</td>
<td>.159</td>
<td>.10</td>
<td>.045</td>
<td>.161</td>
</tr>
<tr>
<td></td>
<td>PB</td>
<td>Accidents</td>
<td>.03</td>
<td>.004</td>
<td>.083</td>
<td>.03</td>
<td>.005</td>
<td>.080</td>
</tr>
<tr>
<td></td>
<td>PB</td>
<td>Close calls</td>
<td>.03</td>
<td>.004</td>
<td>.070</td>
<td>.03</td>
<td>.005</td>
<td>.067</td>
</tr>
<tr>
<td>Study 3</td>
<td>DRT</td>
<td>Accidents</td>
<td>.15</td>
<td>.093</td>
<td>.220</td>
<td>.16</td>
<td>.100</td>
<td>.219</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Close calls</td>
<td>.18</td>
<td>.115</td>
<td>.252</td>
<td>.19</td>
<td>.121</td>
<td>.257</td>
</tr>
<tr>
<td></td>
<td>PB</td>
<td>Accidents</td>
<td>.08</td>
<td>.037</td>
<td>.157</td>
<td>.08</td>
<td>.040</td>
<td>.151</td>
</tr>
<tr>
<td></td>
<td>PB</td>
<td>Close calls</td>
<td>.08</td>
<td>.037</td>
<td>.127</td>
<td>.08</td>
<td>.038</td>
<td>.126</td>
</tr>
</tbody>
</table>

Note. M = Mediator; Y = Outcome variable; b = Unstandardized beta coefficient; LLCI = Lower limit confidence interval; ULCI = Upper limit confidence interval; κ² = Kappa squared; a path = predictor variable to mediator variable; b path = mediator variable to outcome variable; c’ path = direct effect; DRT = Deliberate risk taking on Woodman et al.’s (2013) Risk Taking Inventory; PB = Precautionary behaviors on Woodman et al.’s (2013) Risk Taking Inventory; Accidents and Close calls = factor total scores on the new Accidents and Close Calls Inventory.

* p < .05
** p < .01
*** p < .001
Figure 1. The mediating role of risk taking in the alexithymia – accidents/close calls relationship.
Letter from the editor

Dear Dr. Barlow:

I write concerning Manuscript ID JSEP 2014-0130 (i.e., "Who takes risks in high-risk sport? The role of Alexithymia") which you submitted to the Journal of Sport & Exercise Psychology. Two reviewers with substantial relevant expertise have examined your submission and provided critiques for consideration in the review process. Their observations appear lower in this message.

The reviewers express interest in your submission on various accounts. The report was reasonably well-prepared for entry into the JSEP review process and is likely of interest to JSEP subscribers. I believe the positive sentiment expressed by the reviewers is warranted. The manuscript describes three studies of the potential role of alexithymia in risk-taking and the experience of accidents and close calls. Data were obtained from a substantial number of participants for this investigation. The findings are interesting and potentially suggestive. You and your coauthors have my congratulations.

Reservations are, nonetheless, evident in the reviewers’ critiques. Their observations are presented with clarity so I’ll not risk confusing matters by elaborating or reiterating their comments. While I might quibble with the occasional point, I note that I regard the reviewers’ opinions as substantive and well-informed. I believe that the highlighted reservations require contemplation and appropriate attention in revising the document if it is to contribute appropriately to JSEP and the extant literature.

After reflecting upon my reading of the manuscript and the reviewers’ observations, I have concluded that your submission is presently not suitable for publication in JSEP. Nonetheless, I share the reviewers’ interest in your report, and believe that the manuscript may be revised into publishable condition. I decided to provide you with the opportunity to use the reviewers’ observations to good effect in revising the manuscript as a consequence. I invite you to revise and resubmit the manuscript before I come to a final decision on its disposition at JSEP. If you decide to take advantage of this opportunity by resubmitting the manuscript, I will provide an unambiguous decision after evaluation of the revised report.

I ask that all reviewer observations be addressed in revising the manuscript. How and where the reviewers’ observations are addressed (or rebutted) should be explained on a point-by-point basis. Some matters will require little more than minor editing. Other matters are likely to require much more substantial contemplation and effort. I look forward to reading your revised submission and the accompanying line-by-line responses in any event. I anticipate that both will make for interesting reading.

I note that I would reject your manuscript at this point if I was absolutely certain that the difficulties identified by the reviewers were impossible to overcome. Please understand, however, that this opportunity to revise and resubmit the manuscript does not guarantee that it will ultimately be accepted for publication. I emphasize that this is not a meaningless pro forma admonition. Your efforts to revise the manuscript may resolve the concerns identified by the reviewers and actualize its potential. If so, publication will result. Alternatively, your revisions may fail to adequately resolve current reservations (or raise new ones) thereby making the manuscript unsuitable for publication in JSEP. The revised manuscript and your line-by-line responses will be sent out for further reviewer input to ensure that my decision is appropriately informed.

If you do revise the manuscript, your resubmission should occur as soon as possible but certainly within the next 60 days. If I do not receive a revision within that timeframe (or a request for
extension), I will consider the manuscript withdrawn. At that point, I will amend the logbook to indicate a reject final decision on your manuscript.

Best of luck with your revisions. I look forward to receiving your resubmission. Thank you for choosing JSEP as a potential venue for reporting your research endeavors.

Sincerely,

Robert C. Eklund, PhD FACSM FNAK
Editor-in-Chief, Journal of Sport & Exercise Psychology
jsep@stir.ac.uk, robert.eklund@stir.ac.uk

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Reviewer: 1
This review regards a manuscript covering the topic of alexithymia and risk-taking in high-risk sports. The authors begin by identifying the nature of high-risk sports. However, it would be beneficial for the authors to provide some examples of exactly the types of sports they are referring to when using the label “high-risk” sport.

We agree that this would be of benefit to the readers. As such, an additional paragraph has now been added at the start of the manuscript (see page 3) including a definition, and specific examples, of high-risk sport.

Throughout the literature, labels such as extreme, adventure, alternative, and lifestyle sports (see Kerr & Mackenzie, 2012; West & Allin, 2010) and have also been used to describe the activities defined as high-risk [as per Breivik’s (1996), operational definition] by the authors. Considering the lack of a comprehensive label within the literature, some clarification early in the article by the authors would be helpful.

We agree that the lack of a consistent descriptive moniker is an issue in the extant literature. As such, the clarification you requested has been provided within an additional paragraph at the start of the revised manuscript (page 3).

Reviewer 3 (point 1) made a similar point and asked that we additionally “justify” the use of the label ‘high-risk’ sport. We have provided a detailed justification to Reviewer 3 that, since it has clear overlap with the present point, we would like to draw your attention to. We are grateful for this comment, as it helps to clarify a long-standing issue of definition and sets a much-needed marker within the literature.

The authors provide a good introduction to emotion regulation and the potential role that high-risk sport may play in providing an outlet for such regulation. The authors also integrate recent research (Woodman, Barlow, Bandura, Hill, Kupciw, & MacGregor, 2013) which has identified a fundamentally different perception of risk-taking within high-risk sport (i.e., deliberate risk-taking verses precautionary behavior). They then suggest that emotion regulation is a fruitful framework to understand this difference in risk-taking behavior within high-risk sport. It should be noted, however, that emotion regulation, although the focal point of the current study, is not the only framework within which this difference could be examined. Previous research has suggested that high-risk sport participants’ degree of self-efficacy and more specifically a sense of mastery (Slanger & Rudestam, 1997) could help differentiate extreme from high-risk, risk-taking participants. The authors make reference to the Slanger and Rudestam article, yet choose not to mention this aspect of their findings.

We have now made it clear that emotion regulation is not the only lens through which to view motives for participation in high-risk sport. Specifically, we have added reference to frameworks focusing on mastery (Slanger & Rudestam, 1997) and flow (Houge Mackenzie, Hodge & Boyes, 2011) on page 7, lines 1-2.

The authors provide an excellent explanation of alexithymia and how high-risk sport involvement could be seen as an adaptive behavior to help alexithymic individuals compensate for their emotional difficulties. However, it should be noted that the authors suggest (page 3) that the alexithymic person is unlikely to be able to identify the origin of their emotion. If this is indeed the case, then why would the alexithymic individual continue to pursue high-risk sport? Based on this identified characteristic of alexithymia, the alexithymic individual would not be able to associate the emotion experienced while engaged in the high-risk sport with the sport itself. Yet, the entire premise of the article is that the alexithymic individual seeks out high-risk sport to regulate their emotion, often in a deliberate form of risk-taking, and continues to increase the amount of risk-
taking in order to overcome the emotional acclimation process which occurs. If this is the case, then it would seem as though the alexithymic risk-taker knows exactly the origin of their emotion, and would put into question whether or not the person was actually alexithymic. It is possible that this is only a small characteristic of alexithymia, however it would seem to need some further inquiry.

This is a very interesting point and one that is central to our theoretical position. We do indeed suggest that the alexithymic person is unlikely to be able to identify the origin of their emotion. This personality difficulty is not a feature of their engagement in high-risk sport, however (see below); rather it pervades these individuals’ everyday lives. We have modified this specific paragraph accordingly (see page 5, line 7-8).

It is precisely because alexithymic individuals have difficulty understanding the origin of their emotions in everyday life that they are attracted to high-risk sports. Indeed, high-risk sport provides an environment in which alexithymic individuals are more likely to be able to identify their emotion. This is because in the high-risk domain the emotions are typically “specific and intense”, “attached to an objective danger” and “concerned with externalized relatively objective threats” (page 5). In other words, the emotion and its origin are “more readily identifiable” (page 5) than in everyday life.

The high-risk domain is attractive because it allows the alexithymic individual to overcome temporarily a personality difficulty (identifying and expressing emotions). However, there is no evidence to suggest that this renders an individual less alexithymic or non-alexithymic in the long-term. Consequently, repeated exposure to the high-risk domain (and the concomitant risk-taking behavior and intense emotion therein) is required.

When the authors discuss the specific attraction of the high-risk sport domain (page 4), specific and intense emotions are stated as being attached to the objective danger of the sport, which is labelled the authors refer to as fear. However, this isn’t always the case within high-risk sport participants. Many high-risk sports participants perceive their sport as lacking in danger, whether objectively accurate or not. In fact, it has been documented within the high-risk sport literature that experienced risk-takers rarely perceive their participation in high-risk sport as dangerous (at least to them). Instead they tend to regard their participation as calculated risks (Celsi, Rose, & Leigh, 1993), which are often based on careful planning and rarely involve impulsive or arousal driven needs [although previous studies on alexithymia and high-risk sport (see Woodman, Huggins, Le Scanff, & Cazenave, 2009) have concluded that alexithymia is not the same as arousal or sensation-seeking, the current article did not make this distinction within the review section] (Cazenave, Le Scanff, & Woodman, 2007; Llewellyn & Sanchez, 2008). Therefore, the authors should consider the differences in perceptions of high-risk sport, both in regards to the experience level of the participants and in terms of non-participant observers and the participants themselves. Although the authors may frame this as merely an example of a non-alexithymic high-risk sport participant or perhaps one low in the alexithymia personality trait, they should acknowledge that it is entirely possible that some risk-takers, high in alexithymia or not, may not experience the emotion of fear when participating.

Celsi, Rose & Leigh, (1993) provide a quote from a highly experienced skydiver and former eight-way world champion: "Don’t kid yourselves. Skydiving is dangerous. I’ve had a lot of friends die skydiving. In reality, even though we maneuver through the sky, we are falling like a rock" (p. 17). Additionally, Celsi et al. (1993) provide three examples of accidents and fatalities that “experienced individuals” (p. 17) underwent or witnessed. They conclude that “each performer understood the possibility of such an occurrence. Death or injury is part of the risk that participants knowingly take.” (p. 17). Celsi et al. (1993) then suggest that it is due to this recognition of risk that experienced participants develop contingency strategies and undertake “calculated risks”. Thus, we disagree that experienced
performers rarely perceive their participation in high-risk sport as dangerous. Indeed, the very notion of a calculated risk acknowledges that there is an element of danger involved. We do agree, however, that certain high-risk sport participants report engaging in their activity without the experience of intense emotion such as fear. This lack of intense emotional experience may be due to the individual having engaged in careful planning (precautionary behaviors), which consequently attenuates the in situ experience of fear during participation. We have added a sentence in the introduction (page 7, line 16-17) to acknowledge this point, citing Kerr and Houge Mackenzie (2014). Additionally, we have added a paragraph to the general discussion (see pages 22-23) to further elucidate the point. We would like to thank you for this important comment, and we recognize that it was an oversight not to discuss this important issue in the original manuscript.

The authors should also consider clarifying the experience level of the alexithymic high-risk sport risk-taker that they are referring to. Specifically, when the authors are discussing the alexithymic risk-taker are they referring to novice or leisure risk-takers, who may seek out the experiences only from time to time to regulate their emotions? Or are the alexithymic risk-takers in question more experienced and regular risk-takers? A distinction regarding the frequency of risk-taking by the alexithymic individual would be helpful for the reader.

We agree that the participants’ experience and participation frequency are important considerations both theoretically and in terms of replicability of the present methodology. Indeed, Reviewer 3 raised a similar concern.

In fact we initially included information pertaining to both experience and frequency in the manuscript but then removed this information due to space constraints. We thank you for this comment that highlights the importance of providing such data and we are pleased to reinstate it (see pages 9, 16 and 18-19).

In Study 3 we have opted for the following:

Demographic data revealed that participants’ experience, ability and frequency of participation in their chosen sport, closely resembled those revealed in Study 2.

We will gladly include the full explanation of the data in Study 3 also if required:

Demographic data revealed that participants were largely experienced ($M_{years\, participation} = 12.70, SD = 11.90$), competent (intermediate, $n = 65$; advanced, $n = 168$; expert, $n = 108$) and regularly engaged in their chosen high-risk sport (frequency of participation: $\geq$ weekly, $n = 161$; $\geq$ twice monthly, $n = 103$; $\geq$ monthly, $n = 44$; $\geq$ every 2 months, $n = 16$; $\geq$ twice annually, $n = 14$; $\leq$ annually, $n = 3$).

Finally, we draw attention to the experience and competence level of the present samples in the general discussion (page 22, lines 10-14).

Although the authors require a certain degree of experience for inclusion within their three studies, no rationale for the number of years or distinction between years of experience and actual frequency of experience is made.

We have now provided demographic data pertaining to both the participants’ years of experience and the frequency of their participations (see pages 9, 16 and 18-19).

Although some research has documented changes in motivation across a participant’s engagement with a high-risk sport (e.g., Celsi et al., 1993), none has yet (to the best of our knowledge) delimited the specific time points at which these changes are hypothesized to
occur. Similarly, during the early stages of engagement with high-risk sport there is likely a period wherein participants are somewhat ignorant to the full risks associated with their engagement.

For example within rock climbing the utility of self-placed protection in the rock is affected by the rock type and weather conditions. Specifically, passive protection (nuts and wires) can more readily rip out of the rock, in the advent of a fall, when climbing on ‘soft’ rock (e.g., Slate; found in North Wales, UK). Equally, following heavy rain hand and foot holds can more easily snap-off on certain types of porous rock (e.g., (Red) Sandstone; found in Utah, USA). The development of the requisite skills for dealing with such dangers is somewhat a function of time and experience (i.e., experiencing different rock types in differing climactic conditions). Thus, a novice (with less than three years’ experience) is much less likely to accurately assess danger across various rock climbs than an ‘experienced’ rock climber (who has been climbing three or more years).

We reasoned that three years was a reasonable cutoff but we acknowledge this is somewhat arbitrary. Indeed, it could be two years; it could be four years. Again, we are not aware of any research this specifies the timeframe within which this change in awareness occurs and there is likely a large variance within that timeframe.

Additionally, the quote from Dean Potter (page 4) could be framed better. It’s clear from the quote that emotions felt while experiencing a high-risk sport are intense and overwhelming. However, what is not clear is if Mr. Potter is characterizing the experience from the point of view of an alexithymic individual, or if the quote is merely presented to illustrate how high-risk sport may be appealing to an alexithymic individual. This should be clarified.

We agree and this clarification has now been made as a footnote on page 5.

On page five, it appears that the authors are attempting to clarify the attraction of the fear emotion associated with high-risk sport when discussing the difference between deliberate risk-taking and precautionary behaviors. It appears that an argument is being made that those who tend to take deliberate risks within high-risk sport do so to increase their exposure to danger and more specifically to experience the intense emotion of what the authors refer to as fear that often accompanies this type of behavior. Yet, the examples provided (i.e., rock climbing without ropes and BASE jumping) would seem to be more reflective of precautionary behavior in high-risk sport.

Research has suggested that these types of risk-taking within high-risk sport are often preceded by an extensive degree of careful planning (see Woodman, Hardy, Barlow, & Le Scanff, 2010). It would seem as though an alexithymic risk-taker would prefer bungee jumping or something similar in which the fear emotion would not be dulled by the planning process. The authors seem to acknowledge this within the first paragraph of page 6. Therefore, the authors may want to consider using different examples.

We concede that our example could have been clearer and, in consideration of your comment, we have now modified the example given on page 7, line 9-11.

On page six, the authors suggest a strong theoretical link between alexithymia and risk-taking, however the authors themselves have made a clear distinction between types of risk-taking, for example those which employ precautionary behaviors to minimize and control risk, and conversely those of a deliberate nature which would seem to raise the stakes of danger within the high-risk sport domain. Yet, one area which was not addressed within the literature review concerns the impact of actual high-risk sport experience and sport knowledge. The hypotheses presented reflect the anticipated link between alexithymia and risk-taking, yet fail to account for experience or a lack thereof, and its potential impact on accidents and close calls. It should be noted that within the
methodology for study 1, the authors indicate that only rock climbers with three or more years of experience would meet the inclusion criteria for the study. However, as mentioned, there was no discussion of the potential impact of experience within risk-sport on the alexithymic risk-taker, save for the identification of emotional acclimatization and the potential need for higher risks to experience the desired emotional state.

Our reasons for excluding inexperienced participants have now been further detailed on pages 9-10.

The authors present a thorough rationale for the need to investigate close calls in addition to the number of accidents reported by high-risk sportspeople. As noted by the authors, the development of the Accidents and Close Calls in Sport Inventory (ACCSI) would seem to be highly relevant to both the current article as well as future investigations into the actual risk associated with high-risk sports.

Within the method section for study 1, the authors note that only rock climbers with three or more years of traditional rock climbing experience were included in the final analyses. It would be helpful to the reader to know exactly what the authors mean by “traditional” rock climbing. Did the included participants climb only on natural rock formations or was artificial indoor rock climbing also considered as traditional? Did any of the participants engage in bouldering [horizontal climbing on low rock faces without the use of ropes (considerably more risky than vertical climbing)]?

Additional information on what comprises traditional climbing has been provided on page 9.

Additional information regarding participants’ climbing frequency and knowledge of their current climbing grade would be beneficial.

This information has now been added on page 10.

Within the method section for study 1, the description of the Toronto Alexithymia Scale (TAS-20) is rather brief. Specifically, the authors don’t provide any information regarding how one’s total score is related to alexithymia or what the norms on the TAS are. Although curious readers could inspect the original Bagby and colleagues (1994) article for this information, considering that alexithymia plays such a major role in the current article it would seem beneficial to have this information readily available for the reader.

We agree. Please see the additions made on page 11 lines 18-21.

Additionally, as the Risk-taking Inventory (RTI) is a fairly new measurement of risk-taking behavior, it would benefit the readers if the authors would provide more information regarding it. Specifically, as the RTI has two separate factors, is it possible for one to score high on both factors? Or, does the RTI yield a total score which classifies one as either a “deliberate risk taker” or one who engages in “precautionary behaviors”?

It is indeed possible for one to score high on both factors on the RTI and we have now clarified the orthogonal nature of the two factors (see page 10, line 23). Unfortunately, space constraints limit a detailed explanation on the nature of the relationship between the two factors. However, readers will note the orthogonal nature of the factors from the description of the RTI and they will note the low factor-factor correlations in Table 2 that support this orthogonality. Finally, reliability information has been added (page 11, lines 2-4).
Furthermore, when discussing the results of study 1 (in addition to studies 2 and 3), no information is provided to help make sense of the data regarding the alexithymia scores. Although table 2 does provide the mean and standard deviation for TAS score, there is no indication of whether these scores are high, moderate or low. It is interesting that within study 1, alexithymia scores predicted risk-taking, close calls and accidents, but it would also be helpful to know if the level of alexithymia present within the sample of study 1 (as well as the remaining studies) is higher, similar to, or lower to that of the general population.

Thank you for this comment. We agree that by including the TAS-20 norms (in the measures section of Study 1) this important comparison can now easily be made (see page 10 lines 18-21). Additionally, in the general discussion section we have now drawn attention to the finding that across all three studies, the high-risk sport participants’ mean levels of alexithymia appear comparable to those of sample norms (see page 22, lines 10-14).

On page 11, the in-text reference to Preacher and Kelley uses an ampersand which should be changed to “and”. This occurs twice in the first paragraph of page 11.

This error has now been corrected.

On page 13 the authors refer to base jumping as an example of a high-risk sport. In two previous references to this sport, it was referred to as “BASE” jumping.

This inconsistency has been rectified.

Throughout the article, the authors do a good job of controlling for two potential confounding variables, sensation-seeking (study 1) and anhedonia (study 2), as well as building upon their theoretical framework by obtaining converging evidence for the alexithymia-risk-taking-accidents/close calls model (study 3). Doing so provides the authors with a strong methodological foundation from which to generate conclusions from.

However, within the general discussion, the authors claim that alexithymia causally influences risk-taking behaviors, a claim that the authors suggest is supported via the mediation analyses used within the article. Although it has been supported that mediation analyses can indeed provide evidence that one mediation pattern is more plausible in regards to accounting for the association between variables, this type of analysis cannot definitively establish a causal link (see Shrout & Bolger, 2002). Results of the current study do suggest that alexithymia is a strong predictor of not only deliberate risk-taking, but also of accidents and close-calls. However, this is not necessarily the same as a causal link.

The authors do attempt to counter this argument by claiming that alexithymia is a stable personality trait, and as such it is not possible that risk-taking behavior could have created an alexithymic state within the high-risk sportsperson. However, caution should be made when viewing personality traits as completely stable, and unchanging over time. The authors may want to view Roberts, Walton, and Viechtbauer’s (2006) meta-analysis on change in personality traits. The authors then further attempt to support their argument by pointing out that sensation-seeking and anhedonia were found to be unrelated to the risk-taking behavior.

However, it is at least plausible that prior to alexithymia becoming a “stable” part of the sportsperson’s personality, he or she could have had early experiences with risk-taking behavior, or arousal-inducing activities, similar in nature to what is typically referred to as high-risk sport. The directionality of the relationship within the current study is assumed by the authors to be that of alexithymia influencing risk-taking behavior, specifically a deliberate form of risk-taking, which then results in more close calls and accidents within the high-risk sport domain. Yet, this wasn’t conclusively or exclusively determined from analyses conducted in the three studies. Additionally, only two variables, sensation-seeking and anhedonia, were controlled for. There are numerous other
potential third-variables which could be influencing the relationship, which were not accounted for. Thus, in light of the non-experimental design of the three studies conducted, it seems as though the authors should acknowledge that this counter directional relationship could at least be possible. Instead, the authors take a rather forceful stance on the causal link established within their studies. A more cautious interpretation of the mediation analyses would seem to be more appropriate.

We recognize the need for greater caution in interpreting our results and concede that our initial claim of establishing a causal structure was premature. In the modified general discussion section we have removed sentences that, in light of your comments, could be construed as reflecting a forceful stance (page 20). Additionally, based on the Roberts et al. (2006) reference that you provided, we have noted that even so-called stable personality traits may change over time. As such, we have tempered our directional arguments (pages 20-21).

Finally, as you point out, many additional variables (not just sensation seeking and anhedonia) that were beyond the scope of the present research may contribute to this model. To acknowledge this point we have added a sentence to highlight that future research may consider, for example, escape from self-awareness (page 21, lines 18-19).

Overall, the topic of the current study is one which clearly extends upon previous research in the area of high-risk sports and emotion regulation (see Woodman et al., 2008; Woodman et al., 2009). The current study also provides a new measure of risk-taking in the form of the ACCSI. The authors provide a strong rationale for the study, utilize a sound methodology for each of their three studies, and provide evidence based conclusions. The article provides a further extension from the predominant sensation-seeking model explanation for high-risk sport involvement and establishes a potential for further research in the areas of not only emotion regulation, but also high-risk sport involvement, and a more precise measurement of risk-taking behavior in high-risk sport.

We would like to thank you for these encouraging comments. More importantly, we would like to thank you for your constructive and insightful comments that we believe had strengthened the manuscript.

Reviewer: 2
Comments to the Author

This manuscript presents a series of empirical studies in which the association between alexithymia and the experiencing of accidents and close calls in high-risk sports was examined. The topic under consideration is relevant to the readership of the Journal of Sport and Exercise Psychology (JSEP), the manuscript is clearly written, and the systematic investigation of a topic across multiple studies with large sample sizes is refreshing. These positive aspects notwithstanding, I have several concerns about the manuscript in its current form:

1. On p. 1, l. 8, “led to” should probably be replaced with something like “was associated with” to avoid conveying a causal interpretation the research design used does not permit.

   This has been amended in line with your recommendations.

2. On p. 3, l. 9 & 25 and p. 4, l. 9-10, there is singular-plural disagreement. It might be easiest just to use plural (i.e., “alexithymic people”).
Thank you for spotting these grammatical errors. We agree that “alexithymic people” is the most elegant solution and this change has now been made throughout the revised manuscript.

3. In accordance with APA style, it should be “because” instead of “since” on p. 4, l. 6 and p. 7, l. 23.

   This has been amended in line with your recommendations.

4. It would be helpful to provide validity information for the TAS-20, the RTI, and the BSSS.

   This information has now been added in the Study 1 measures section for all three inventories. Additionally, validity information for the SHAPS has been added in the Study 2 measures section.

5. On p. 11, l. 4 & 6, it should be “Preacher and Kelley.”

   This amendment has been made.

6. On p. 13, a plausible argument is made for why anhedonia might predict precautionary behaviors and purposeful risk taking. On what basis, aside from how the results turned out, was it hypothesized “that it is specifically alexithymia that provokes risk taking behaviors...”?

   This is a very good question that has caused us to rethink how we introduce anhedonia. Indeed, in conceptualizing the present studies our aim was to control for the effects of anhedonia as a means of testing whether the alexithymia – risk-taking relationship still held. Thus, the inclusion of a specific ‘hypothesis’ pertaining to anhedonia was somewhat misrepresentative of our original intention. We have now modified the manuscript accordingly and removed all references to a specific ‘hypothesis’ pertaining to anhedonia.

7. With respect to the description of the SHAPS on p. 14, can it be assumed that high scores correspond with high levels of anhedonia?

   This is correct. A clarifying sentence has been added to the measures section of Study 2 (page 17 lines 1-3).

8. The References section is highly consistent with APA style with the exception that appropriate use of upper and lower case letters in journal article and book titles should be attended to in numerous references listed (e.g., Ahmed et al., Celsi et al., Cisler et al., Gravetter & Foranzo, etc.).

   These errors in consistency have now been addressed and modifications have been made throughout the references section.

9a. I have some concerns about the measure of accidents and close calls in sport and about claims that it has been “validated.” The questionnaire is essentially a trait measure of the tendency to experience accidents and close calls, not an assessment of actual accidents and close calls experienced. Recall measures were rejected, yet the ACCSI relies on recall of past experiences of accidents and close calls (a point that is acknowledged on p. 7). It is unclear how exactly the ACCSI was “validated” in the current study. Aside from the CFAs and demonstrated relationships with variables it should theoretically be related to, there is no evidence that it actually measures the constructs it is intended to measure. The ACCSI could, of course, be validated with observational data (which I realize would be difficult to do) and diary data (which would be much easier to do, but would still rely on self-report).
Following your comment here, our claims the ACCSI has been “validated” have been rightly scaled back. Additionally, the specific sentence that you made reference to has now been modified to state that the ACCSI “evidenced preliminary concurrent validity” (page 20, line 15).

With regard to the issue of recall, when we embarked on developing the ACCSI, we were fully cognizant of the thorny nature of the task at hand. We dismissed a prospective design on the basis of ethical concerns because it would be extremely difficult to get an ethics committee to ratify a study where we were proposing to collect “observational data” pertaining to a participant’s accidents (which could be very serious, by definition of the activities being observed).

As you suggest, the obvious way around this problem is simply to collect self-report prospective data, in the form of “diary data”, in the same vein as conducted retrospectively. The concern here was that accidents (and close-calls) are typically fairly rare in these sorts of sports. In a prospective design we would likely need to collect data over a number of years in order for sufficient variance (or simply numbers) to emerge. It was for these reasons that we chose the retrospective design. We fully acknowledge that it is far from ideal but we considered it the best berry in a thorny bush. Thus, we have now revised the general discussion to acknowledge that a prospective design is an obvious future direction for research in this line of enquiry (page 24 lines 12-14).

9b. I also question how the high correlations between the two factors “confirmed the discriminant validity of the two-factor model.” I suspect that the factor-factor correlations would likely approach or exceed the test-retest reliability of the two subscales.

We fully acknowledge the limited detail pertaining to the factor-factor correlations in the original version (we were doing, and are continuing to do, our best to keep the page numbers to a reasonable limit...).

Satorra and Bentler (2001) scaled difference $\chi^2$ tests were conducted but we left them unreported in the original submission due to space constraints. These have now been reinstated (see pages 12, lines 21-24; page 17, lines 8-10; page 19, lines 6-8). We can remove them again if needed...

9c. Finally, inspection of the item content reveals several questionable items. Item 5 would seem to be mutually exclusive with experiencing accidents (which makes the high factor-factor correlations all the more interesting!), item 7 does not tap experiencing close calls (but instead taps how respondents feel regardless of whether they have had a close call), and item 6 does not tap experiencing accidents (but instead taps whether the accidents they have experienced have led to injuries). My concerns about the ACCSI do not negate the impressive findings of the current series of studies, but they do suggest a need for a more cautious interpretation of the findings and validation status of the ACCSI.

This is an interesting point. The ACCSI structure performed very well when tested with each set of data so we can only surmise here as to the relative merit of individual items. Specifically, in relation to the items that you have picked here, we would argue:

a) Item 5. Given that the Likert response scale is a frequency (never to always), Item 5 is not mutually exclusive to experiencing accidents: an individual can frequently (i) “narrowly avoid accidents” and also have accidents; or (ii) “narrowly avoid accidents” and not have accidents. “Narrowly avoiding an accident” is a close call, which may or may not be associated with the experience of accidents.
b) Item 7. We agree that Item 7 taps more the feeling regarding a close call than the close call itself, but the item also taps into the experience of that close call itself (the item reflects something like: “phew, that was close...”; i.e., a close call).

c) Item 6. Accidents in the high-risk domain almost always lead to an injury. In fact, we cannot think of an instance where an injury would not be sustained in the event of an accident. If an injury is not sustained then it is typically deemed a close call. Equally, in a similar vein to the previous Item (Item 7), this item assumes an injury as an integral part of the item (if a person did not have accidents they would score lowly on this item, regardless of injuries sustained because of something else, such as overtraining).

We believe these are very interesting points on which to ponder but are concerned that the manuscript will become somewhat bloated if we address them within the body of the text. As such, and given that the model fit the data well across three studies, we have not developed these arguments within the manuscript. We can of course include them if required.

10. I agree with the assertion in the Discussion section that the findings are suggestive of a causal chain involving alexithymia, risk taking behavior, and accidents/close calls in high risk sport. Nevertheless, the cross-sectional research design, exclusive reliance on self-report measures, and lack of validation of the ACCSI are limitations that preclude drawing causal inferences from the data. It is fine to present arguments as to why the limitations should not be of concern (as is done on pp. 17-20), but in the end, the limitations remain.

We recognize the need for greater caution in interpreting our results and concede that our initial claim of establishing a causal structure was premature and forceful. In the modified general discussion section we have removed sentences (e.g., “Put simply, one can be confident that the direction of the mediation models are as theorized”) that, in light of your comments, we now consider premature. Finally, we have tempered the strength of our terminology somewhat by including phrases such as “tentative” (page 20, line 17) and “[not] definitive” (page 20, line 25).

In particular, the argument made against using a prospective design with diary data on p. 20 is not persuasive. Such a study is the logical “next step” in this line of research, as it would help to address the issue of time-order relations among variables, could include additional factors that may contribute to risk taking behavior, and could help validate the ACCSI.

We agree and have aimed to deal with the present comment in our response to your point 9a (above).

Reviewer: 3

As I understand the message the authors argue that people with a certain ‘trait’ will take risks in particular sports. The authors have used Alexithymia to differentiate between athletes who deliberately take risks and those who participate in a manner which reduces the chance of mishap. That is, certain individuals who are interested in taking risks might be attracted to a particular type of sport. If this is the case then this argument has been made before and the conclusions drawn here add weight to previous perspectives. As such this article will add to the current discourse and has considerable merit in its approach and innovative perspective.
Unfortunately the previous research in question has not been referred to. As a result, as it is currently written there are 3 issues that need addressing, all of which centre on the authors’ presumptions about the type of activities chosen.

1. There seems to be an acceptance in this article that there is a category of sports that are accepted as ‘high-risk’ sports. This seems to be based on 20 year old perspective on the categorisation of certain sports/ recreational activities. This article might be strengthened by referring to recent articles by authors such as (but not limited to) Houge-Mackenzie, Kerr and Brymer. For example, there are perhaps 6 articles that relate to this study written by one or other of these three authors that would strengthen this paper and help the authors strengthen the introduction section and the discussion.

The authors note this circular argument in the first line of the second paragraph page 2 “The high-risk sport participant is, by definition, a risk-taker,” but perhaps without meaning to. Is it necessarily the case that a participant chooses kayaking because they are a risk taker? … there is now quite a bit of literature that questions this perspective.

Given the above point and if the authors do wish to continue with the ‘high-risk’ argument then this article will need to explain why the activities chosen are deemed high-risk, especially as some work suggests the opposite.

The discussion as to how activities such as rock climbing and skydiving are most accurately defined and labelled is an interesting one. Indeed, not only has this issue been raised by Reviewer 1, but it is an issue that we have previously frequently discussed; both within our own research group and in discourse with other researchers. Thus, the ongoing lack of consensus pertaining to an adequate descriptive moniker only serves to highlight the thorny nature of this particular issue. With this in mind we acknowledge the parsimony of the original introduction with regard to this specific issue. As such, we have added a new opening paragraph to the general introduction (see page 3).

We accept that the sentence, “The high-risk sport participant is, by definition, a risk-taker” is open to different interpretations and we have therefore removed it. Specifically, in the extreme, such a sentence could potentially be misconstrued as suggesting that all participants of ‘high-risk’ sport are motivated to maximize/increase their expose to risk. We accept there is a growing body of literature that correctly questions this perspective; indeed, we have contributed to that very literature and the present manuscript examines individual personality differences that may influence an individual’s risk-seeking propensity.

As you have pointed out, alternatives to the label ‘high-risk’ do exist. Each of the labels discussed below have merit and it is their relative merit that continues to fuel the fire of these interesting discussions. The alternatives to ‘high-risk’ sport are discussed below in the context of our ongoing preference for the term “high-risk sport”:

1. **Risk-taking sport**: This label suffers from the same limitation as the problematic sentence that you highlighted above. Specifically, this label potentially leads one to assume that participants of high-risk sports are all risk-takers. This interpretation would be doubly confusing in the context of the present manuscript given that the mediating variable is risk-taking. Risk-taking is different from participating in a sport that is considered high-risk. That is the point of this manuscript. We thus do not wish to adopt this label.

2. **Extreme sport**: Extreme is defined as “reaching a high or the highest degree; very great” (see [http://www.oxforddictionaries.com/definition/english/extreme](http://www.oxforddictionaries.com/definition/english/extreme)). Thus, Olympic sport could be labeled and defined as extreme sport because Olympic athletes have attained the “highest degree”, or an extreme level, of their sport. Alternatively, certain
rowers, for example, could be defined as extreme sport participants if their engagements in rowing lead them to overtrain, or collapse, due to extreme levels of training comprising pushing themselves physically to a “very great” degree. This potential confusion dampens our enthusiasm for this label.

**Adventure sport:** Adventure is defined as, “an unusual and exciting or daring experience” (see [http://www.oxforddictionaries.com/definition/english/adventure](http://www.oxforddictionaries.com/definition/english/adventure)). Many participants of ‘high-risk’ sports participate on a frequent and regular basis (as in the present study) and thus their participation is not an ‘unusual’ experience for them; it is not an “adventure” and participants of those sports would not describe their normal activity as an “adventure.” (they may even describe it as “training”). Conversely, a person who does not normally engage in high-risk sports and who chooses to go on a vacation that involved walking in some remote forest could justifiably state that she was going on an “adventure.” Everyone would know what she was talking about and they would accept that she was indeed going on an “adventure vacation.” Risk and adventure are separate constructs. The sports that we are investigating involve an element of risk (see definition, p. 2); they do not necessarily involve an element of adventure. As such, we prefer “high-risk sports” to “adventure sports” as the label for these activities.

3. **Lifestyle sport:** Lifestyle is defined as “the way in which a person lives” (see [http://www.oxforddictionaries.com/definition/english/lifestyle](http://www.oxforddictionaries.com/definition/english/lifestyle)). Therefore, under this definition, golf, for example, could be classed as a ‘lifestyle sport’.

Given these relative merits of the alternative labels we have opted to retain the label “high-risk sport” in the present study. Additionally, we recognize that ‘medium-risk sport’ and ‘extreme-risk sport’ might be useful labels for other activities.

Finally, we consulted research from the authors that you recommended and we agree that our manuscript has benefitted as a consequence. You will now see reference to the following papers in our revised manuscript:


2. The above issues need clarification not just to frame the paper but also the response to these issues directly feeds into the methodology. For example, on page 13 the authors list a number of sports that were included but they do not clarify the level of difficulty for some sports. For example, while some activities like BASE might be quite narrowly defined, white-water kayaking can be undertaken at a very low level on grade 2 or a very high level at grade 5. The outcomes from a mishap at grade 2 would likely be getting wet... however, on grade 6 the outcome would potentially be very serious. The skill level required is also therefore very different. Does Alexithymia help us
understand differentiations here? Is it more prevalent in participants who work at a level where death is the most likely outcome of a mismanaged accident or mistake or only at a level where one could get wet, a few scratches or minor injuries?

We agree that further demographic information pertaining to the participants’ level of engagement in high-risk sport is important both theoretically and in terms of replicability of the present methodology.

Reviewer 1 (point 6) made a similar point that overlaps the present point. Thus, we would like to draw your attention to our reply to Reviewer 1 (point 6) above.

Additionally, we agree with your comment that depending on one’s “level” of engagement in a particular high-risk sport that “the skill level required is... very different.” With that in mind, further detail regarding the ‘inclusion criteria’ has also been reinstated. In the original submitted manuscript the inclusion criteria was stated as being “a minimum of 18 years of age and a minimum of 3 years’ participation in the individual’s main high-risk sport.” (page 13, line 24 & 25, original manuscript). These inclusion criteria have now been modified. Specifically, we state that any respondents classifying themselves as a ‘beginner’ were (also) excluded (see page 10, line 1).

It is important to note that we first removed all participants who had less than three years’ experience. Then, secondly, we aimed to remove any remaining participants who were classified as a ‘beginner’. This second screen did not remove any participants. In other words, as one would intuitively expect, anyone with three or more years’ experience described their level of competence as ‘novice’ or greater (i.e., advanced or elite). With this in mind, reporting beginners were excluded, was deemed somewhat of a moot point in the original manuscript. However, we now recognize this was an oversight. We thank you for highlighting the importance of including these data that further allows the reader to accurately ‘classify’ the participation “level” of the participants within the present study.

3. The authors recognise the role of gender and the potential for gender to influence results. However, there is also a great deal of work looking at young people and risk taking, this paper would be strengthened if we knew more about the influence of age with regards to the interpretation of their findings and the authors recognised the potential influence of age.

This is a particularly interesting point that we now recognize is a clear omission from the original manuscript. As such, we have now inserted age into the correlation matrix (page 36). Additionally, we re-ran the mediation analysis in Study 1, with age as a covariate, which demonstrated the mediation model still held when controlling for the effects of age (see page 14, lines 7-12).