*South African Journal for Research in Sport, Physical Education and Recreation Social Sciences, 2023, ISBN: 0379-9069*

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# ROCK CLIMBERS: DELIBERATE OR PRECAUTIONARY RISK-TAKERS IN RELATION TO SENSATION-SEEKING

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***ABSTRACT***

*A group of rock climbers were classified into two categories, deliberate or precautionary risk-takers, using the Risk-Taking Inventory (RTI). The aim of the study was to determine if these categories played a role in sensation-seeking behaviour. The study also aimed to determine if the type of risk-taking behaviour correlated with the number of injuries sustained by the participants. The study was quantitative in nature and an exploratory design was used. A sample of 70 rock climbers from the Mountain Club of South Africa participated. Participants completed a demographic questionnaire, the RTI and the Sensation Seeking Scale-V. Non-parametric statistics were used. The results revealed statistically significant differences between the two risk-taking groups on the total score of the Sensation Seeking Scale-V and its subscales of Disinhibition and Boredom Susceptibility. No significant correlations were observed between the RTI groups and the number of injuries sustained. A significant positive correlation was, however, found between the number of injuries and number of years rock climbing. The results indicated that being a precautionary or deliberate risk-taker will have an impact on rock climbers' sensation-seeking behaviour but will have no effect on the number of injuries these groups sustain.*

***Keywords:*** Deliberate risk-taker; Extreme sport; Precautionary risk-taker; Rock climbing; Sensation-seeking.

## INTRODUCTION

High-risk sports can be classified as sports in which the participant must accept the possibility of severe injury or death (Castenier *et al*., 2010; Kupciw & MacGregor, 2012; Barlow, 2013; Croukamp, 2017; Woodman *et al*., 2020). Rock climbing is an example of a high-risk sport, in which the participants have to climb across, up or down artificial rock walls or natural rock formations (The River Rock, 2016). Rock climbers focus on reaching the summit, endpoint formation or wall of a predetermined route without falling (Croukamp, 2017). This sport is thus classified as a challenging sport that tests physical and mental strength, agility, endurance and balance, and which demands the use of specialised equipment and training to mediate the risks involved (Health Fitness Revolution, 2015; Croukamp, 2017).

Rock climbing includes various subdisciplines and styles and the variety of rock formations, route difficulty and route options are based on individual choice (Chaloupsky, 2014). The

different subdisciplines of climbing are commonly described as free climbing, sport climbing, traditional climbing and bouldering (Croukamp, 2017). The most common form of rock climbing in South Africa is sport climbing (Croukamp, 2017). Sport climbing involves ascending a rock face using a rope that is attached to bolts that are anchored into the rock wall (Valenzuela *et al*., 2015). The climber follows a predetermined route and their ascent is controlled by a "belayer" on the ground who brakes the free-flowing action of the rope and prevents the climber from falling (Valenzuela *et al*., 2015). Because sport climbers assert more control over their environment, they tend to take greater risks in an attempt to increase their search for novelty (Barlow *et al*., 2013; Croukamp, 2017). Sport climbing is, however, considered less dangerous than other forms of climbing because of injury preventive measures such as the use of specialised equipment and the assistance of the belayer on the ground (Chaloupsky, 2014; Max, 2016). The most dangerous form of climbing is free climbing, in which the climber ascends a rock face only using his/her hands and feet (Max, 2016). Climbers hence do not make use of any equipment to control their ascent or prevent them from falling (Max, 2016). At present, free climbing is not as popular in South Africa as it is internationally.

Other common forms of rock climbing in South Africa are traditional climbing and bouldering. Traditional climbing involves ascending a rock face with the climber placing their own safety equipment, such as nuts and camming devices, into the cracks of the rock wall as they progress to the top (Valenzuela *et al*., 2015). Traditional climbers make use of a combination of specialised equipment and their bodies to ascend rock faces (Max, 2016). As a result, they do use predetermined routes, and they explore any possible route to ensure their ascent (Max, 2016; Croukamp, 2017). This type of climbing tests climbers' mental ability and judgement, which increases the novelty of the experience (Croukamp, 2017). The technological improvements of traditional climbing equipment have also contributed to making it a lot safer (Max, 2016). Bouldering, on the other hand, is a form of climbing in which boulders between 2 and 15 metres are climbed without a rope. The boulders are usually large, natural or artificial and are available in training facilities or outdoor areas (Draper *et al*., 2011; Croukamp, 2017). In comparison to traditional or sport climbing, bouldering involves more stamina and strength. Bouldering enables the climber to execute more risky moves as the climber is not as high from the ground as with traditional or sport climbing. Max (2016) noted that bouldering is safe yet challenging and therefore is popular among climbers seeking high-risk and novel experiences.

Reports from The Outdoor Industry Foundation (2011) highlighted that participation in rock climbing has increased by 25% over the last few years. In the United States of America alone, more than 9 million people participate in rock climbing annually (Saul *et al*., 2019). Rock climbing in South Africa has been identified as one of the fastest growing sport industries in the Western Cape, which is becoming a popular location for rock climbing (Wegner *et al*., 2015).

As rock climbing is a high-risk sport that involves physical risks, it can also be classified as an extreme sport (Coetzee, 2010; Kerr & Mackenzie, 2012; Jones *et al*., 2017; Klinar *et al*., 2017). Jones *et al.* (2017) explain that individuals participating in extreme sports can be described as sensation seekers in search of novel and intense experiences. Sensation-seeking is defined as "a human trait characterised by the need for varied, novel, and complex sensations and experiences, and the willingness to take physical and social risks for the sake of such experiences" (Jones *et al*., 2017:6). It is also referred to as novelty-, arousal-, thrill-, experience-

, excitement- and fun-seeking behaviour (Jones *et al*., 2017; Woodman *et al*., 2020). Langseth and Salvesen (2018) explained that rock climbers often reason that they engage in risk -taking not just because they enjoy it, or because of the thrill, but because there seems to be a social component linked to rock climbing.

Zuckerman (2009) and Goma -i-Freixanet (2004) argued that there is a positive correlation between sensation-seeking and the amount of risk participants of extreme sports are willing to take. High-risk environments appear to stimulate the minds of extreme athletes who are known for displaying restless behaviour in day-to-day settings (Goma-i-Freixanet, 2004; Saletti *et al.*, 2017). It appears that those athletes who measure high on sensation seeking will therefore take more risks, as the latter are void of routine and repetition (Goma-i-Freixanet, 2004; Croukamp, 2017; Saletti *et al.*, 2017). Chaloupsky (2014) and Brymer and Schweitzer (2013) also noted that the presence of risk sets extreme sports athletes apart from other athletes, as the latter a re known for taking precautionary approaches to mitigate any unnecessary risks when participating in the sports of their choice. Coetzee (2010) additionally found that those participating in extreme sports display different personality types that affect the way in which they approach the risk associated with the sport. In a similar vein, Langseth and Salvesen (2018) argued that risk-taking can be described as a personality trait that is equated with an inborn need to engage in risky behaviours. Extreme sports athletes may thus have a deep-rooted personal tendency to sensation seeking. Woodman *et al*. (2013) proposed that high-risk sports athletes can either be seen as deliberate risk-takers or precautionary risk-takers. Deliberate risk-taking is when individuals purposely expose themselves to dangerous situations without any precautions for avoidingserious injury or death (Woodman *et al*., 2013; Croukamp, 2017; Chen *et al*., 2019). Precautionary risk-taking, however, involves exposure to dangerous situations while attempting to minimise and control the risk associated with the situation using precautionary measures (Brymer & Schweitzer, 2013; Schüler & Nakamura, 2013). Because of this it was theorised that, within the context of rock climbing, deliberate risk-takers and precautionary risk-takers would differ with regard to their sensation-seeking behaviour. Rock climbers displaying sensation-seeking behaviour would hence take more physical risks and seek out routes not climbed by others before. They would also excel in those types of rock climbing not deemed safe or perceived as more challenging, such as free climbing (Croukamp. 2017).

In a study of 116 rock climbers conducted by Llewellyn and Sanchez (2013), it was discovered that sensation-seekingand impulsivity contributed to inexperienced climbers taking intentional risks, whereas experienced rock climbers mainly took calculated risks. Llewelyn and Sanchez (2013) concluded that sensation-seeking tends to drive inexperienced climbers to take more deliberate risks than experienced climbers. This supported their earlier findings that experienced rock climbers took more calculated risks and were not driven by impulsivity and sensation-seeking, compared with amateur rock climbers (Llewellyn & Sanchez, 2013). However, research conducted by Crust and Keegan (2010), as well as Young (2012), contradicted the results of Llewelyn and Sanchez (2013). They noted that rock climbers take greater risks once they become confident in their ability to climb more difficult and exciting routes. Research conducted by Zuckerman (2009) also yielded contradictory results with regard to the relationship between risk-taking and sensation-seeking, sometimes noting positive associations between the two, and other times negative ones. These contradictory findings supported the viewpoint of Jones *et al*. (2017) that although risk-taking could be perceived as

a component of sensation-seeking, there is uncertainty about the manner in which different types of risk-takers associate with components of sensation-seeking in the context of rock climbing. Extant literature describes risk-taking from a compensation model – or an adaptation model perspective (Langseth & Salvesen, 2018). The compensation model holds that people engage in risky sports because society is too concerned with safety. Risky sports thus allow them to escape the limits imposed by society. In this case, the sensation-seeking may be linked to taking risks to escape the restrictions society imposes. The adaptation model, on the other hand, explains partaking in risky sports as a product of modern society and cultural standards. Modern society expects people to make the best of their lives by doing something exciting and creative (Langseth & Salvesen, 2018). Here, risk-taking and sensation-seeking may be a way for climbers to live up to the expectations of modern society. The nature of sensation-seeking and risk-taking amongst South African rock climbers, however, is unclear and warrants further exploration. To this end, in this study we used the Risk-Taking Inventory (RTI) to distinguish between deliberate or precautionary risk-takers among a group of South African rock climbers. Then we established if the RTI classification had an impact on the climbers' sensation-seeking behaviour. A second aim of the study was to determine if relationships exist between the type of risk-taking behaviour and number of injuries sustained among the participants.

## METHODOLOGY

### Research design

A cross-sectional exploratory research design was used in this study, a design employed to determine basic relationships between variables before more rigorous research is implemented (Salkind, 2010). The purpose of the research was to differentiate rock climbers as deliberate or precautionary risk-takers and to explore how these categories of risk-takers associate with sensation-seeking.

### Sampling

Purposive sampling was used. Permission was obtained from the Mountain Club of South Africa (MCSA) to approach their members to participate in the study. The MCSA was established in 1891 and is the only African club affiliated with the world mountaineering body, the Union Internationale des Associations d'Alpinisme (UIAA). Members of the MCSA were approached at various rock climbing "meets" or gatherings in Gauteng, North West and Limpopo provinces. In the end, 70 members (42 male; 28 female) agreed to participate in the study. Participants were aged from 18 to 63 years (mean [*M*]=32.9, standard deviation [*SD*]=11.06).

### Instruments

A *demographic questionnaire* was used to obtain information from the participants about their rock climbing habits, including duration and frequency of climbing. Information about age and gender was also obtained.

The RTI was developed by Woodman *et al*. (2013). It consists of seven items that distinguish between deliberate and precautionary risk-taking behaviour. Items are measured on a five-point Likert scale with items rated as *Never*, *Rarely*, *Sometimes*, *Often* and *Always*. Woodman *et al*. conducted a series of studies in 2013 to investigate the validity of the RTI. The first study

involved conducting confirmatory factor analysis on a sample of 336 individuals. The results confirmed the two-factor structure of the inventory (Woodman *et al*., 2013). Two more studies of 518 participants and 290 participants, respectively, yet again confirmed the two-factor structure of the RTI. These studies also revealed that the instrument demonstrated good concurrent validity (Woodman *et al*., 2013). Additionally, a final study that included 221 individuals showed that the RTI displayed good predictive validity (Woodman *et al*., 2013). Reliability was also examined during these studies and Woodman *et al*. (2013) reported α values of α=0.69 for Deliberate Risk-Taking and α=0.73 for Precautionary Behaviour, and composite reliability for Deliberate Risk-Taking as α=0.78 and for Precautionary Behaviour α=0.71. The measure has also been successfully applied in other research studies exploring risk-taking behaviour (Barlow *et al*., 2013; Rinella *et al*., 2019).

Owing to the few items included in the Precautionary Behaviour and Deliberate Risk-taking subscales, inter-item correlations were used to assess the reliability the RTI demonstrated in the present study (Pallant, 2010). According to Piedmont (2014), the inter-item correlation coefficient assesses how related the score of one item is to scores on the other items in a scale. If the average inter-item correlation scores are between .20 and .40, the items are homogenous and contain unique variance. Scores below .20 indicate that the items may not represent the same content, and values above .40 indicate that the construct is only partially measured. Table 1 presents the inter-item correlation matrix for the Deliberate Risk-Taking subscale 1 and Table 2 the inter-item correlation matrix for the Deliberate Risk-Taking subscale 2.

***Table 1.*** **INTER-ITEM CORRELATION MATRIX FOR THE DELIBERATE RISK-TAKING SUBSCALE 1**

| | RTI 1: I deliberately put myself in danger. | RTI 3: It's like gambling, you can't win unless you try. | RTI 5: I actively seek out dangerous situations. |
|---|---|---|---|
| RTI 1: I deliberately put myself in danger. | 1.000 | .104 | .610 |
| RTI 3: It's like gambling, you can't win unless you try. | .104 | 1.000 | .083 |
| RTI 5: I actively seek out dangerous situations. | .610 | .083 | 1.000 |

***Table 2.*** **INTER-ITEM CORRELATION MATRIX FOR THE PRECAUTIONARY RISK-TAKING SUBSCALE 2**

| | RTI 2: I take time to check conditions (e.g., weather). | RTI 4: I check any gear/equipment that I borrow. | RTI 6: I am aware of the nearest help and first aid. | RTI 7: I take time to check for potential hazards. |
|---|---|---|---|---|
| RTI 2: I take time to check conditions (e.g., weather). | 1.000 | .160 | .274 | .332 |
| RTI 4: I check any gear/ equipment that I borrow. | .160 | 1.000 | .251 | .329 |
| RTI 6: I am aware of the nearest help and first aid. | .274 | .251 | 1.000 | .575 |
| RTI 7: I take time to check for potential hazards. | .332 | .329 | .575 | 1.000 |

It is clear from Tables 1 and 2 that both subscales displayed internal consistency to some extent. The Precautionary Behaviour subscale, however, displayed more internal consistency than the Deliberate Risk-Taking subscale. Unfortunately, owing to the small sample size of our study, confirmatory factor analysis could not be conducted. As a result, a decision was made to revert the raw scores obtained on the RTI to z-scores in an effort to standardise the scores.

*The Sensation-Seeking Scale-V (SSS-V)* was developed by Zuckerman (1983) and includes 40 items with two forced-choice response categories for each item. The 40 items are divided into four subscales: Thrill and Adventure Seeking (TAS), Experience Seeking (ES), Disinhibition (Dis) and Boredom Susceptibility (BS). The SSS-V is often used when studying the relationship between sensation-seeking and risk-taking behaviour (Rosenbloom, 2003; Diehm & Armatas, 2004; De Vries *et al*., 2009).

In a study conducted by Grey and Wilson (2007), the following α levels were found for the subscales: TAS: α=0.91, ES: α=0.80, Dis: α=0.84, and BS: α=0.74. Grey and Wilson (2007) furthermore confirmed that the scale demonstrated discriminant validity. For the present study, Cronbach α was run to determine the reliability of the subscales. The α level for TAS was α=0.42, for ES α=0.72, BS α=0.65, and Dis α=0.72. The lower α value for TAS was likely due to the small sample size (Bujang *et al*., 2018). Raharjanti *et al*. (2022), however, noted that Cronbach α values between 0.60 and 0.80 are acceptable for research purposes. This implies that the ES, BS and Dis subscales yielded relatively reliable data. However, because the validity of the SSS-V could also not be computed for the present study due to the small sample size, a decision was made to interpret all results with caution.

**Data collection**

Data collection spanned 2 years. During this time, data were collected on weekends at various MCSA rock climbing gatherings in Gauteng, North West and Limpopo provinces. Participants completed the measurement instruments at a designated area before the start of their climbs.

**Data analyses**

Data were analysed using SPSS version 28. Descriptive and non-parametric statistical analyses were conducted. Descriptive statistics were used to provide information on the sample according to the two groups, i.e., precautionary and deliberate risk-takers, including the types of rock climbing in which they participated, the number of years participants had climbed, and injury history. A chi-square test for independence was used to determine significant differences between the gender of participants and risk-taking type. Spearman's Rho correlational coefficient was used to determine relationships between the two categories of risk-taking behaviour and the number of injuries sustained, as well as the number of years climbing. Finally, Mann-Whitney U tests were conducted to investigate significant differences between the type of risk-taker and the subscales of the SSS-V.

**Ethical considerations**

Permission to conduct the research was obtained from the Ethics Committee of the Faculty of Humanities, University of Pretoria (Reference number: GW20150602HS). Participants provided written consent to confirm their voluntary participation in the study and to indicate that the results may be used for research purposes. Participant numbers were allocated to ensure the confidentiality of the participants' information.

**RESULTS**

The results showed that the participants had been climbing on average for 6.2 years. The minimum time was 8 months and the longest 40 years (*SD*=8.7 years). All the participants participated in sport climbing (n=70), and some of these also partook in bouldering (n=21) or traditional climbing (n=14). Most of the participants (n=46) participated in rock climbing at least once a week, whereas others (n=8) climbed more than once a week. The rest climbed once a month (n=9), or once in 6 months to a year (n=7).

Few (n=7) participants had experienced an acute injury during their climbing career. Acute injuries are injuries that can result in substantial trauma and require hospitalisation (Logan *et al*., 2004; Woodman *et al*., 2020). Chronic injuries relate to stress fractures or tendonitis obtained during climbing (Grønhaug, 2018; Woodman *et al*., 2020). The latter types of injuries appeared more frequently, with 12 participants experiencing such injuries during their climbing career, of whom four had experienced this type of injury at least once and the remaining eight between two and six times. The data yielded for each group of injury was found to be inadequate for further analysis and therefore a decision was made to create a new variable, "number of injuries". This variable combined acute and chronic injuries and was then used during the data analysis procedure. The number of injuries had *M*=1.57 with *SD*=3.648.

The RTI (Woodman *et al.,* 2013) was used to differentiate between deliberate and precautionary risk-takers. As mentioned previously, the raw scores obtained on the Deliberate Risk-Taking and Precautionary Risk-Taking subscales were standardised by reverting them to z-scores. Using the RTI's guidelines (Woodman *et al*., 2013), the next step was to sum the responses linked to each construct. Two summed values were obtained for each participant, one for each category. The highest value then determined if the participant would be grouped into the deliberate risk-taking or precautionary risk-taking group (Woodman *et al.,* 2013). In the end, 33 participants were identified as deliberate risk-takers and 37 as precautionary risk-takers. Table 3 contains the descriptive statistics that were obtained for the two groups on the RTI.

***Table 3.*** **THE DESCRIPTIVE STATISTICS FOR THE PRECAUTIONARY AND DELIBERATE RISK-TAKING GROUPS**

| Groups | N | Mean | Median | SD | Range | Minimum | Maximum |
|---|---|---|---|---|---|---|---|
| **Deliberate risk-taking** | 33 | 0.59 | 0.400 | 0.920 | 3.60 | –1.40 | 2.20 |
| **Precautionary risk-taking** | 37 | 0.675 | 0.484 | 0.556 | 1.77 | –0.22 | 1.54 |

The next step of statistical analyses involved determining whether there were significant differences between the precautionary and deliberate risk-takers when they were compared by gender. A chi-square test for independence yielded no significant differences between gender and the type of risk-taker. Statistical analyses were also conducted to determine if the two categories of risk-taking behaviour correlated with the number of injuries sustained. The number of years climbing was also included in the correlational analysis to see if it impacted risk-taking behaviour. The results are displayed in Table 4.

***Table 4.*** **SPEARMAN'S RHO CORRELATION COEFFICIENTS FOR DELIBERATE RISK-TAKING, PRECAUTIONARY RISK-TAKING, YEARS IN ROCK CLIMBING AND NUMBER OF INJURIES**

| | | Number of years participating in rock climbing | Number of injuries | Deliberate risk-taking | Precautionary risk-taking |
|---|---|---|---|---|---|
| **Number of years participating in rock climbing** | Correlation coefficient | 1.000 | .275* | –.279* | –.003 |
| | Sig. (two-tailed) | – | .032 | .020 | .981 |
| | N | 69 | 61 | 69 | 69 |
| **Number of injuries** | Correlation coefficient | .275* | 1.000 | –.055 | .098 |
| | Sig. (two-tailed) | .032 | – | .670 | .450 |
| | N | 61 | 62 | 62 | 62 |
| **Deliberate risk-taking** | Correlation coefficient | –.279* | -.055 | 1.000 | –.227 |
| | Sig. (two-tailed) | .020 | .670 | – | .059 |
| | N | 69 | 62 | 70 | 70 |
| **Precautionary risk-taking** | Correlation coefficient | –.003 | .098 | –.227 | 1.000 |
| | Sig. (two-tailed) | .981 | .450 | .059 | – |
| | N | 69 | 62 | 70 | 70 |

Table 4 shows a significant positive correlation between the number of injuries and how long participants have been partaking in rock climbing. Based on the findings it seems plausible that the longer participants have engaged in rock climbing the more injuries they have experienced. A significant negative correlation between deliberate risk-takers and the duration of rock climbing was also observed. This suggests that the longer participants engage in rock climbing, the less likely they are to take deliberate risks. No correlations were observed between the category of risk-taking and number of injuries.

Next, the researchers set out to establish if there were significant differences between the type of risk-taker and the subscales of the SSS-V. However, before the analysis was conducted, descriptive statistics were calculated for both groups for the SSS-V. The results are displayed in Table 5.

***Table 5.*** **MEAN, MEDIAN, STANDARD DEVIATION, RANGE, MINIMUM AND MAXIMUM SCORES FOR THE SENSATION-SEEKING SCALE PER RISK-TAKING GROUP**

| | Risk-taking group | Mean | Median | SD | Range | Min | Max |
|---|---|---|---|---|---|---|---|
| **Total Sensation Seeking Scale** | Deliberate risk-taking | 23.97 | 24.00 | 6.03 | 27 | 7 | 34 |
| | Precautionary risk-taking | 20.47 | 19.00 | 5.74 | 27 | 8 | 35 |
| **Thrill and Adventure Seeking** | Deliberate risk-taking | 7.55 | 8.00 | 1.90 | 9 | 1 | 10 |
| | Precautionary risk-taking | 7.39 | 7.00 | 1.34 | 5 | 5 | 10 |
| **Experience Seeking** | Deliberate risk-taking | 6.58 | 6.00 | 1.94 | 8 | 2 | 10 |
| | Precautionary risk-taking | 6.19 | 5.00 | 2.16 | 8 | 2 | 10 |
| **Disinhibition** | Deliberate risk-taking | 5.24 | 6.00 | 2.40 | 8 | 1 | 9 |
| | Precautionary risk-taking | 3.67 | 3.00 | 2.33 | 9 | 0 | 9 |
| **Boredom Susceptibility** | Deliberate risk-taking | 4.61 | 5.00 | 3.40 | 9 | 0 | 9 |
| | Precautionary risk-taking | 3.22 | 3.00 | 2.07 | 9 | 0 | 9 |

Owing to the small size of the sample, Mann-Whitney U tests were conducted to assess for differences between the two groups on the subscales of the SSS-V, as well as in the overall scores obtained on the latter. Pallant (2010) stated that the Mann -Whitney U test is a non-parametric alternative to the *t*-test for independent samples and compares the medians of two groups (independent variables) with regard to a dependent variable. Only the findings that yielded significant results are presented in Table 6.

***Table 6.*** **RESULTS OF MANN-WHITNEY U TESTS**

| Name of SSS-V subscale | Mann-Whitney U | Standard error | Standardised test statistic | Asymptotic significance | Effect size |
|---|---|---|---|---|---|
| **Overall score** | 385.00 | 83.07 | –2.52 | 0.012 | –0.30 |
| **Disinhibition** | 383.50 | 82.47 | –2.55 | 0.011 | –0.31 |
| **Boredom Susceptibility** | 388.00 | 82.46 | –2.50 | 0.012 | –0.30 |

Table 6 indicates that there were statistically significant differences between the deliberate risk-takers (*Md*=24.00, *n*=33) and precautionary risk-takers (*Md*=19.00, *n*=36) on the Total Sensation-Seeking Scale (*U*=385.00, *z*=–2.516, *p*=0.012) and a medium effect size (r=–0.30) (Cohen, 1988) was obtained. The deliberate risk-takers measured higher on the overall score of the sensation-seeking scale than the precautionary risk-takers.

Statistically significant differences were also observed between the deliberate risk-takers (*Md*=6.00, *n*=33) and precautionary risk-takers (*Md*=3.00, *n*=36) on the Dis subscale (*U*=383.50, *z*=–2.55, *p*=0.011) and the BS subscale (*U*=388.00, *z*=–2.50, *p*=0.012). In both

instances, medium effect sizes were obtained (Cohen, 1988) and the deliberate risk-takers' mean rank scores were higher than those of the precautionary risk-takers.

## DISCUSSION

Woodman *et al.* (2013) argued that the RTI could be used to establish how participants of high-risk sports such as rock climbing approach the risks associated with their sport. After standardising the RTI scores, participants in the current study were divided into two groups, deliberate risk-takers and precautionary risk-takers. Table 3 indicates that the precautionary risk-taking group was slightly larger than the deliberate risk-taking group. This result might explain why most of the sample participated in sport climbing, which is deemed one of the safest forms of rock climbing (Chaloupsky, 2014; Max, 2016). Literature supports the notion that precautionary risk-takers take more calculated risks while climbing and tend to avoid impulsive or any other form of sensation-seeking behaviour (Llewellyn & Sanchez, 2013). As a result, they will plan their routes carefully, avoid physical risks and take the necessary precautions to elude injuries (Brymer & Schweitzer, 2013; Schüler & Nakamura, 2013; Croukamp, 2017).

There were significant differences between the scores of the deliberate risk-takers and the precautionary risk-takers on the overall score of the SSS-V, as well as on the scores of the Dis and BS subscales (see Table 5). The deliberate risk-takers also measured higher on the scales in question. Taking into consideration that the participants spent a substantial amount of time rock climbing, it appears that Crust and Keegan (2010), as well as Young (2012), accurately assumed that deliberate risk-taking is more prominent amongst rock climbers who demonstrate high levels of confidence in their ability and skill in climbing more complicated and thrilling routes. The negative correlation observed between deliberate risk-taking and number of years climbing, however, suggests that deliberate risk-taking decreases as the climbers' number of years in the sport increases. It therefore appears that the more experienced rock climbers become, the more caution they exercise, which would result in a decrease in risk-taking behaviour. This confirms Llewellyn and Sanchez's (2013) findings, which indicated that experienced rock climbers are more cautious. In a similar vein, Croukamp (2017) noted that rock climbers who participated longer in the sport will be likely to exercise greater control, thereby exhibiting more calculated risk-taking. The lack of any correlation between the number of injuries and risk-taking group, however, seems to contradict these findings. Turner *et al.* (2004) offered a possible explanation for this, noting that research involving risk-taking behaviour and injuries is diverse and as a result, there appears to be a lack of agreement on how risk-taking behaviour is conceptualised. Turner *et al.* (2004) furthermore noted that studies tend not to differentiate between extreme sport and other contexts when the relationship between risk-taking behaviour and injuries is investigated.

Another result that seems to contradict the study findings is the positive correlation observed between the number of years climbing and the number of injuries (see Table 4). The authors acknowledge that the correlation was weak, indicating that the relationship between the two variables was not strong enough to warrant definitive conclusions. It is plausible that the more participants engage in rock climbing, i.e., the longer they have been climbing, the higher the likelihood of sustaining an injury. Kontos (2004) found that estimation of ability and the overestimation of ability tend to be better predictors of the occurrence of injuries than years

participating in a sport. He also theorised that the estimation of ability will impact the way in which risk-taking self-report questionnaires are completed. Measuring the estimation and overestimation of ability, however, fell outside the scope of the present study and was therefore not carried out. As a result, the conclusions are speculative and should be explored further in future research.

Because the deliberate risk-takers and precautionary risk-takers did not display significant differences on the TAS and ES subscales (see Table 6), one could argue that these elements of sensation-seeking are present in both groups of rock climbers. This implies that both groups thrive on challenges and are always in search of novel experiences, as well as opportunities in the form of new routes that will test them physically and mentally (Croukamp, 2017; Jones *et al*., 2017). Physical and mental challenges help extreme athletes, such as rock climbers, to avoid routine and the boredom associated with everyday life (Goma-i-Freixanet, 2004; Coetzee, 2010). The adaptation model maintains that people tend to engage in risky behaviours as a way to live up to the thrill-seeking expectations set by modern society. Langseth and Salvesen (2018) argued that today's cultural norms foster a "…seize the day…" attitude (p.2), which may increase the tendency of people to seek out risky behaviours.

In the light of the discussions presented, it is posited that rock climbers taking deliberate risks will differ, to some extent, from rock climbers taking precautionary risks with regard to sensation-seeking behaviour. The risks rock climbers take may be perceived as a way to rebel against societal restrictions while, at the same time, fulfilling the modern cultural need of thrill seeking. According to Langseth and Salvesen (2018), rock climbers stated that, apart from the risks involved with the sport, there are other aspects (for example, spending time with friends) that they love about the sport. These aspects may also influence their sensation-seeking behaviour (Castenier *et al*., 2010; Kupciw & MacGregor, 2012).

**Limitations and recommendations**

This study was explorative in nature and subject to a number of limitations. The first limitation was the sample size. Although growing numbers of people participate in rock climbing every year, the number of climbers in South Africa is still limited. This is evident in the small sample obtained. In addition, most climbers are located in Western Cape Province and owing to logistical constraints could not be included in the study. It is therefore recommended that future studies include rock climbers from Western Cape Province in a larger, more diverse sample. Because of the small sample of this study, the results should be interpreted with caution and within the limits of the study parameters.

A second limitation of the study relates to the lack of research on the reliability and validity of the RTI and the SSS-V in a South African context. It is recommended that more research is conducted on both scales within the South African context, as well as within the context of extreme sport.

A third limitation of the study relates to the type of statistical analyses conducted on the data. Because of the limited sample and a subsequent lack of normal distribution of the data, only non-parametric statistical analyses could be conducted. These forms of analyses do not have as much power as parametric statistical analyses.

The last limitation relates to the restricted data yielded by the sample on the type, as well as number, of injuries that occurred among the participants. Future studies should therefore not only differentiate between the types of injuries, but also allow for more questions to be included in the demographic questionnaire on the topic. As the estimate and overestimate of ability may have an impact on the occurrence of injuries, it is recommended that future research should incorporate these variables.

## CONCLUSION

The two groups into which rock climbers were divided, deliberate and precautionary risk-takers, differed significantly in certain types of sensation-seeking behaviour. The number of years climbing appear to be associated with some form of risk-taking behaviour but played no role in the number of injuries sustained. Rock climbers can thus be viewed as risk-takers and the findings suggest that the level of risk is mediated by their level of sensation -seeking.

## FUNDING

This research received no funding. No grant or funding organisation was thus involved in this research project.

## CONFLICT OF INTERESTS

The authors declare that there is no conflict of interest that may compromise the content presented in this paper.

## REFERENCES

BARLOW, M.D.; WOODMAN, T. & HARDY, L.J. (2013). Great expectations: Different high-risk activities satisfy different motives. *Journal of Personality and Social Psychology*, 105(3): 458475. https://doi.org/10.1037/a0033542

BRYMER, E. & SCHWEITZER, R. (2013). The search for freedom in extreme sports: A phenomenological exploration. *Psychology of Sport and Exercise*, 14(6): 865-873. http://dx.doi.org/10.1016/j.psychsport.2013.07.004

BUJANG, M.A; OMAR, E.D. & BAHARUM, N.A. (2018) A review on sample size determination for Cronbach's Alpha Test: A simple guide for researchers. *The Malaysian Journal of Medical Science*, 25(6): 85-99. https://doi.org/10.21315%2Fmjms2018.25.6.9

CASTENIER, C.; LE SCANFF, C. & WOODMAN, T. (2010). Who takes risks in high-risk sports? A typological personality approach. *Research Quarterly for Exercise and Sport*, 81(4): 478-484. https://doi.org/10.1080/02701367.2010.10599709

COETZEE, N. (2010). Personality profiles of scuba divers. *African Journal for Physical Health Education, Recreation and Dance*, 16(4): 570-581. http://doi:10.4314/ajpherd.v16i4.63416

CHALOUPSKY, D. (2014). The acceptable level of risk-taking for traditional rock climbers. *Journal of Human Sport & Exercise*, 9(1): 263-269. http://doi:10.14198/jhse.2014.9.Proc1.08

CHEN, Y.; BUGGY, C. & KELLY, S. (2019). Winning at all costs: a review of risk-taking behaviour and sporting injury from an occupational safety and health perspective. *Sports Medicine – Open*, 5(15): 1-21. https://doi.org/10.1186/s40798-019-0189-9

COHEN, J. (1988). *Statistical power analysis for the behavioural sciences* (2nd ed.). New York, US: Lawrence Erlbaum Associates, Publishers.

CROUKAMP, M. (2017). The differences between deliberate and precautionary risk-takers based on their associations with sensation-seeking. Published master's thesis. Pretoria, South Africa: University of Pretoria. https://repository.up.ac.za/handle/2263/65625

CRUST, L. & KEEGAN, R. (2010). Mental toughness and attitudes to risk. *Personality and Individual Differences*, 49(3): 164-168. https://psycnet.apa.org/doi/10.1016/j.paid.2010.03.026

DE VRIES, R.E.; DE VRIES, A & FEIJ, J.A. (2009). Sensation seeking, risk-taking, and the HEXACO model of personality. *Personality and Individual Differences,* 47(6): 536-540. https://doi.org/10.1016/j.paid.2009.05.029

DIEHM, R. & ARMATAS, C. (2004). Surfing: An avenue for socially acceptable risk-taking, satisfying needs for sensation seeking and experience seeking. *Personality and Individual Differences*, 36(3): 663-677. https://doi.org/10.1016/S0191-8869(03)00124-7

DRAPER, N.; DICKSON, T.; BLACKWELL, G.; FRYER, S.; PRIESTLEY, S.; WINTER, D. & ELLIS, G. (2011). Self-reported ability assessment in rock climbing. *Journal of Sports Sciences,* 29(8): 851-858. https://doi.org/10.1080/02640414.2011.565362

GOMA-I-FREIXANET, M. (2004). Sensation seeking and participation in physical risk sports. In R.M. Stelmack (Ed.), *On the psychobiology of personality: Essays in honor of Marvin Zuckerman* (pp. 185-201). New York, US: Elsevier Science.

GRØNHAUG, G. (2018). Self-reported chronic injuries in climbing: Who gets injured when? *BMJ Open Sport & Exercise Medicine*, 4: e000406, 1-6. doi: 10.1136/bmjsem-2018-000406

GREY, J.M. & WILSON, M.A. (2007). A detailed analysis of the reliability and validity of the sensation seeking scale in a UK sample. *Personality and Individual Differences*, 42(2): 641-651. https://doi.org/10.1016/j.paid.2006.08.019

HEALTH FITNESS REVOLUTION (2015). "Top 10 health benefits of rock climbing". *Fitness Revolution*. Hyperlink: [https://www.healthfitnessrevolution.com/top-10-health-benefits-rock-climbing/]. Retrieved on 11 November 2022

JONES, G.; MILLIGAN, J.; LLEWELLYN, D.; GLEDHILL, A. & JOHNSON, M.I. (2017). Motivational orientation and risk-taking in elite winter climbers: A qualitative study. *International Journal of Sport and Exercise Psychology*, 15(1): 25-40. http://dx.doi.org/10.1080/1612197X.2015.1069876

KERR, J.H. & MACKENZIE, S.H. (2012). Multiple motives for participating in adventure sports. *Psychology of Sports and Exercise*, 13(5): 649-657. http://dx.doi.org/10.1016/j.psychsport.2012.04.002

KLINAR, P.; BURNIK, S. & KAJTNA, T. (2017). Personality and sensation-seeking in high-risk sports. *Acta Gymnica*, 47(1): 41-48. https://gymnica.upol.cz/artkey/gym-201701-0006_Personality_and_sensation_seeking_in_high-risk_sports.php

KONTOS, A.P. (2004). Perceived risk, risk taking, estimation of ability and injury among adolescent sport participants. *Journal of Pediatric Psychology*, 29(6): 447-455. https://doi.org/10.1093/jpepsy/jsh048

KUPCIW, D. & MACGREGOR, A. (2012). High risk sport research. *The Sport and Exercise Scientist,* 31: 28-29. https://psychologsportu.files.wordpress.com/2012/04/28-291.pdf

LANGSETH, T. & SALVESEN, Ø. (2018). Rock climbing, risk, and recognition. *Frontiers in Psychology*, 9(1793): 1-10. https://doi.org/10.3389/fpsyg.2018.01793

LLEWELLYN, D.J. & SANCHEZ, X. (2013). Individual differences and risk-taking in rock climbing. *Psychology of Sport and Exercise,* 9(4): 413-426. http://hdl.handle.net/10034/220235

LOGAN, A.J.; MAKWANA, N.; MASON, G. & DIAS, J. (2004). Acute hand and wrist injuries in experienced rock climbers. *British Journal of Sports Medicine,* 38(5): 545-548. doi:10.1136/bjsm.2003.003558

MAX, W. (2016). *Rock climbing guide.* North Carolina, US: Lulu Press.

PALLANT, J. (2010). *SPSS survival manual. A step by step guide to data analysis using SPSS* (4th ed.). New York, US: McGraw Hill.

PIEDMONT, R.L. (2014). Inter-item correlations. In A.C. Michalos (Ed.), *Encyclopaedia of quality of life and well-being research* (pp. 3303-3304). Netherlands: Springer.

RAHARJANTI, N.W.; WIGUNA, T.; PURWADIANTO, A.; SOEMANTRI, D.; INDRIATMI, W.; POERWANDARI, E.K.; MAHAJUDIN, M.S.; NUGRAHADI, N.R.; ROEKMAN, A.E.; SAROSO, O.J.D.A.; RAMADIANTO, A.S. & LEVANIA, M.K. (2022). Translation, validity and reliability of decision style scale in forensic psychiatric setting in Indonesia. *Heliyon*, 8(7): e09810 https://doi.org/10.1016/j.heliyon.2022.e09810

RINELLA, S.; BUSCEMI, A.; MASSIMINO, S.; PERCIAVALLE, V.; TORTORICI, M.M.; TOMASELLI, D.G.; PERCIAVALLE, V.; DI CORRADO, D. & COCO, M. (2019). Risk-taking behavior, the second-to-fourth digit ratio and psychological features in a sample of cavers. *PeerJ*, 7: e8029. https://doi.org/10.7717/peerj.8029

ROSENBLOOM, T. (2003). Sensation seeking and risk taking in mortality salience. *Personality and Individual Differences*, 35(8): 1809-1819. https://doi.org/10.1016/S0191-8869(03)00031-X

SALETTI, S.R.; CHANG, D.O.; PEREZ-ARANIBAR, C.C. & CAMPOS, F.O. (2017). Psychometric properties of the Brief Sensation-seeking Scale in Peruvian teenagers. *Psicothema*, 29(1): 133-138. https://pubmed.ncbi.nlm.nih.gov/28126071/

SALKIND, N.J. (2010). *Encyclopaedia of research design*. Thousand Oaks, CA: Sage Publications.

SAUL, D.; STEINMETZ, G.; LEHMANN, W. & SCHILLING, A.F. (2019). Determinants for success in climbing: A systematic review. *Journal of Exercise Science & Fitness*, 17: 91-100. https://pubmed.ncbi.nlm.nih.gov/31193395/

SCHÜLER, J. & NAKAMURA, J. (2013). Does flow experience lead to risk? How and for whom. *Applied Psychology: Health and Well-Being*, 5(3): 311-331. https://dx.doi.org/10.1111/aphw.12012

THE OUTDOOR FOUNDATION. (2011). "Outdoor recreation participation report 2011". *Outdoor Industry*. Hyperlink: [https://outdoorindustry.org/resource/outdoor-recreation-participation-report-2011/]. Retrieved on 11 November 2022.

THE RIVER ROCK. (2016). *The River Rock Summit Challenge 2016.* Hyperlink: [http://riverrockclimbing.com/wp-content/uploads/2015/12/River-Rock-Challenge-2016.pdf]. 11 November 2022

TURNER, C.; MCCLURE, R. & PIROZZO, S. (2004). Injury and risk-taking behavior- A systematic review. *Accident Analysis and Prevention*, 36(1): 93-101. https://doi.org/10.1016/s0001-4575(02)00131-8

VALENZUELA, P.L.; DE LA VILLA, P. & FERRAGUT, C. (2015). Effect of two types of active recovery on fatigue and climbing performance. *Journal of Sport Science and Medicine*, 14: 769-775. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4657419/

WEGNER, L.; PAGEL, J.E.; SMIT, A.W.; STRASZACKER, A.; SWART, S.L. & TAFT, J. (2015). Common neuromusculoskeletal injuries amongst rock climbers in the Western Cape. *South African Journal of Physiotherapy*, 71(1): 227-249. https://sajp.co.za/index.php/sajp/article/view/227/264

WOODMAN, T.; HARDY, L. & BARLOW, M. (2020). High-risk sports. In G. Tenenbaum & R.C. Eklund (Eds.), *Handbook of sport psychology* (pp. 177-189). Wiley Online Books.

WOODMAN, T.; BARLOW, M.; BANDURA, C.; HILL, M.; KUPCIW, D. & MACGREGOR, A. (2013). Not all risks are equal: the Risk-Taking Inventory for high-risk sports. *Journal of Sport and Exercise Psychology*, 35(5): 479-492. http://dx.doi.org/10.1123/jsep.35.5.479

YOUNG, P.R. (2012). The effect of attentional interference on a rock climbing task: A pilot study. *Pamukkale Journal of Sport Sciences*, 3(1): 10-19. https://dergipark.org.tr/tr/download/article-file/191763

ZUCKERMAN, M. (1983). Sensation-seeking and sports. *Personality and Individual Differences*, 4(3): 285-293. https://doi.org/10.1016/0191-8869(93)90319-X

ZUCKERMAN, M. (2009). Sensation-seeking. In I.B. Weiner & W.E. Craighead (Eds.), *The Corsini encyclopaedia of psychology* (pp. 1-4). New Jersey, US: John Wiley & Sons.

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