

Addiction in Extreme Sports: An Exploration of Withdrawal States in Rock Climbers

ROBERT M. HEIRENE^{1*}, DAVID SHEARER¹, GARETH RODERIQUE-DAVIES¹ and STEPHEN D. MELLALIEU²

¹School of Psychology and Therapeutic Studies, University of South Wales, Pontypridd, United Kingdom

²Cardiff School of Sport, Cardiff Metropolitan University, Cardiff, United Kingdom

(Received: September 16, 2015; accepted: April 28, 2016)

Background and aims: Extreme sports athletes are often labeled “adrenaline junkies” by the media, implying they are addicted to their sport. Research suggests during abstinence these athletes may experience withdrawal states characteristic of individuals with an addiction (Celsi, Rose, & Leigh, 1993; Franken, Zijlstra, & Muris, 2006; Willig, 2008). Despite this notion, no research has directly explored withdrawal experiences of extreme sports athletes. *Methods:* Using semi-structured interviews, we explored withdrawal experiences of high ($n=4$) and average-ability ($n=4$) male rock climbers during periods of abstinence. We investigated the psychological and behavioral aspects of withdrawal, including craving, anhedonia, and negative affect; and differences in the frequency and intensity of these states between groups. *Results:* Deductive content analysis indicated support for each of the three categories of anhedonia, craving, and negative affect. Consistent with existing substance addiction literature, high-ability climbers recalled more frequent and intense craving states and negative affect during abstinence compared with average-ability climbers. No differences in anhedonic symptoms between high and average-ability participants were found. *Conclusions:* Rock climbing athletes appear to experience withdrawal symptoms when abstinent from their sport comparable to individuals with substance and behavioral addictions. The implications of these findings and suggestions for future research are discussed.

Keywords: extreme sports, anhedonia, negative affect, craving, behavioral-addiction

INTRODUCTION

Despite risk of severe physical injury or death, participation in extreme sports such as skydiving, downhill skiing, and rock climbing continues to grow (Brymer & Schweitzer, 2013; Pain & Pain, 2005). Participating athletes are often referred to as “adrenaline junkies” by the popular media (Salassa & Zapala, 2009; Storry, 2003), suggesting they are addicted to their sport. To date, however, no research has explored how psychological principles of addiction observed in other domains (e.g., substance use) might explain engagement in high-risk sports.

It has been argued any behavior with the ability to engender immediate reward can become the focus of an addiction (Fattore, Melis, Fadda, Pistis, & Fratta, 2010; Griffiths, 1996). Indeed, the term addiction, although formerly exclusively associated with pharmacological substances, is now used to explain compulsive or excessive engagement in behaviors such as gambling, shopping, exercising, internet gaming, and sexual behavior (Grant, Potenza, Weinstein, & Gorelick, 2010; Leeman & Potenza, 2013; Olsen, 2011; Weinstein, Feder, Rosenberg, & Dannon, 2014). Goodman (2008) has suggested that all addictions, behavioral and pharmacological, are underpinned by a universal addictive process manifesting in one or more behavioral pattern.

The extent that “non-drug” or “behavioral” addictions (Grant et al., 2010) resemble substance addictions is debatable (Potenza, 2006), though there are several parallels between them. Those with non-drug addictions share similar

personality traits with drug users, including sensation seeking and impulsivity (Di Nicola et al., 2015; Robbins & Clark, 2015). Similarities also exist in psychological and behavioral manifestations of drug and non-drug addictions. Both include cravings, high rates of relapse, increased tolerance, and withdrawal states (Aidman & Woollard, 2003; Potenza, 2006). Finally, functional neuroimaging studies indicate brain regions known to respond to drug use are also activated by gambling (van Holst, de Ruiter, van den Brink, Veltman, & Goudriaan, 2012), appetizing food (Wang et al., 2004), internet gaming (Hoeft, Watson, Kesler, Bettinger, & Reiss, 2008), and shopping (Knutson, Rick, Wimmer, Prelec, & Loewenstein, 2007), suggesting an overlap with addiction circuitry.

Parallels have also been identified between extreme sports participants and those with substance addictions. For example, both groups report high levels of the sensation seeking personality trait (Franques et al., 2003; Goma-i-Freixanet, Martha, & Muro, 2012). Elevated levels of impulsivity, often observed in those with drug and non-drug addictions (Di Nicola et al., 2015), have also been identified in extreme sports athletes. Myrseth, Tverå, Hagtun, and Lindgren (2012) compared the impulsivity levels of pathological gamblers, skydivers, and controls, finding both

* Corresponding author: Robert M. Heirene; School of Psychology, Early Years and Therapeutic Studies, University of South Wales, Pontypridd, Wales CF37 1DL, United Kingdom; Phone: +44 01443 482690; E-mail: rob.heirene@southwales.ac.uk

pathological gamblers and skydivers scored higher than controls, with no significant difference between these groups.

Similarities in the phenomenology of extreme sports participation and substance-related addiction are also apparent. Extreme sports athletes commonly describe a “rush” or “high” when participating in their sport (Buckley, 2012; Price & Bundesen, 2005) and liken these experiences to those of drug users (Willig, 2008). For example, a participant in Willig’s study described: “It’s like for a drug user, they will take cocaine to get high. For me it’s my addiction, I have to go to the mountains to get high.” Similarly, skydivers have described their sport as “like an addiction,” stating that they “can’t get enough,” and their “relationships suffer” as a result (Celsi, Rose, & Leigh, 1993).

Traditional definitions of addiction, where the emphasis lies on continued participation in the behavior despite serious negative consequences, can be successfully applied to extreme sports athletes (Pain & Kerr, 2008; Price & Bundesen, 2005). Indeed, an extreme sports athlete in Pain and Kerr’s case study continued to participate despite receiving numerous physical injuries from sky-diving and go-karting. More recently, multidimensional definitions of addiction have been applied to extreme sports athletes (Price & Bundesen, 2005). Using a 24-item addiction questionnaire with dimensions including pre-occupation, self-medication and the occurrence of physical injuries, Price and Bundesen found addiction strongly and positively related to skydivers’ experiences of their sport. Addiction to skydiving was low in novice participants, moderate in intermediate participants, and high in experienced participants, implying addiction increased with experience and exposure to their sport. This is consistent with studies that suggest the severity of both drug and non-drug addictions are positively correlated with their duration (e.g., Barrault & Varescon, 2013; Hopley, Dempsy, & Nicki, 2012), supporting the concept of addiction applied to extreme sports.

Evidence also exists which suggests extreme sports athletes experience symptoms of withdrawal while not participating in their sport (Celsi et al., 1993; Franken, Zijlstra, & Muris, 2006; Willig, 2008). In medicine, “withdrawal” refers to the cluster of physical or psychological sequelae induced when a drug no longer remains in the body (Craft & Lustyk, 2013). However, withdrawal states such as craving and anhedonia are also observed in behavioral addictions, despite the absence of exogenous psychoactive substances (e.g., Trotzke, Starcke, Pedersen, & Brand, 2014). Consequently, we refer to withdrawal as the negative psychological and behavioral manifestations of abstinence from any stimuli.

In substance addictions, periods of abstinence have been associated with states of anhedonia (Sekine et al., 2003; Zijlstra, Booij, van den Brink, & Franken, 2008), a negative mood state characterized by diminished interest/pleasure in response to previously rewarding stimuli (Giannantonia & Martinotti, 2012). Franken et al. (2006) suggested that extreme sports athletes also experience anhedonia during periods of abstinence from their sport. Comparing the prevalence of anhedonic symptoms between skydivers and controls who participated in low risk sports (e.g., rowing), Franken and colleagues found skydivers experienced more anhedonic symptoms than low-risk sportsmen. These findings

suggest that frequent exposure to extreme sports that produce a “natural high,” such as sky diving, can result in anhedonia during periods of abstinence (Franken et al., 2006). Celsi et al. (1993) also noted their participants “lose interest in other activities and things” as a result of skydiving.

As in drug and non-drug addictions (Grant et al., 2010), extreme sports athletes also display strong urges or cravings for participation in their sport (Celsi et al., 1993; Willig, 2008). In the psychopharmacology literature, craving is defined as a subjective motivational state characterized by an intense desire for the effects of a drug (Kozlowski & Wilkinson, 1987; Marlatt, 1987). Drug craving is believed to underlie the maintenance of addiction and be moderated by factors such as cue-exposure (e.g., Zhao et al., 2012) and abstinence (Roderique-Davies, 2008). Research has not explored the existence of craving in an extreme sport setting, though athletes often report urges which resemble craving. For example, skydiver participants in Celsi et al. (1993) research stated “I love it, man. I just can’t get enough of it,” “it calls you back every time,” and “I suffer withdrawal when I haven’t jumped for a while.” The concept of craving applied to extreme sports may explain the addictive like behavior displayed by athletes. However, more direct research is needed to explore the role of craving in extreme sports athletes before this can be confirmed.

In addition to anhedonia and craving, extreme sports athletes also experience negative affective states during periods of abstinence (Celsi et al., 1993; Willig, 2008). Athletes have described the need for extreme sport participation as fundamental, and reported experiencing negative affective states such as being “stressed,” “unhappy,” and “itchy” when not participating (Willig, 2008). Such states resemble dysphoria observed in abstinent drug users (Newton, Kalechstein, Tervo, & Ling, 2003), suggesting similar emotional withdrawal experiences may be shared.

Based on the evidence discussed, extreme sports athletes, like those individuals with behavioral addictions (e.g., Grant et al., 2010), experience comparable withdrawal states to those observed in substance users. Though, like gambling, shopping, or exercise, extreme sports participation lacks the exogenous psychopharmacological agent often assumed to be responsible for withdrawal experiences in drug users. However, psychological factors, such as hedonistic motives, are also known to play a significant role in the development and maintenance of withdrawal experiences in substance misusers (Robinson & Berridge, 2000), offering an explanation for the presence of such states in behavioral addictions. Currently, research on addiction with an extreme sports setting is scant, with none directly exploring the withdrawal experiences of extreme sports athletes. Additionally, extant research has focused on skydiving participants, excluding other extreme sport populations (e.g., Franken et al., 2006; Price & Bundesen, 2005). Consequently, this study aimed to explore the existence of withdrawal states typically associated with addiction (i.e., anhedonia, craving, and negative affect) in a sample of rock climbers in order to investigate whether these concepts can assist in explaining the comparable psychological experiences of extreme sports athletes.

Semi-structured interviews were employed to explore participants’ experiences of withdrawal when absent from

climbing. Deductive content analysis was selected as a systematic method of data analysis (Schreier, 2014) to explore existing concepts of withdrawal, with participants dichotomized into average and high-ability groups. As previous research on substance and behavioral addictions has suggested addiction severity increases with exposure to the stimuli (e.g., Barrault & Varescon, 2013), high-ability climbers were expected to report more frequent and intense withdrawal experiences than their average-ability counterparts.

METHODS

Methodology and epistemological assumptions

The methodology used was underpinned by a post-positivist viewpoint. This approach accepts objective knowledge can be gained from observation, though is imperfect and fallible (Willis, 2007). Post-positivism assumes a modified objectivist epistemology which largely abandons dualism accepted by positivist research. Instead data objectivity is judged on external criteria, such as the degree that it “fits” pre-existing knowledge of the subject (Guba & Lincoln, 1994). Thus, post-positivist research often assumes a deductive approach that supports existing theories or extends their applications to different environments. In the present study, the aim was to investigate whether concepts of withdrawal from the substance misuse field can explain the psychological experiences of extreme sports athletes. We sought to examine participants’ experiences against pre-defined criteria (i.e., withdrawal states) based on evidence suggesting multiple similarities between the subjective experiences of extreme sports athletes and drug users.

Participants

Participants were high [$n = 4$, mean age: 24.75 ($SD = 3.3$)] and average-ability [$n = 4$, mean age: 23.75 ($SD = 6.2$)] male rock climbers, dichotomized into ability categories using the French (Fr.) grading system employed in the UK and Europe (for information see: <http://www.adventurehunter.co.uk/uk-traditional-sport-climbing-grades-explained/>). High-ability climbers were classed as those with the self-reported ability to climb at 7c and above, and average-ability climbers as those within the 6a – 7b+ range. Differences in climbing experience between sub-groups are displayed in Table 1.

Participants were recruited via emails to local climbers. Selection criteria outlined in recruitment emails included the length (a minimum of 2 years) and frequency (at least one day per week) of climbing participation. In total, 15 responses were received to recruitment emails. Of these responses, purposive sampling was used to select eight participants who provided information rich cases from a varied (e.g., ability level/experience) sample of rock climbers (Elo et al., 2014).

Data collection

In the absence of specific quantitative measures and previous research in this area interviews were selected as the means of data collection. Interviews offered an effective method of obtaining accounts of participants’ psychological and behavioral experiences while not participating in their sport (Rubin & Rubin, 2012). Specifically, semi-structured interviews were employed as a flexible approach to data collection, allowing researchers to explore pre-set topic areas while pursuing other emerging topics in more depth (Diefenbach, 2009).

Semi-structured interviews. Interviews were conducted by the first and second author. Interviews took place in designated interview rooms at the first author’s university institution and lasted between 40 and 72 min. Interviews were recorded in their entirety and transcribed verbatim for subsequent analysis.

Interviews were conducted using an interview guide based on an extensive review of the relevant research (e.g., Buckley, 2012; Franken et al., 2006; Giannantonia & Martinotti, 2012; Price & Bundesen, 2005). Questions were also informed by the definition of each withdrawal state under study. Anhedonia, for example, can be defined as a diminished interest or pleasure in response to previously rewarding stimuli (Giannantonia & Martinotti, 2012); thus questions exploring anhedonic experiences in participants focused on: (1) the influence of climbing on enjoyment of other activities, and (2) their ability to enjoy other activities when abstinent from climbing; for example: How enjoyable do you find other activities during periods when you are not able to rock climb? Relevant findings from the drug and non-drug addictions literature also informed question development. For example, research suggests craving is moderated by factors such as abstinence and cue-exposure (Roderique-Davies, 2008). Accordingly, questions were developed to explore participant’s emotions when abstinent

Table 1. Participant information

Level	Participant	Age	Climbing duration (years)	Climbing frequency (days/week)	Main climbing disciplines	Maximum climbing grade
High-ability	1	23	9	3	Traditional bouldering	Fr.7c
	2	21	7	5	Sport bouldering	Fr.8b
	3	27	8	3	Bouldering	Fr.8a
	4	28	10	3	Bouldering traditional	Fr.8a
Average-ability	5	20	3.5	1	Indoor sport bouldering	Fr.6a
	6	20	3	2	Sport	Fr.7a+
	7	22	3.5	1	Traditional bouldering	Fr.6b
	8	33	8	3	Traditional indoors	Fr.7a

(e.g., How do you feel when you are not able to rock climb due to injury or other reason?) and their response to climbing-related cues. To avoid leading participants, all questions were worded without the use of withdrawal terminology (e.g., craving and anhedonia).

Interviews began with questions relating to participants' demographic information and rock climbing behavior (e.g., How many times per week do you participate in climbing?). In order to establish differences between groups, participants were asked to comment on the frequency of each withdrawal experience they cited (e.g., How often do you experience that?). To supplement the interview guide, pre-planned probes were used to deepen understanding and clarify participant responses (e.g., Tell me more about that experience; Wilson, 2014). Prior to data collection, two pilot interviews were conducted by the first and second author with average-ability climbers to assess the effectiveness of the interview guide and provide an opportunity to establish familiarity with the questions (Elo et al., 2014). Based on feedback from these participants and an assessment of the validity of the schedule by the researchers, the interview guide was deemed satisfactory for use in the study and no changes were made.

Data analysis

Deductive content analysis was selected as a systematic method of analyzing interview transcripts (Elo et al., 2014) in line with the post-positivism viewpoint. Each interview transcript was analyzed by the first and second author. In order to ensure clarity and transparency in the data analysis process, Zhang and Wildemuth's (2009) eight-step guide for content analysis was used to base each stage of analysis upon.

Stage 1 of analysis, the data preparation phase, consisted of the data familiarization and transcription process. In the second stage of analysis, themes were selected as the units of coding, which were defined as any word, sentence, or paragraph representing a single expression, meaning or idea (Mayring, 2000). In the context of this study, themes represented information pertaining to particular withdrawal experiences.

The third stage of analysis focused on the development of categories and a coding scheme. A deductive, or "directive" (Hsieh & Shannon, 2005), approach to develop categories and coding data was selected as the study aimed to explore concepts of withdrawal well-established in the psychopharmacology literature (Grant et al., 2010; Lynch, Peterson, Sanchez, Abel, & Smith, 2013). In line with the post-positivist epistemology, the directive approach uses knowledge from existing research and theory to develop initial

categories and coding rules (Hsieh & Shannon, 2005). Thus, an initial matrix was formulated prior to data collection containing three core categories: anhedonia, craving, and negative affect. The process of coding themes to these pre-determined categories was supported by the development of a coding manual containing category names, an operational definition of each withdrawal state, text examples, and rules for assigning codes (Table 2). A systematic approach was taken to test the coding manual (Elo et al., 2014; Schilling, 2006) using a sample of text from one of the pilot interview transcripts (Stage 4). Using the coding manual, both the first and second author analyzed the text sample independently, subsequently reconvening to discuss any issues and inconsistencies in the coding and thus ensure inter-coder agreement (Schreier, 2012).

The first step of coding data consisted of highlighting all themes that appeared to represent withdrawal experiences. Next, the coding manual was used to assign relevant highlighted themes to the pre-determined categories (Stage 5) with the aim of achieving category saturation. We defined category saturation as the point at which no new information pertaining to the category was identified. If themes could not be assigned to one of the three existing categories, an inductive approach was taken where new categories were created and reviewed at each instance of analysis. Additional categories were removed if little supporting evidence was found across more than one participant. Throughout the coding process, each researcher continually reviewed their own and their colleagues' coding for consistency between transcriptions and between researchers (Stage 6).

Following the initial assignment of themes to categories, Stage 7 of analysis involved researchers engaging in data reduction that focused on identifying common themes within each category and removing nonessential themes to produce sub-categories. Nonessential themes were defined as those that demonstrated poor intra- and inter-participant reliability. Criteria for sub-category development included sufficient supporting data in the form of multiple themes. Each sub-category was continuously reviewed at each instance of analysis and between researchers to ensure coding consistency and recognize the point of saturation. Although every effort was made to ensure categories and sub-categories were as internally homogeneous and externally heterogeneous as possible, some overlap was expected based on similarities in the constructs of anhedonia and negative affect (Crawford & Henry, 2004). Consequently, it was accepted that units of data might be assigned to more than one category simultaneously. The final stage of analysis, Stage 8, involved the detailed reporting methods used and the processes undertaken to consider the trustworthiness of findings.

Table 2. Coding manual extract

Category	Definition	Examples	Coding rules
Anhedonia	A diminished interest or pleasure in rewarding activities.	<i>"climbing is so enjoyable it's hard to find anything else that is"</i> <i>"I compare everything I do to climbing, and nothing compares"</i>	Any theme assigned to this category must correspond to the definition of anhedonia provided. Passages must reflect anhedonic experiences related to climbing abstinence.

Methodological rigor

A number of steps were undertaken to pursue methodological rigor based on guidance for improving trustworthiness in qualitative content analysis (Elo et al., 2014) and in post-positivist research (Morrow, 2005). First, detailed participant information and selection criteria have been presented to enhance the transferability of findings (Elo et al., 2014). In order to further improve transferability, emphasis was placed on the detailed reporting of the research procedures and data analysis process.

Researchers enhanced the credibility of the data collection method used by each carrying out pilot interviews with the view of assessing the efficacy of the interview schedule for obtaining relevant information. The pilot interviews served as a form of self-evaluation for researchers who reflected upon their performance, looking to identify areas where they may have been unclear or led the participant. This process of self-evaluation was continued throughout the data collection phase. Based on guidance provided by Elo et al. (2014), further improvement in the credibility of the methods was achieved using a circular approach to participant sampling and data analysis whereby data analysis commenced following the completion of four interviews, as opposed to collect all data then carrying out analysis. This allowed researchers to recognize the point of category saturation and accordingly cease participant recruitment, thus ensuring an appropriate sample size.

To enhance the conformability of findings, two researchers were involved in the coding process (Elo et al., 2014). This allowed for “double coding” (Schreier, 2012), the process whereby two researchers’ code data using the same coding manual, subsequently reconvening to assess consistency, remove any ambiguity in coding instructions and ensure no sub-categories overlapped. Regular meetings to assess inter-coder reliability also allowed researchers to identify and remove any biases that may have influenced their coding. To further improve the conformability of findings, particular care was taken when writing and presenting findings. Multiple quotations were used to support categories and the development of sub-categories, demonstrating the connection between interpretation and text (Malterud, 2001).

Ethics

Ethical approval was obtained from the school ethics committee of the first author’s university institution. All participants were informed of the purpose of the study and their

role as a participant. Informed consent was obtained prior to interviews.

RESULTS

Systematic content analysis of interview transcripts resulted in the saturation of the core categories of anhedonia, craving, and negative affect, and the development of several sub-categories depicting participants’ experiences, or lack thereof, of each withdrawal state (Table 3). In total seven sub-categories were developed, with only six of these pertaining to high-ability climbers and all seven pertaining to average ability climbers. The following section provides a description of each sub-category with example quotes from participants to support the narrative. Due to the large volume of data, a summary of description within each sub-category is offered.

Anhedonia

Raw data themes suggested climbers of both ability levels experienced anhedonia. Average and high-ability participants reported experiences resembling symptoms of anhedonia during periods of abstinence from their sport, with no difference in frequency of experience between groups. Experiences were subsequently grouped into themes labeled “nothing compared to climbing” and “climbing heightens enjoyment threshold.”

Nothing compares to climbing. All participants felt climbing was the most enjoyable activity that they participated in and perceived other activities as unexciting by comparison. For instance, one high-ability participant indicated, “I compare everything I do to climbing, and nothing compares,” while an average-ability participant stated, “Other things don’t excite me as much.” When asked how he felt when abstinent from climbing, one average ability participant noted, “nothing feels positive.” All participants reported engaging in few other recreational activities when not climbing and that they specifically avoided other activities that they viewed may hinder their climbing performance (e.g., weight lifting).

Climbing heightens enjoyment threshold. Several participants reported that since starting climbing they felt their enjoyment threshold had increased, resulting in the need for more stimulating activities to achieve enjoyment. For example, an average-ability participant stated that he had become “desensitized” to other activities as a result of climbing, while a high-ability participant reported,

Table 3. Summary of categories and sub-categories

Category	Sub-categories: Average-ability climbers	Sub-categories: High-ability climbers
Anhedonia	Nothing compares to climbing (4) Climbing heightens enjoyment threshold (3)	Nothing compares to climbing (4) Climbing heightens enjoyment threshold (3)
Craving	Cravings/urges (4) Impact of cue-usage (3)	Cravings/urges (4) Impact of cue-usage (4)
Negative affect	Negative affect during abstinence (4) Alleviation of negative affect (4) Ability to cope without climbing (2)	Negative affect during abstinence (4) Alleviation of negative affect (4)

“it changes your expectations of enjoyment.” Many climbers also stated that their fear threshold had increased and more safe disciplines of climbing (i.e., indoor climbing) gave them little excitement compared to the outdoor climbing they had become accustomed to.

Craving

A high level of motivation to participate in climbing was shared by all participants. Climbers reported regularly experiencing intense urges or drives to climb, supporting the notion of craving. Responses regarding craving resulted in the development of two themes, one focusing on the specific drives experienced and a second on the influence of climbing-related cues upon these drives.

Cravings/urges. All participants reported a strong, overarching need to participate in climbing. Missing climbing sessions or going for several days without climbing was suggested to be difficult and resulted in greater urges or craving: “You end up climbing anything you can get your fingers on.” Further, climbing was cited as the primary focus of many participants’ lives. That is, climbers structured their daily and weekly routines around their training schedules and weather conditions for outdoor climbing, with all other activities coming second. Indeed, participants reported urges to climb so strong that they frequently overpowered other responsibilities. For example, one high-ability participant stated:

I could only think of one other climber who would want to climb as much, or would basically not let other things get in the way of climbing, not have excuses to not go climbing. He’d do everything to go climbing, which is how I feel.

While several statements by average-ability climbers fit the craving category, high-ability climbers related directly to the concepts of cravings/urges for their sport. For example, a high-ability participant stated, “I just feel like I need to go (climbing).” One high-ability participant even likened their craving to that of a cigarette smoker: “Definitely experience a craving to get out ... sometimes it’s just lovely to have that release. I would consider it very similar to having a cigarette in the morning or something like that, you know.” Overall, high-ability climbers reported more statements pertaining to this theme.

Effects of cue exposure. All participants reported accessing climbing related materials/cues when not climbing, such as videos, magazines, or websites. However, the frequency of use and impact of climbing related cues varied between groups. High-ability climbers reported accessing climbing related material to stimulate and motivate them to climb “everyday” or “most days.” When asked how climbing related cues affected them, they responded with statements including, “I get psyched,” “I just find it really motivating, I get really inspired,” and “the adrenaline comes in.” Jealousy was cited as a common result of seeing others climb while they could not, and one high-ability participant even stated, “it would annoy me.”

In contrast, average-ability climbers reported accessing climbing materials irregularly or “when bored.” Two average-ability climbers stated that viewing cues such as climbing movies would motivate them: “You watch a film and want to go out climbing.” However, the remaining two

average-ability climbers remarked how climbing materials only served to provide information on climbing locations and routes. These participants indicated climbing cues had little impact on them: “I’d be pretty laid back.”

Negative affect

Substantial evidence existed to support the notion that participants experienced negative affect during times of abstinence, with responses grouped into the three themes focusing on negative affective experiences during times of abstinence, the alleviation of negative affect as a result of climbing, and the ability to cope without climbing.

Negative affect during abstinence. For all participants, periods of climbing abstinence were associated with negative mood states, including feelings of “restlessness” and being “miserable,” “agitated,” or “frustrated.” When questioned about how climbing abstinence makes them feel, one average-ability climber stated “I feel wrong not going for so long” and that as the time they spent not climbing increased “the more of an evil, angry person I become.” Overall, negative affective states were the most prevalent and distressing during periods of forced abstinence. Times of injury, in particular, were reported as a stressful time for many climbers. Other climbers reported frequently experiencing frustration with non-permitting weather conditions or when work commitments prevented them from climbing.

Average-ability climbers reported experiencing such states “after a few days off (climbing)” or “when I’m injured sometimes.” In contrast high ability climbers reported frequently experiencing such states when having “rest days,” suggesting they more frequently experienced negative affect during abstinence. One high-ability climber even likened their state to that of a drug user: “The general feeling when you’re held off it (climbing) would be exactly the same as drug takers, frustrated, driven to get it whatever it is and elation when you actually manage it.”

Alleviation of negative affect. All participants reported using climbing to alleviate negative emotional states. Participants specifically related climbing to the alleviation of stress, stating climbing acts as a “good stress reliever,” “When I’m stressed at work its (climbing) total escapism,” and “If you’re in a bad mood, particularly if you’re stressed about something and you go climbing it can relieve it.” Other climbers made general statements about how climbing relieved negative affect. For example, one average-ability climber reported, “Climbing helps me to get away from negative things.”

When discussing the impact of climbing on their mood states participants also referred to the positive emotional experiences associated with climbing. Participants reported feeling “invincible,” “excited,” “focused,” and “driven,” and stated that a good day climbing would positively impacted their overall mood: “it is a great feeling.” One average-ability climber described this experience as: “The relief of reaching the top of something hard is close to elation.”

Ability to cope without climbing. Despite recognizing that climbing abstinence sometimes negatively impacted their mood state, two average-ability climbers made statements suggesting that they were able to cope adequately

while not climbing. For example, when discussing climbing abstinence one of the participants stated “*I’m not tearing my hair out*” and another “*You really want to get out climbing, but it’s not to the point where you really, really can’t bear to not do it anymore.*” In contrast, high-ability climbers only discussed the negative consequences of climbing abstinence on their mood state.

DISCUSSION

Deductive content analysis of transcripts from semi-structured interviews found substantial evidence to support each of the three core categories of anhedonia, craving, and negative affect. As expected, high-ability participants reported more frequent and intense craving and negative affective experiences compared with average-ability climbers. In contrast, there was little variation between the way high and average-ability participants described their experiences of anhedonia. Findings support the notion that rock climbers experience withdrawal symptoms when abstinent from their sport typical of drug and non-drug addictions.

Within the category of anhedonia two themes emerged, labeled “nothing compares to climbing” and “climbing heightens enjoyment threshold.” All participants reported gaining less enjoyment from other activities since beginning climbing, congruent with the definition of anhedonia as a diminished interest or pleasure in response to previously rewarding stimuli (Giannantonia & Martinotti, 2012). Climbers indicated that this phenomenon was due to climbing heightening their threshold for enjoyment, making other activities seem mundane by comparison. These findings support previous research from Franken et al. (2006) and Celsi et al. (1993) that identified symptoms of anhedonia in skydivers. As suggested by Franken et al., frequent exposure to the natural high caused by extreme sports may result in the experience of anhedonia when unavailable to the individual. Franken et al. proposed that this is because anhedonia may be part caused by the psychological mechanisms underlying the negative mood state, and not solely resultant from the effects of psychopharmacological substances. No difference was identified between groups in relation to the frequency and intensity of anhedonic experiences, inconsistent with previous literature that has found addiction severity increases with exposure to the relevant stimuli (e.g., Barrault & Varescon, 2013). However, all participants involved in the study had engaged regularly in climbing for a minimum of 2 years, implying this period was sufficient to engender anhedonic symptoms in participants when not partaking in their sport.

Craving as a category was subdivided into two themes labeled “cravings/urges” and “effects of cue-usage.” All participants indicated a strong need to participate in their sport, which often overcame other responsibilities. High-ability participants directly related to the concept of craving to a greater extent than their average-ability counterparts, suggesting this group experienced more intense cravings or urges. For example, high-ability participants reported they felt a “need” to go climbing and likened their cravings to those of smokers. This difference between ability levels is consistent with previous research exploring addiction in

substance users (Barrault & Varescon, 2013) and extreme sports athletes (Price & Bundesen, 2005) and suggests addiction severity increases with exposure to the stimuli.

Also congruent with previous craving research across other domains, participants described how their cravings were augmented in the face of climbing-related cues such as climbing videos or watching others climb (Zhao et al., 2012). High-ability participants not only reported accessing climbing-related cues more frequently than average-ability participants, but also implied they experienced more intense cravings as a result of such stimuli. Again, this implies withdrawal experiences were greater in high-ability climbers, and is consistent with previous addiction research regarding the relationship between addiction severity and duration (Barrault & Varescon, 2013; Price & Bundesen, 2005).

All participants reported negative affective experiences during abstinence, including states of “restlessness” and being “miserable,” “agitated,” or “frustrated.” Similar dysphoric states have been identified in drug users, exercise addicts, and extreme sports athletes during abstinence (e.g., Aidman & Woollard, 2003; Newton et al., 2003; Willig, 2008). In the present study, both groups reported using climbing to alleviate negative affective states, particularly stress. This finding supports previous research that has reported skydivers use their sport in a self-medicating manner (Price & Bundesen, 2005). Similarly, psychopharmacology literature has found individuals engage in substance abuse as a means of coping with stress (Hassanbeigi, Askan, Hassanbeigi, & Pourmovahed, 2013), suggesting similar participation motives in both drug use and extreme sports.

Although participants reported experiencing negative affect while abstinent from their sport, two average-ability participants indicated abstinence was tolerable and did not considerably influence their mood state. In contrast, high-ability participants mentioned only the negative impact of climbing abstinence on their emotions. This suggests withdrawal symptoms were greater in high-ability compared with average-ability climbers and is consistent with the trends identified in drug and non-drug addictions research (Barrault & Varescon, 2013; Price & Bundesen, 2005). As high-ability climbers have participated in their sport for a longer duration and more regularly engaged in climbing activities, they may have become more dependent on their sport to achieve positive emotional states.

The present findings provide a novel insight into withdrawal states in rock climbers, a previously unexplored area of research. There are, however, limitations to the study. First, low-ability climbers were excluded from the participant sample, the inclusion of which may have led to a greater understanding of withdrawal experiences across the spectrum of climbing abilities. However, low-ability climbers may have experienced difficulty in answering questions during the interview due to a low level of climbing knowledge and little experience of the sport. The study also did not consider participants’ drug-use history, which, if present, may have confounded the findings of the study.

Future research on this subject area should use more systematic, quantitative measures to explore withdrawal states in extreme sports athletes, allowing for statistical

comparison of withdrawal experiences between climbing ability levels. Existing measures of craving, for example, can be adapted to assess levels of craving in an extreme sport setting. The questionnaire of smoking urges developed by Tiffany and Drobes (1991), has since been adapted to measure craving for a variety of substances including alcohol (Bohn, Krahn, & Staehler, 1995) and caffeine (West & Roderique-Davies, 2008), suggesting it could also be effectively adapted to assess levels of extreme sports craving. Similar methods can also be utilized to measure anhedonia and negative affective experiences. Such measures would allow for a comparison of the intensity of withdrawal experiences between extreme sports athletes and those with drug and non-drug addictions, providing a better understanding of similarities between the two. Research is also advised to explore withdrawal states in other extreme sports domains (e.g., BASE jumping, downhill skiing) to identify similarities between the experiences of athletes from varying disciplines. Finally, neuroimaging methods could be employed to identify specific brain regions implicated in extreme sports participation and the effects of withdrawal and cue-presentation, allowing further comparison between extreme sports and drug use.

Our findings have potential implications for addiction treatment programs. If extreme athletes experience similar withdrawal experiences to drug users, extreme sports may provide an avenue through which drug users can re-direct their drug-taking behavior and alleviate withdrawal symptoms. It is possible that the risk element and physiological arousal created by extreme sports participation may satisfy the high sensation seeking levels typically found in drug users (cf. Ersche, Turton, Pradhan, Bullmore, & Robbins, 2010; Franques et al., 2003) and replace stimulation previously sought from drug use. Slaght, Lyman, and Lyman (2004) note that lives of ex-drug-users can be unstimulating compared to their previous drug-taking life, and they advocate the inclusion of adventurous risk taking activities into addiction treatment programs to maintain stimulation and satisfy sensation seeking traits. Myrseth et al. (2012) advocate similar methods to fulfill the sensation seeking and impulsivity traits found in pathological gamblers.

In addition to satisfying personality traits, extreme sports may serve as an affect regulator for recovering drug users. Difficulties in affect regulation are cited as a key endophenotype for drug addiction (e.g., Goodman, 2008). Research suggests individuals who participate in extreme sports may possess impairments in their ability to regulate emotional states (Woodman, Cazenave, & Le Scanff, 2008) and may be motivated by a need for agency over these states (Woodman, Hardy, Barlow, & Le Scanff, 2010). Indeed, our study suggests rock climbing served as a form of “*escapism*” for participants and alleviated negative affect, supporting the notion that extreme sports may function as a method of affect regulation in recovering drug users.

Funding sources: No financial support was received for this study.

Authors' contribution: RH and DS were involved in all phases of the research, including the design, data collection, analysis, and the writing of the manuscript. GR-D and SM contributed to the discussion and presentation of the results section and provided feedback on the manuscript. All authors had access to the data collected in the study.

Conflict of interest: None declared.

REFERENCES

- Aidman, E. V., & Woollard, S. (2003). The influence of self-reported exercise addiction on acute emotional and physiological responses to brief exercise deprivation. *Psychology of Sport and Exercise, 4*, 225–236. doi:10.1016/S1469-0292(02)00003-1
- Barrault, S., & Varescon, I. (2013). Impulsive sensation seeking and gambling practice among a sample of online poker players: Comparison between non pathological, problem and pathological gamblers. *Personality and Individual Differences, 55*, 502–507. doi:10.1016/j.paid.2013.04.022
- Bohn, M. J., Krahn, D. D., & Staehler, B. A. (1995). Development and initial validation of a measure of drinking urges in abstinent alcoholics. *Alcoholism: Clinical and Experimental Research, 19*, 600–606. doi:10.1111/acer.1995.19.issue-3
- Brymer, E., & Schweitzer, R. (2013). The search for freedom in extreme sports: A phenomenological exploration. *Psychology of Sport and Exercise, 14*, 865–873. doi:10.1016/j.psychsport.2013.07.004
- Buckley, R. (2012). Rush as a key motivation in skilled adventure tourism: Resolving the risk recreation paradox. *Tourism Management, 33*, 961–970. doi:10.1016/j.tourman.2011.10.002
- Celsi, R. L., Rose, R. L., & Leigh, T. W. (1993). An exploration of high risk leisure consumption through skydiving. *Journal of Consumer Research, 20*(1), 1–23. doi:10.1086/jcr.1993.20.issue-1
- Craft, B. B., & Lustyk, K. B. (2013). Tolerance and withdrawal. In P. Miller (Ed.), *Principles of addiction* (pp. 177–186). London, UK: Academic Press.
- Crawford, J. R., & Henry, J. D. (2004). The Positive and Negative Affect Schedule (PANAS): Construct validity, measurement properties and normative data in a large non-clinical sample. *British Journal of Clinical Psychology, 43*, 245–265. doi:10.1348/0144665031752934
- Diefenbach, T. (2009). Are case studies more than sophisticated storytelling?: Methodological problems of qualitative empirical research mainly based on semi-structured interviews. *Quality and Quantity, 43*, 875–894. doi:10.1007/s11135-008-9164-0
- Di Nicola, M., Tedeschi, D., De Risio, L., Pettorusso, M., Martinotti, G., Ruggeri, F., Swierkosz-Lenart, K., Guglielmo, R., Callea, A., Ruggeri, G., Pozzi, G., Di Giannantonio, M., & Janiri, L. (2015). Co-occurrence of alcohol use disorder and behavioural addictions: Relevance of impulsivity and craving. *Drug and Alcohol Dependence, 148*, 118–125. doi:10.1016/j.drugalcdep.2014.12.028
- Elo, S., Kääriäinen, M., Kanste, O., Pölkki, T., Utriainen, K., & Kyngäs, H. (2014). Qualitative content analysis: A focus on trustworthiness. SAGE Open. Retrieved from <http://sgo.sagepub.com/content/4/1/2158244014522633>

- Ersche, K. D., Turton, A. J., Pradhan, S., Bullmore, E. T., & Robbins, T. W. (2010). Drug addiction endophenotypes: Impulsive versus sensation-seeking personality traits. *Biological Psychiatry*, *68*, 770–773. doi:10.1016/j.biopsych.2010.06.015
- Fattore, L., Melis, M., Fadda, P., Pistis, M., & Fratta, W. (2010). The endocannabinoid system and nondrug rewarding behaviours. *Experimental Neurology*, *224*, 23–36. doi:10.1016/j.expneurol.2010.03.020
- Franken, I., Zijlstra, C., & Muris, P. (2006). Are nonpharmacological induced rewards related to anhedonia? A study among skydivers. *Progress in Neuro Psychopharmacology & Biological Psychiatry*, *30*, 297–300. doi:10.1016/j.pnpbp.2005.10.011
- Franques, P., Auriacombe, M., Piquemal, E., Verger, M., Brisseau-Gimenez, S., Grabot, D., & Tignol, J. (2003). Sensation seeking as a common factor in opioid dependent subject and high risk sport practising subjects. A cross sectional study. *Drug and Alcohol Dependence*, *69*, 121–126. doi:10.1016/S0376-8716(02)00309-5
- Giannantonia, M. D., & Martinotti, G. (2012). Anhedonia and major depression: The role of agomelatine. *European Neuropsychopharmacology*, *22*, S505–S510. doi:10.1016/j.euroneuro.2012.07.004
- Goma-i-Freixanet, M., Martha, C., & Muro, A. (2012). Does the sensation-seeking trait differ among participants engaged in sports with different levels of physical risk? *Anales de Psicología*, *28*, 223–232. <http://www.redalyc.org/pdf/167/16723161025.pdf>
- Goodman, A. (2008). Neurobiology of addiction: An integrative review. *Biochemical Pharmacology*, *75*, 266–322. doi:10.1016/j.bcp.2007.07.030
- Grant, J. E., Potenza, M. N., Weinstein, A., & Gorelick, D. A. (2010). Introduction to behavioural addictions. *American Journal of Drug and Alcohol Abuse*, *36*, 233–241. doi:10.3109/00952990.2010.491884
- Griffiths, M. D. (1996). Behavioural addiction: An issue for everybody? *Journal of Workplace Learning*, *8*, 19–25. doi:10.1108/13665629610116872
- Guba, E. G., & Lincoln, Y. S. (1994). Competing paradigms in qualitative research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (pp. 105–117). Thousand Oaks, CA: Sage.
- Hassanbeigi, A., Askan, J., Hassanbeigi, D., & Pourmovahed, Z. (2013). The relationship between stress and addiction. *Procedia – Social and Behavioural Sciences*, *84*, 1333–1340. doi:10.1016/j.sbspro.2013.06.752
- Hoeft, F., Watson, C. L., Kesler, S. R., Bettinger, K. E., & Reiss, A. L. (2008). Gender differences in the mesocorticolimbic system during computer game-play. *Journal of Psychiatry Research*, *42*, 253–258. doi:10.1016/j.jpsychires.2007.11.010
- Hopley, A., Dempsey, K., & Nicki, R. (2012). Texas Hold'em online poker: A further examination. *International Journal of Mental Health and Addiction*, *10*, 563–572. doi:10.1007/s11469-011-9353-2
- Hsieh, H. F., & Shannon, S. E. (2005). Three approaches to qualitative content analysis. *Qualitative Health Research*, *15*, 1277–1288. doi:10.1177/1049732305276687
- Knutson, B., Rick, S., Wimmer, G. E., Prelec, D., & Loewenstein, G. (2007). Neural predictors of purchases. *Neuron*, *53*, 147–156. doi:10.1016/j.neuron.2006.11.010
- Kozlowski, L. T., & Wilkinson, A. D. (1987). Use and misuse of the concept of craving by alcohol, tobacco, and drug researchers. *British Journal of Addiction*, *82*, 31–36. doi:10.1111/add.1987.82.issue-1
- Leeman, R. F., & Potenza, M. N. (2013). A targeted review of the neurobiology and genetics of behavioural addictions: An emerging area of research. *Canadian Journal of Psychiatry*, *58*, 260–273.
- Lynch, W. J., Peterson, A. B., Sanchez, V., Abel, J., & Smith, M. A. (2013). Exercise as a novel treatment for drug addiction: A neurobiological and stage-dependent hypothesis. *Neuroscience and Biobehavioural Reviews*, *37*, 1622–1644. doi:10.1016/j.neubiorev.2013.06.011
- Malterud, K. (2001). Qualitative research: Standards, challenges, and guidelines. *The Lancet*, *358*, 483–488. doi:10.1016/S0140-6736(01)05627-6
- Marlatt, G. (1987). Craving notes. *British Journal of Addiction*, *82*, 42–44. doi:10.1111/add.1987.82.issue-1
- Mayring, P. (2000). *Qualitative inhaltsanalyse. Grundlagen und Techniken* (7th ed.). Weinheim: Deutscher Studien Verlag.
- Morrow, S. L. (2005). Quality and trustworthiness in qualitative research in counselling psychology. *Journal of Counselling Psychology*, *52*, 250–260. doi:10.1037/0022-0167.52.2.250
- Myrseth, H., Tverå, R., Hagtun, S., & Lindgren, C. (2012). A comparison of impulsivity and sensation seeking in pathological gamblers and skydivers. *Scandinavian Journal of Psychology*, *53*, 340–346. doi:10.1111/sjop.2012.53.issue-4
- Newton, T. F., Kalechstein, A. D., Tervo, K. E., & Ling, W. (2003). Irritability following abstinence from cocaine predicts euphoric effects of cocaine administration. *Addictive Behaviours*, *28*, 817–821. doi:10.1016/S0306-4603(01)00273-8
- Olsen, C. M. (2011). Natural rewards, neuroplasticity, and non-drug addictions. *Neuropharmacology*, *61*, 1109–1122. doi:10.1016/j.neuropharm.2011.03.010
- Pain, M., & Kerr, J. H. (2008). Extreme risk taker who wants to continue taking part in high risk sports after serious injury. *British Journal of Sports Medicine*, *38*, 337–339. doi:10.1136/bjsm.2002.003111
- Pain, M. T. G., & Pain, M. A. (2005). Essay: Risk taking in sport. *The Lancet*, *366*, S33–S34. doi:10.1016/S0140-6736(05)67838-5
- Potenza, M. N. (2006). Should addictive disorders include non-substance related conditions? *Addiction*, *101*, 142–151. doi:10.1111/add.2006.101.issue-1
- Price, I. R., & Bundesen, C. (2005). Emotional changes in skydivers in relation to experience. *Personality and Individual Differences*, *38*, 1203–1211. doi:10.1016/j.paid.2004.08.003
- Robbins, T. W., & Clark, L. (2015). Behavioural addictions. *Current Opinion in Neurobiology*, *30*, 66–72. doi:10.1016/j.conb.2014.09.005
- Robinson, T. E., & Berridge, K. C. (2000). The psychology and neurobiology of addiction: An incentive-sensitization view. *Addiction*, *95*, S91–117. doi:10.1080/09652140050111681
- Roderique-Davies, G. (2008). Cigarette craving: Exploring the enigma. In J. E. Landow (Ed.), *Smoking cessation: Theory, interventions and prevention*. New York, NY: Nova Science.
- Rubin, H. J., & Rubin, I. S. (2012). *Qualitative interviewing: The art of hearing* (3rd ed.). London, UK: Sage.
- Salassa, J. R., & Zapala, D. A. (2009). Love and fear of heights: The pathophysiology and psychology of height imbalance.

- Wilderness and Environmental Medicine*, 20, 378–382. doi:10.1580/1080-6032-020.004.0378
- Schilling, J. (2006). On the pragmatics of qualitative assessment: Designing the process for content analysis. *European Journal of Psychological Assessment*, 22(1), 28–37. doi:10.1027/1015-5759.22.1.28
- Schreier, M. (2012). Qualitative rigour or research validity in qualitative research. *Journal for Specialists in Paediatric Nursing*, 16, 151–155. doi:10.1111/j.1744-6155.2011.00283.x
- Schreier, M. (2014). Qualitative content analysis. In U. Flick (Ed.), *The SAGE handbook of qualitative data analysis* (pp. 170–183). London, UK: Sage.
- Sekine, Y., Minabe, Y., Ouchi, Y., Takei, N., Iyo, M., Nakamura, K., & Mori, N. (2003). Association of dopamine transporter loss in the orbitofrontal and dorsolateral prefrontal cortices with methamphetamine-related psychiatric symptoms. *American Journal of Psychiatry*, 160, 1699–1701. doi:10.1176/appi.ajp.160.9.1699
- Slaght, E., Lyman, S., & Lyman, S. (2004). Promoting healthy lifestyles as a biopsychosocial approach to addictions counseling. *Journal of Alcohol & Drug Education*, 48(2), 5–16.
- Storry, T. (2003). Ours to reason why. *Journal of Adventure Education and Outdoor Learning*, 3, 133–143. doi:10.1080/14729670385200321
- Tiffany, S. T., & Drobes, D. J., (1991). The development and initial validation of a questionnaire on smoking urges. *British Journal of Addiction*, 86, 1467–1476. doi:10.1111/add.1991.86.issue-11
- Trotzke, P., Starcke, K., Pedersen, A., & Brand, M. (2014). Cue-induced craving in pathological buying: Empirical evidence and clinical implications. *Psychometric Medicine*, 76, 694–700. doi:10.1097/PSY.0000000000000126
- van Holst, R. J., de Ruiter, M. B., van den Brink, W., Veltman, D. J., & Goudriaan, A. E. (2012). A voxel-based morphometry study comparing problem gamblers, alcohol abusers, and healthy controls. *Drug and Alcohol Dependence*, 124, 142–148. doi:10.1016/j.drugalcdep.2011.12.025
- Wang, G. J., Volkow, N. D., Telang, F., Jayne, M., Ma, J., Rao, M., Zhu, W., Wong, C. T., Pappas, N. R., Geliebter, A., & Fowler, J. S. (2004). Exposure to appetitive food stimuli markedly activates the human brain. *Neuroimage*, 21, 1790–1797. doi:10.1016/j.neuroimage.2003.11.026
- Weinstein, A., Feder, L. C., Rosenberg, K. P., & Dannon, P. (2014). Internet addiction disorder: Overview and controversies. In K. P. Rosenberg & L. C. Feder (Eds.), *Behavioural addictions: Criteria, evidence, and treatment* (pp. 99–117). London, UK: Academic Press.
- West, O., & Roderique-Davies, G. (2008). Development and initial validation of a caffeine craving questionnaire. *Journal of Psychopharmacology*, 22(1), 80–91. doi:10.1177/0269881107082746
- Willig, C. (2008). A phenomenological investigation of the experience of taking part in ‘extreme sports’. *Journal of Health Psychology*, 13, 690–702. doi:10.1177/1359105307082459
- Willis, J. W. (2007). *Foundations of qualitative research: Interpretive and critical approaches*, London, UK: Sage.
- Wilson, C. (2014). Semi-structured interviews. In M. Dunkerley & H. Scherer (Eds.), *Interview techniques for UX practitioners. A user-centred design method* (pp. 23–41). London, UK: Morgan Kaufmann.
- Woodman, T., Cazenave, N., & Le Scanff, C. (2008). Skydiving as emotion regulation: The rise and fall of anxiety is moderated by alexithymia. *Journal of Sport and Exercise Psychology*, 30, 424–433.
- Woodman, T., Hardy, L., Barlow, M., & Le Scanff, C. (2010). Motives for participation in prolonged engagement high-risk sports: An agentic emotion regulation perspective. *Psychology of Sport and Exercise*, 11, 345–352. doi:10.1016/j.psychsport.2010.04.002
- Zhang, Y., & Wildemuth, B. M. (2009). Qualitative analysis of content. In B. Wildemuth (Ed.), *Applications of social research methods to questions in information and library science* (pp. 308–319). Westport, CT: Libraries Unlimited.
- Zhao, M., Fan, C., Du, J., Jiang, H., Chen, H., & Sun, H. (2012). Cue-induced craving and physiological reactions in recently and long-abstinent heroin-dependent patients. *Addictive Behaviours*, 37, 393–398. doi:10.1016/j.addbeh.2011.11.030
- Zijlstra, F., Booij, J., van den Brink, W., & Franken, I. H. (2008). Striatal dopamine D₂ receptor binding and dopamine release during cue-elicited craving in recently abstinent opiate-dependent males. *European Neuropsychopharmacology*, 18, 262–270. doi:10.1016/j.euroneuro.2007.11.002