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Exploration of the processes and outcomes associated with participation in outdoor sports

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Exploration of the Processes and Outcomes Associated with Participation in Outdoor Sports

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Summary

The view that participation in sports in outdoor environments provides unique opportunities for growth and development is supported by the literature (Hattie, Marsh, Neill, & Richards, 1997). However, the list of types of outcomes previously examined are not exhaustive, and scant research has examined *why* or *how* particular changes occur (McKenzie, 2000). The present thesis identifies factors specific to outdoor sports that relate to outcomes of participation. Chapter 1 introduces and develops the theoretical framework for the present research. Chapter 2 develops and confirms the structure of informant-rated measures of coping effectiveness outcomes and confirms the structure of modified versions of existing self-report outcome measures. The measures are then utilised to examine the processes and outcomes in relation to participating in high-risk sports. Results revealed that the experience of emotion regulation and agency during participation are unique to high-risk sports (i.e., rock climbing) and provides evidence that the experience of emotion regulation and agency during rock climbing is related to the positive outcomes of participating in outdoor sports (i.e., increased self-esteem, greater sense of emotion regulation). Chapter 3 examines the role of the exercise environment in relation to the processes and outcomes of participation in outdoor sports. The pattern of results was counter to our original hypotheses, and reflects the reality of engaging in sports in outdoor environments. When individuals initially take part in outdoor sports they experience difficulties and adversity that challenges them psychologically. Chapter 4 summarises the main findings, the strengths and limitations of the thesis, and directions for future research. The results from the present thesis suggest that the experience of emotion regulation and agency during participation are mechanisms that are involved in changes in outcomes. The findings in the present thesis also highlight the psychological hardship and challenge that individuals face when initially participating in a sport in outdoor environments. It is through longer-term involvement in outdoor sports that individuals glean benefits from participating.

Keywords: emotion regulation, agency, mechanisms, outdoor, high-risk sport, environment

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Chapter 1
General Introduction

The opportunities for growth and development that the outdoor environment can provide can be traced as far back as the fourth century B.C., when Plato identified that such environments may be beneficial for both the body and the mind (Hopkins & Putnam, 1993). Since then three prominent areas of research have emerged. The first area of research relates to studies investigating outdoor adventure programs (e.g., Outward Bound). The second concerns research relating to participation in high-risk sports (e.g., mountaineering). The third body of research relates to the mental health benefits of exposure to natural environments. In the present research program, we draw upon all three areas of research.

Initiatives such as The Scouts (established in 1907) and the Outward Bound Trust (founded in 1941) lead to a growth in popularity of outdoor adventure programs in the UK during the twentieth century and into the twenty-first century. For a number of years outdoor activity providers have recognised the value of such programs, yet researchers have reported mixed results regarding the potential benefits of participation (Crompton & Sellar, 1981; Ewert, 1987; Gibson, 1979; McKenzie, 2000).

The scientific quality of the early research studies conducted may explain the mixed research findings, particularly as anecdotal evidence formed a large proportion of the early research literature (Gibson, 1979). In the same way early empirical studies lack methodological rigor (e.g., no control group) (e.g., Marsh, Richards, & Barnes, 1986a). Consequently, uncertainty remains as to whether the observed effects are due to the adventure program or some other factor (e.g., influence of the leader, personality of the participant, placebo effect). This limits the potential theoretical and practical impacts of the research.

The reviews of research relating to outdoor adventure programs highlight the need for sound research relating to the outcomes of such programs, particularly as beneficial effects appear to be evident (Cason & Gillis, 1994; Hattie et al., 1997). Cason and Gillis (1994) conducted a meta-analysis of forty-three studies examining the outcomes of wilderness programs with adolescent populations. The authors reported an overall effect size of .31, which represented seven broad categories of outcome measures (self-concept, behavioural assessments, attitude surveys, locus of control, clinical scales, grades, and school attendance). The authors noted a considerable lack of published studies available

for review. Most of the studies included in the meta-analysis were unpublished (Cason & Gillis, 1994).

The authors of a second meta-analysis conducted in the same decade also noted the shortcomings of much of the research available for review (Hattie et al., 1997). Hattie and colleagues (1997) conducted a review of ninety-six studies involving adolescents and adults. Similar to the findings of Cason and Gillis (1994) the authors reported an overall effect size of .34, which represented the average effect size of six broad categories (leadership, self-concept, personality, interpersonal, academic, and adventuresome).

Although the results of both meta-analyses support claims regarding the beneficial outcomes of outdoor adventure programs, the authors noted that there was considerable variability in the effect sizes reported (Cason & Gillis, 1994; Hattie et al., 1997). For example, Hattie et al. (1997) reported an average effect size of .13 for studies that examined interpersonal communication outcomes, which is considerably lower than the overall effect size reported. In the same study, the authors reported an average effect size of .49 for studies that examined emotional stability outcomes, which is considerably greater than the overall effect size reported. The findings suggest that outdoor adventure programs influence some outcomes more than other outcomes.

Given that the research suggests that outdoor adventure programs have a positive impact on a number of outcomes (e.g., self-concept, personality) (Cason & Gillis, 1994; Hattie et al., 1997), examining the long-term impact of programs once individuals return to their everyday lives seems worthwhile. In their meta-analysis, Hattie et al. (1997) also examined the long-term effects of outdoor adventure programs. The authors reported an overall effect size of .17 (leadership, self-concept, personality, interpersonal, academic, adventuresome) for up to 18 months after completing the adventure program. However, many of the studies were Outward Bound-type programs, which limits the generalisability of the research finding.

Furthermore, some outcomes may not be evident until some time after the outdoor experience. Positive outcomes could be missed if studies only examine effects immediately after. For example Hartig, Mang and Evans (1991) examined the effects of a wilderness backpacking experience on outcomes such as overall happiness and reported no differences between groups at post-test. However, when the authors assessed overall happiness again 21 days after the activity, the wilderness-backpacking group reported significantly greater overall happiness than the other two groups (i.e., non-wilderness

vacation, no vacation control). Although overall happiness is a relatively crude outcome measure, the results illustrate the importance of considering the long-term effects.

Key features of outdoor adventure programs are activities such as rock-climbing (Marsh, Richards, & Barnes, 1986b). These types of activities are defined as high-risk as the possibility of serious injury or death is an inherent part of the activity (Breivik, 1999). However, the level of involvement largely dictates the degree of risk. For example, activities such as rock-climbing take place in environments where there is substantially reduced physical risk when individuals start participating in the sport (e.g., top-rope rock-climbing[1]). As individuals' progress within the sport the degree of physical risk increases (e.g., traditional lead rock-climbing[2]) (Barlow et al., 2015).

High-Risk Sport

For much of the twentieth century voluntary participation in high-risk sports was regarded as an unhealthy behaviour and was considered by some a sign of psychopathology (Fenichel, 1939). In recent years researchers have viewed high-risk sport participation in a more positive light and have begun to explore the outcomes associated with participation (Barlow, Woodman, & Hardy, 2013; Brymer & Schweitzer, 2013a; Willig, 2008). For instance, in a qualitative investigation of the experience of taking part in high-risk sports Willig (2008) found that taking part in high-risk sports meant more to participants than searching for thrills and excitement. Participants reported that taking part in high-risk sports had a positive impact on their self-esteem and self-confidence (Willig, 2008).

The majority of research has focused on outcomes of participation (e.g., self-concept, emotions etc.) with few studies examining how specific outcomes are achieved (Hattie et al., 1997; McKenzie, 2000). In other words, we know from the research literature that engaging in outdoor activities has a positive impact on outcomes such as self-concept, but we still do not understand what processes are occurring during participating that are influencing these outcomes. If we know specifically what factors during participation lead to specific outcomes, outdoor activities can be tailored to maximise their effectiveness (McKenzie, 2000).

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[1] Climbing the route with a rope from above without first having led the climb. The belayer (i.e., the person who is safeguarding the rope) is positioned at the top

[2] Climbs on which the protection is placed by the person who climbs first with the rope from below, placing protection linked to the rope by a karabiner as a safeguard

It is surprising that few studies have examined how outcomes are achieved, particularly as the need for studies which examine the processes underlying specific outcomes was recognised over thirty years ago (Ewert, 1983). Current understanding is largely based on theoretical explanations (e.g., facing challenges during participation) as opposed to empirical research (McKenzie, 2000). A clear gap in the current knowledge base exists that warrants research attention. However, before exploring *why* and *how* particular changes occur it is important to first consider the research relating to the outcomes associated with participating in outdoor sports.

Self-Esteem

Global self-esteem refers to a person's overall evaluation or appraisal of his or her worth (Rosenberg, 1965) and is associated with psychological well-being (Rosenberg, Schooler, Schoenbach, & Rosenberg, 1995). Low self-esteem has been linked to mental health disorders such as depression (Orth, Robins, & Roberts, 2008), therefore activities that enhance self-esteem are worthy of consideration. Changes in the way people feel about themselves as a consequence of engaging in outdoor activities has been of most interest to researchers (Cason & Gillis, 1994), and self-esteem is most commonly advocated by outdoor activity providers.

Empirical research has generally supported the impacts of outdoor activities on self-esteem. For example, Hattie et al. (1997) examined the impact of outdoor adventure programs and reported that such programs had a positive effect on participants' self-esteem. Similarly Grocott and Hunter (2009) found increases in self-esteem following a 10-day sailing voyage, and the self-esteem effects were maintained three months following the voyage. Support for the self-esteem effects of participating in high-risk sports has also been demonstrated in the literature (Bahaeloo-Horeh & Assari, 2008; Iso-Ahola & Graefe, 1988). Iso-Ahola and Graefe (1988) found that success in rock climbing led to increases in self-esteem, and Bahaeloo-Horeh and Assari (2008) showed that participating in a single mountaineering program improved self-esteem.

The research conducted to date is not, however, without criticism and not all studies report improvements in self-esteem (Cason & Gillis, 1994). Many studies do not include a control group (Bahaeloo-Horeh & Assari, 2008; Grocott & Hunter, 2009). Uncertainty remains as to whether the outdoor activity was accountable for self-esteem increases. Consequently, there is a need for further studies regarding the self-esteem outcomes of outdoor activities that incorporate sound methodological rigor.

Sense of Emotion Regulation

Emotions often seem unbidden, appear and disappear quickly, result in changes in multiple response systems (e.g., subjective experience, expressive behaviour, physiological responding), and usually arise when situations are perceived as posing potential opportunities or challenges (Gross & Muñoz, 1995). A clear definition of what emotions are has yet to be agreed upon more than a century after William James in 1884 asked "What is an emotion?" (Gross & Muñoz, 1995). In a review of emotion definitions Kleinginna and Kleinginna (1981) compiled 92 definitions of emotion which the researchers sorted into 11 categories representing similar themes that form the bases of the definitions (e.g., cognitive, physiological etc.). Consequently, researchers are increasingly reliant on prototype conceptions of emotion rather than precise definitions when studying emotions and emotion regulation (Gross & Thompson, 2007).

Emotion regulation is defined as "the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions" (Gross, 1998, p. 275), and has been regarded as an essential feature of mental health (Gross & Muñoz, 1995). Effective emotion regulation prevents stressful levels of positive and negative emotions (Gross, Richards, & John, 2006) and maladaptive behaviour (Cicchetti, Ackerman, & Izard, 1995). Emotion regulation is important in ensuring a balanced emotional life, and ineffective regulation of emotions can have short- and long-term consequences (Gilligan & Bower, 1984).

In recent years researchers have begun to empirically examine the emotion regulatory opportunities outdoor activities may provide (Barlow et al., 2013; Cazenave, Le Scanff, & Woodman, 2007; Woodman, Cazenave, & Le Scanff, 2008; Woodman, Hardy, Barlow, & Le Scanff, 2010). Individuals are said to be attracted to the high-risk sport domain as it provides them with an opportunity to initiate and experience externally derived emotions (e.g., fear) (Barlow et al., 2013; Fenichel, 1939; Woodman et al., 2008). The potential life-threatening risks associated with participating in high-risk sports (Breivik, 1999) means that ineffective emotion regulation can have severe consequences. In order to successfully complete the task (e.g., reach the top of a climb) individuals have to take control of their emotions. Previous research has found that gleaning a sense of emotion regulation in the high-risk sport domain transfers back into individuals everyday lives (Barlow et al., 2013). In other words, as a consequence of participating in high-risk sports they feel better able to regulate their emotions.

Research has shown that some individuals (e.g., mountaineers) are attracted to the high-risk sport domain due to the emotion regulatory opportunities they provide (Barlow et al., 2013; Woodman et al., 2008, 2010). However, previous research has largely focused on prolonged-engagement high-risk sports (e.g., mountaineering, ocean rowing). Furthermore, researchers have only recently started to examine emotion regulation in the context of high-risk sports (Barlow et al., 2013; Woodman et al., 2008, 2010). There is a need to examine whether participation in other outdoor sports provide similar emotion regulatory outcomes.

Sense of Agency

The term agency refers to individuals' belief that they intentionally influence or have control over the choices that they make in life (Bandura, 1989, 2001). According to social-cognitive theory (Bandura, 1989, 2001), several facets of human agency exist (e.g., personal, proxy etc.) and personal agency is most relevant to the outdoor domain. Bandura (2006) explains that "to be an agent is to influence intentionally one's functioning and life circumstances" (Bandura, 2006, p. 164). In this view, individuals actively contribute to or direct their life circumstances rather than taking a more passive approach, so "by acting as an agent, an individual makes causal contributions to the course of events" (Bandura, 2006, p. 165).

Researchers have found that participation in high-risk sports increases individuals' sense of agency (Barlow et al., 2013; Woodman et al., 2010). The risks associated with participation in high-risk sports (i.e., potential for serious injury or death) (Breivik, 1999) forces individuals to take direct control of their life circumstances, as a passive approach to participation can have serious consequences. Consequently, participation in high-risk sports provides individuals with opportunities to glean a sense of agency (Barlow et al., 2013). Research has shown that a sense of agency developed through high-risk sport can transfer back into individuals' everyday lives (Barlow et al., 2013). However, transfer effects may be short-lived, as some individuals who experience long periods of time between high-risk sport activities have reported a diminished sense of agency (Barlow et al., 2013; Woodman et al., 2010). Similar to the emotion regulation literature there is a need to examine whether similar agentic outcomes can be attained through participation in other outdoor sports.

Coping

Coping is an active and conscious process that allows individuals to manage demands appraised as exceeding the resources of the individual (Lazarus & Folkman,

1984). When faced with challenging situations individuals cope in different ways (Lazarus & Folkman, 1984) and being able to effectively manage environmental demands is essential for mental health (Aldwin & Revenson, 1987). Researchers have almost universally focused on the strategies that people use to cope with stress (Lazarus & Folkman, 1984). Effective use of coping strategies help to alleviate stress levels by keeping the demands of stressful situations within manageable bounds (Zeidner & Endler, 1996). However, coping as an outcome (i.e., how well an individual copes with stress) has received much less research attention (Zeidner & Endler, 1996).

Research suggests that outdoor activities provide an ideal milieu for individuals to learn to effectively cope with challenging situations (Hattie et al., 1997; Watts, Cohen, & Toplis, 1994). Outdoor activities take place in unfamiliar environments whereby risk and uncertainty is an inherent part of participation (Breivik, 1999). Individuals are forced to face challenges head on and overcome anxieties and worries in order to minimise risk to life. Hattie et al. (1997) identified that the challenging nature of outdoor activities provides individuals with immediate feedback regarding their ability to deal with challenging situations. Activities that provide opportunities to effectively cope with challenges could provide significant mental health benefits (Miller & McCool, 2003). The degree to which participation in outdoor sports helps individuals to effectively cope with stressors in everyday life would be worthwhile.

Basic Psychological Needs Satisfaction

Self-determination theory (Deci & Ryan, 1985, 2002) details the existence of three basic psychological needs – the need for autonomy, competence, and relatedness – which are considered essential for psychological growth and well-being (Deci & Ryan, 2000). The need for autonomy refers to an individuals' desire to feel volitional, experience a sense of freedom and choice in life's endeavours (deCharms, 1968; Deci & Ryan, 1985, 2000; Ryan & Connell, 1989; Ryan, 1995). The need for competence refers to the need to feel effective in one's environment and experience opportunities to demonstrate one's capabilities (Deci & Ryan, 1985, 2002; Harter, 1983; White, 1959). The need for relatedness refers to feeling a sense of relatedness to both other individuals and one's wider community (Baumeister & Leary, 1995; Deci & Ryan, 2002; Harlow, 1958; Ryan, 1995). Contexts that satisfy these needs are suggested to lead to higher levels of psychological well-being, whilst contexts that hinder need satisfaction are suggested to lead to psychological ill-being (Deci & Ryan, 2002; Ryan, 1995; Sheldon, Williams, & Joiner, 2003). Studies have shown that need satisfaction predicts well being and other

positive outcomes in a number of life domains, including exercise settings (Wilson & Rogers, 2008).

Although studies have not explicitly examined the degree to which outdoor activities satisfy the needs for autonomy, competence, and relatedness, researchers have recognised the relevance of need satisfaction to outdoor sports (Iso-Ahola & Graefe, 1988; Meier, 1976; Robinson, 1992). For example, researchers have shown that competencies developed through rock-climbing can have a positive impact on psychological outcomes such as self-esteem (Iso-Ahola & Graefe, 1988). While the study did not examine competence in relation to the self-determination theory framework, the findings support the idea that participation in outdoor sports may satisfy the need for competence.

Researchers have also argued that participating in outdoor activities can lead to the development of unique interpersonal relations with others (Meier, 1976; Robinson, 1992). The impending presence of risk during participation in outdoor sports forces individuals to work together in the pursuit of common goals (e.g., reaching the top of a rock climb). Outdoor sport participants develop a unique and strong sense of closeness to others through participation, termed by Meier (1976) as the "kinship of the rope."

Researchers have suggested that outdoor sports provide opportunities for autonomously determined behaviour (Robinson, 1992). Individuals are required to make decisions (e.g., route choice) based on their perceived competency to complete the activity and deal with the perceived risks (Robinson, 1992). Self-determined behaviour is suggested to develop as an individual progresses within the sport from novice to expert (Robinson, 1992). Outdoor activities may provide a domain whereby individuals can feel a sense of volition and choice in life's endeavours.

Processes

Whilst much of the research continues to focus on the outcomes of outdoor activities (McKenzie, 2000), scant research has examined *why* or *how* particular changes occur. Despite the fact that the need for studies which examine the processes underlying specific outcomes was recognised over thirty years ago (Ewert, 1983). If we are able to identify what factors lead to specific outcomes (e.g., experiences during participation, the outdoor environment), outdoor activities could be tailored to maximise their effectiveness (McKenzie, 2000). Current understanding is largely based on theoretical explanations (e.g., facing challenges during participation) as opposed to empirical research (McKenzie, 2000). A clear gap in the current knowledge base exists that warrants research attention.

Experiences during participation. The experiences during participation in outdoor activities may be responsible for participant growth and development (McKenzie, 2000). Outdoor sports involve a degree of challenge, risk, and uncertainty, which brings about feelings of anxiety and fear during the activity that needs to be dealt with effectively in order for individuals to safely participate (Breivik, 1996). Although researchers have suggested that these qualities may lead to program outcomes, current understanding is largely based on theoretical explanations as opposed to empirical research (McKenzie, 2000). However, recently researchers have found that individuals are motivated to participate in high-risk sports due to the emotion regulatory and agentic opportunities they provide during participation (Barlow et al., 2013; Woodman et al., 2010). The emotion regulatory and agentic opportunities outdoor sports provide may be key to understanding *why* and *how* changes in outcomes occur.

High-risk sports are "all sports where you have to reckon with the possibility of serious injury or death as an inherent part of the activity" (Breivik, 1999, p.10). Due to the challenging and potentially life-threatening consequences associated with the outdoor domain, individuals are likely to experience emotions that are more intense, more obvious, and more externalised (e.g., fear; Castanier, Le Scanff & Woodman, 2011) than in everyday life, where individuals may experience less obvious and more internalised emotions (e.g., anxiety). The individual has to deal with their emotions, as emotion dysregulation in the outdoor domain could potentially compromise safety. Emotion regulation is essential during high-risk sport participation. This is supported by recent research which has found that high-risk sport participants experience a significant degree of emotion regulation during participation (Barlow et al., 2013).

Taking part in outdoor sports can also provide opportunities to experience agency during participation (Barlow et al., 2013). In the outdoor domain individuals take control of and dictate the course of their life (Barlow et al., 2013; Woodman et al., 2010) as not doing so could have life-threatening consequences due to the challenging nature of the outdoor domain (Breivik, 1999). Individuals experience opportunities during participation to shape their environment so that they become the influence within that environment – they become an agent of their actions (Barlow et al., 2013). In recent research, high-risk sport participants reported that they experienced a significant degree of agency during participation (Barlow et al., 2013).

Research suggests that emotion regulation and agency are important for mental health (Gross & Muñoz, 1995) and psychological well-being (Smith et al., 2000).

Fundamental to high-risk sports is the experience of emotion regulation and agency during participation (Barlow et al., 2013). Emotion regulation and agency are important constructs to consider in relation to outcomes of participating in outdoor sports, as they may be a mechanism to which changes in outcomes such as self-esteem occur.

The outdoor environment. High-risk sports take place in a dynamic environment that has unique characteristics and features (e.g., changing weather conditions) (Breivik, 1999). This is an important aspect to consider, particularly as many of the potential benefits of participating may be derived from the fact that all these activities take place in the outdoors. The comparison between outdoor and indoor exercise settings has become the focus of a number of research studies in recent years (e.g., Gladwell, Brown, Wood, Sandercock, & Barton, 2013; Pretty, Peacock, Sellens, & Griffin, 2005). In a systematic review of the effects on mental health and physical wellbeing of participating in physical activity in natural environments compared to physical activity indoors, Thompson et al. (2011) reported that most studies included showed a positive improvement in outcome measures (e.g., self-esteem).

Although some studies have demonstrated positive mental health benefits relating to exercise in natural environments (Barton & Pretty, 2010; Bowler, Buyung-Ali, Knight, & Pullin, 2010; Thompson et al., 2011). Studies typically examine the mental health outcomes of relatively safe activities such as walking or running in green spaces such as parks and nature reserves (e.g., Focht, 2009; Kerr et al., 2006; Pretty et al., 2005). The types of activities examined in previous research relating to exercise environment, do not lend themselves well to explore the differences between outdoor and indoor environments, particularly in relation to the dynamic and challenging environment outdoor activities take place in.

Thesis Structure

The present thesis consists of two research chapters and a general discussion. Chapter 1 has identified that whilst there is a large body of research pertaining to the potential outcomes of outdoor sports, scant research has examined *why* or *how* outcomes occur. A potential mechanism worthy of investigation is the emotion regulatory and agentic opportunities outdoor sports provide during participation. Furthermore, exploring whether the natural environment is crucial to the underlying processes and outcomes is also worthy of investigation.

Chapter 2 consists of three studies. In Study 1 and Study 2 two new informant-rated measures of coping effectiveness outcomes (i.e., performance, health) were

developed and validated, as there was a lack of a suitable measure in existing literature. A second aim of Study 1 and Study 2 was to assess the psychometric properties of modified versions of existing self-report measures of the other outcomes examined with respect to the populations of interest in Study 3. The final study in Chapter 2 sought to examine the processes (i.e., experience of emotion regulation and agency) and outcomes (sense of emotion regulation and agency, self-esteem, basic psychological need satisfaction, coping effectiveness outcomes) in relation to participating in high-risk sports (i.e., rock-climbing).

Chapter 3 examines the role of the exercise environment in relation to the processes and outcomes of participation in outdoor sports. This approach involved conducting an experimental study whereby participants swam either outdoors in a natural lake or indoors in a swimming pool.

Finally, Chapter 4 summarises the main findings of Chapter 2 and Chapter 3, and the strengths and limitations of the research program. The research implications and future research directions are also discussed.

Chapter 2

The Processes and Outcomes of Participating in High-Risk Sports

Recreational participation in outdoor sports has increased in popularity in recent years (Breivik, 2010; West & Allin, 2010). Researchers suggest that such sports may provide opportunities for growth and development that cannot be attained through participation in mainstream sports due to the challenging and dynamic environment they take place in (Breivik, 2010). Outdoor sport individuals are required to perform under stressful conditions, coping with anxiety and dealing with intense emotions during participation (Breivik, 2010; Castanier et al., 2011). Thus, researchers have argued that the central aspects associated with outdoor environments, such as challenge and risk, are likely to lead to positive outcomes (e.g., self-esteem; Hattie et al., 1997).

Although a large proportion of the research literature relating to outdoor activities has examined the impact of participation on self-concept related outcome variables (e.g., self-esteem) (Cason & Gillis, 1994), some researchers have examined other outcome variables (e.g., personality, leadership) (Hattie et al., 1997). Researchers have reported mixed results regarding the potential benefits of participation (Crompton & Sellar, 1981; Ewert, 1987; Gibson, 1979; McKenzie, 2000). The mixed findings may be due to the scientific quality of the research studies conducted, as anecdotal evidence formed a large proportion of the early research literature (Gibson, 1979), and many empirical studies lack methodological rigor (e.g., no control group) (e.g., Marsh, Richards, & Barnes, 1986a).

Furthermore, the types of outcomes previously examined are not exhaustive. For example, scant research has examined whether participation in outdoor sports can influence an individuals' ability to regulate emotion (Barlow et al., 2013). Emotion regulation seems an important outcome to examine, particularly since outdoor sport participants have to cope with anxiety and intense emotions during participation (Breivik, 2010; Castanier et al., 2011). Whilst much of the research has focused on the outcomes associated with participating in outdoor sports (Cason & Gillis, 1994), researchers have made no attempt to explore the mechanisms that might underlie any such beneficial outcomes. Consequently, in the present research program we aim to address this gap in the literature through examining the processes and outcomes most likely to be associated with participating in outdoor sports.

Processes Associated with Participating in Outdoor Sports

High-risk sports are described as "all sports where you have to reckon with the possibility of serious injury or death as an inherent part of the activity" (Breivik, 1999, p.

10). Due to the challenging and potentially life-threatening consequences associated with the outdoor domain, individuals are likely to experience emotions that are more intense, more obvious, and more externalised (e.g., fear; Castanier et al., 2011) than in everyday life, where individuals may experience less obvious and more internalised emotions (e.g., anxiety). In the outdoor domain individuals have to deal with their emotions, as emotion dysregulation in the outdoor domain could potentially compromise safety. Similar emotion regulatory opportunities are less likely to be prevalent in mainstream sports, as they do not characteristically yield the intense emotions commonly associated with engaging in outdoor sports (Breivik, 2010). Emotion regulation, which refers to the heterogeneous set of processes by which individuals influence "which emotions they have, when they have them, and how they experience and express these emotions" (Gross, 1998, p. 275), is essential during high-risk sport participation. Researchers have recently found that high-risk sport participants experience significantly greater emotion regulation during participation than low-risk sport participants (Barlow et al., 2013).

Taking part in outdoor sports can also provide opportunities to experience a sense of agency during participation (Barlow et al., 2013). To be an agent is to influence intentionally one's functioning and life circumstances by one's actions (Bandura, 2001, 2006). In the outdoor domain individuals have to take control of and dictate the course of their life (Barlow et al., 2013; Woodman et al., 2010) as not doing so could have life-threatening consequences due to the challenging nature of the outdoor domain (Breivik, 1999). During participation individuals are provided with opportunities to shape their environment so that they become the influence within that environment – they become an agent of their actions (Barlow et al., 2013). High-risk sport participants have reported significantly greater experience of agency during participation than low-risk sport participants (Barlow et al., 2013).

Consequently, the experience of emotion regulation and agency during participation is important to consider in relation to the outcomes of participating in outdoor sports, particularly as the experience of emotion regulation and agency during participation may influence psychological outcomes such as self-esteem. According to Gross and Muñoz (1995) emotion regulation is an essential feature of mental health, and self-esteem is associated with psychological well-being (Rosenberg et al., 1995). The experience of emotion regulation during participation may make individuals better able to regulate their emotions, and as a result positively influence outcomes such as self-esteem.

Sense of Emotion Regulation and Agency

Researchers have recently found that individuals are better able to regulate their emotions after participating in outdoor sports (Barlow et al., 2013; Woodman et al., 2010). Specifically, researchers have shown that participation in prolonged-engagement outdoor activities (e.g., mountaineering) provides a means of emotion regulation for individuals who struggle to regulate their emotions effectively in everyday life (Barlow et al., 2013). Furthermore, the emotion regulatory and agentic benefits are shown to transfer from the outdoor domain back into other aspects of individuals' everyday life (Barlow et al., 2013; Woodman et al., 2010). That is to say, through participating in prolonged engagement high-risk sports individuals feel better able to regulate their emotions and feel agentic in other life domains (e.g., interpersonal relationships).

In a study looking at expeditionary mountaineers, Barlow et al. (2013) found that after completing a mountaineering expedition the participants reported greater feelings of agentic emotion regulation. The effects were not found in low-risk controls, suggesting that emotion regulatory and agency outcomes are specific to high-risk sports (Barlow et al., 2013). Whilst the results are promising, these results may only be applicable to expeditionary mountaineers who are well documented to have a difficulty with emotion regulation in everyday life and diminished agency in emotional interpersonal relationships (Lester, 1983, 2004; Woodman et al., 2010). Further, expeditionary mountaineering is a highly skilled and challenging sport that takes large amounts of preparation and planning, and involves prolonged periods away from everyday life. As such, there is a need to examine whether similar emotion regulatory and agentic opportunities and transfer effects can be found in shorter-duration and more widely accessible outdoor sports.

Self-Esteem

Self-esteem is defined as a "favourable or unfavourable attitude towards the self" (Rosenberg, 1965, p. 15), and is regarded as the evaluative component of the self. Self-esteem is also one of the most commonly measured outcomes of outdoor activities (Cason & Gillis, 1994; Hattie et al., 1997). Research suggests that overcoming the various challenges that individuals are faced with when participating in outdoor activities enhances both global and domain-specific self-esteem (Hattie et al., 1997; Wilson & Lipsey, 2000).

In a meta-analysis of the outcomes of outdoor adventure programs, Hattie and colleagues (1997) found that individuals generally reported increases in self-esteem immediately after completing an outdoor adventure program, which was maintained up to 18 months later. However, few studies included conducted follow-ups. Furthermore, the

populations examined consisted of largely adolescents and young adults attending a short-duration organised outdoor adventure program (e.g., Outward Bound).

In the present research program we are interested in adults who regularly engage in an outdoor pursuit recreationally (e.g., rock climbing). These individuals will have participated in an outdoor sport for a long period to time, much longer than outdoor adventure program participants. Based on the findings of previous research (e.g., Hattie et al., 1997) it could be argued that individuals who regularly participate in an outdoor sport recreationally would report high self-esteem.

Basic Psychological Need Satisfaction

Self-determination theory (Deci & Ryan, 1985, 2002) details the existence of three innate psychological needs (i.e., autonomy, competence, relatedness) "that are essential for on-going psychological growth, integrity, and well-being" (Deci & Ryan, 2000, p. 229). The need for autonomy refers to an individuals' desire to feel volitional, experience a sense of freedom and choice in life's endeavors (deCharms, 1968; Deci & Ryan, 1985, 2000; Ryan & Connell, 1989; Ryan, 1995). Competence refers to the need to feel effective in one's environment and experience opportunities to demonstrate one's capabilities (Deci, 1975; Deci & Ryan, 2002; Harter, 1983; White, 1959). Finally, the need for relatedness refers to feeling a sense of relatedness to both other individuals and one's wider community (Baumeister & Leary, 1995; Deci & Ryan, 2002; Harlow, 1958; Ryan, 1995).

Researchers have not yet examined the degree to which outdoor sports satisfy basic psychological needs, or considered whether there is a psychological needs satisfaction transfer effect from a specific domain (e.g., outdoor sports) into life generally. Outdoor sports lend themselves well to satisfy these innate needs. For example, recreational outdoor sport participants make a choice to participate in the activity, and choose the level at which they wish to engage in that chosen activity, supporting the need for autonomy (Robinson, 1992). The nature of outdoor sports allows individuals to develop a sense of competence through exploring their performance limits, and in doing so they are continually pushing the boundaries of what they can do (Iso-Ahola & Graefe, 1988). Finally, the outdoor participant does not generally participate alone, the individual engages with others in order to pursue their chosen activity, whether it is as part of a group (e.g., kayaking) or working with a partner (e.g., rock climbing). The impending presence of risk during participation forces individuals to work together in the pursuit of common goals (e.g., reaching the top of a rock climb). The outdoor participant develops a sense of relatedness rapidly with other individuals (Meier, 1976; Robinson, 1992). In the present

study we aim to explore the degree to which outdoor sports may satisfy the need for competence, relatedness, and autonomy, and whether these effects transfer into life generally.

Coping Outcomes

Coping refers to one's ability to manage the internal and external demands of situations that are appraised as stressful (Folkman & Lazarus, 1980; Lazarus & Folkman, 1984). Researchers have suggested that leisure activities may provide individuals with an opportunity to develop effective coping resources (Iwasaki, 2003), which may in turn make individuals better able to cope with stress in everyday life. This view lends itself well to outdoor sports whereby objective danger and the element of the unknown is an inherent part of outdoor sport environments (Breivik, 1996). It is not uncommon for individuals to face challenging and stressful situations during participation (Breivik, 1996, 2010). Individuals are forced to face challenges head on and effectively cope with stressful situations in outdoor sports, as not coping well can have real life-threatening consequences (Breivik, 1996, 2010).

The theoretical work of Lazarus and Folkman (1984) has largely influenced the coping research which has led to researchers almost universally focusing on the strategies that people use to cope with stress (Lazarus & Folkman, 1984). Coping as an outcome has received much less research attention (Zeidner & Endler, 1996). In a systematic review of coping in sport, Nicholls and Polman (2007) advocated the importance of examining coping effectiveness, which has been examined in terms of whether individuals' perceived a particular set of coping strategies (e.g., emotion-focused) helped them to cope effectively with a specific stressful event (Aldwin & Revenson, 1987; Iwasaki, 2003). Coping as an outcome (i.e., how well an individual copes with stress generally) has received much less research attention (Zeidner & Endler, 1996).

A model of coping which may allow us to gain a better understanding of individuals' ability to cope with stress is Hardy, Jones and Gould (1996) working model of coping in sport. The model illustrates coping as a transactional process in that coping efforts can influence coping outcomes such as performance, health, mood, and satisfaction. While coping efforts can appear to have a positive impact on some outcomes (e.g., performance) it may be at a cost to other outcomes (e.g., health) (Gould, Finch, & Jackson, 1993). For example, in order to cope with pressures at work an individual may work until late in the evening to complete a task, leading to a positive impact on performance at work. However, if the strategy is used more often this could have a negative impact on the

individuals' health (e.g., burnout; Thornton, 1992) through not receiving sufficient sleep. Consequently, it is important to look at multiple coping outcomes to get a more holistic account of how well a person is coping with stress in general.

Research suggests that informant reports may provide more reliable data than self-report assessment methods (Vazire, 2006). Consequently, in the present study we sought to examine coping outcomes using informant-rated measures. The specific coping outcomes we are interested in are coping effectiveness in terms of performance and health, which Hardy et al. (1996) referred to in their working model of coping in sport. Although four outcomes were outlined in the model (i.e., performance, health, mood, satisfaction), we chose to focus on performance and health, as they were considered more observable to informants than mood and satisfaction.

There was no suitable measure available in current literature to examine coping outcomes from an informant perspective. Consequently, in the present study we developed two informant-rated coping outcome measures (i.e., coping effectiveness – performance, coping effectiveness - health). These variables were examined in an exploratory fashion. The performance outcome is the behavioural outcome of coping and refers to an informant's perception of whether the individual is able to maintain a high level of performance effectiveness (e.g., uses time effectively, works to a high standard, does not generally make serious mistakes) when faced with adversity. The health outcome is the health effects of coping and refers to an informant's perception of whether the individual is able to maintain a high level of personal health (e.g., has good sleeping patterns, does not get unreasonably emotional, is easy to engage and interact with) when faced with adversity. In relation to the present study it is expected that due to the fact that challenges and uncertainty are an inherent part of participating in outdoor sports (Breivik, 2010; Willig, 2008) high-risk sport participants will be better equipped to cope with stressful situations in life (i.e., maintaining a high level of performance and personal health when faced with adversity).

Purpose of the Present Research

Researchers have typically focused on the short-term psychological outcomes associated with the activity itself with little research examining the long-term effects of participation. Since research suggests that some outcomes may not be evident until sometime after participation (Hartig et al., 1991) it is important to consider the lasting effects. Furthermore, although researchers imply that there are aspects associated with outdoor environments that are central to participation (e.g., challenge, risk) which may

lead to positive outcomes (e.g., self-esteem; Hattie et al., 1997), researchers make no attempt to explore the mechanisms that might underlie specific outcomes. Consequently, the primary aim of the present research program was to investigate the long-term outcomes of engaging in recreational outdoor sports, and the associated underlying mechanisms.

Study 1

In Study 1, we developed two new informant-rated measures of coping outcomes (i.e., performance, health), as no suitable measures existed in the literature. We also modified existing self-report outcome measures of self-esteem, emotion regulation and agency, and basic psychological need satisfaction. The aim of Study 1 was to develop informant-rated measures of coping effectiveness outcomes (i.e., performance, health), and to examine the psychometric integrity of the modified self-report outcome measures.

Method

Participants

The sample comprised of 363 individuals from a diverse range of outdoor sports (e.g., mountaineering, cross-country mountain biking, white water kayaking etc.). The chance to win £50 worth of vouchers to spend at an outdoor sport retailer was offered as an incentive upon completion of the online inventories. The data was screened to identify spurious data (e.g., response patterns, multiple responses submitted). Three participants were removed from the *self-esteem* and *basic psychological needs satisfaction* inventories as participants had answered all the items in each inventory with the same response value. Both inventories include reverse-scored items, therefore some variation in scores across the inventory was expected.

A further 11 participants were removed from the *coping effectiveness – performance* and *coping effectiveness - health* inventories, as the person they completed the inventories about engaged in a non-outdoor sport (e.g., bird watching). In the present study, participants completed both the self-report inventories and the informant-rated inventories (i.e., a separate informant sample was not recruited). The 11 participants were only removed from the informant-rated inventory data as the participants took part in a valid outdoor sport themselves.

The final samples for each inventory were as follows: emotion regulation and agency n = 363 (246 men, 117 women; M_{age} = 33.32, SD = 12.35); self-esteem n = 360 (244 men, 116 women; M_{age} = 33.23, SD = 12.32); basic psychological needs satisfaction n = 360 (244 men, 116 women; M_{age} = 33.23, SD = 12.32); coping effectiveness –

performance n = 352 (200 men, 152 women; $M_{\text{age group}}$ = 25-34); and coping effectiveness – health n = 352 (200 men, 152 women; $M_{\text{age group}}$ = 25-34).

Measures

We made modifications to existing measures of emotion regulation, agency, self-esteem, and basic psychological needs satisfaction. In the present research program we were interested in individuals' feelings regarding a specific time period in the past, rather than their feelings at that present moment in time. The tense of each item was altered to the past perfect tense, and the stem of each measure was altered to reflect feelings in the past two months. For example, the original emotion regulation item from the between participation inventory of the Sensation Seeking, Emotion Regulation, and Agency Scale (SEAS; Barlow et al., 2013) "The emotional elements of my life are difficult to deal with", was changed to "The emotional elements of my life *have been* difficult to deal with". A two-month time period was considered sufficient to reflect individuals' experiences generally. It was also considered a more tangible time period for individuals than for example, a twelve-month time period.

Sense of emotion regulation and agency. We used the six emotion regulation (e.g., "The emotional elements of my life *have been* difficult to deal with") and six agency (e.g., "I *have* felt like people or circumstances *have been* trying to impose limits on me") items from the *between participation* inventory of the Sensation Seeking, Emotion Regulation, and Agency Scale (SEAS; Barlow et al., 2013). Items scored on a Likert scale from 1 (*completely disagree*) to 7 (*completely agree*). Higher scores are indicative of greater difficulty with emotion regulation and diminished sense of agency.

Self-esteem. We used the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965), which comprises 10-items (e.g., "At times, I *have thought* I am no good at all") scored on a Likert scale from 1 (*strongly disagree*) to 4 (*strongly agree*). The scale contains an equal number of positively and negatively worded items. Higher scores are indicative of a higher level of self-esteem.

Basic psychological needs satisfaction. We used the 21-item Basic Psychological Needs Satisfaction – General (BPNS-G; Gagné, 2003), which comprises seven autonomy items (e.g., "I *have felt that I was* free to decide for myself how to live my life"), six competence items (e.g., "In my life I *have not had* much of a chance to show how capable I am"), and eight relatedness items (e.g., "I *have* really *liked* the people I *have interacted* with"). Nine of the 21 items are negatively worded. Items scored on a Likert scale ranging

from 1 (*not at all true*) to 7 (*very true*). Higher scores are indicative of a higher level of satisfaction of needs.

Coping outcomes. We developed two separate informant-rated coping outcome scales, a 16-item coping effectiveness – performance measure, and a 17-item coping effectiveness – health measure. The items in each measure focus on stressors that individuals typically face in everyday life. The authors generated the items based on theoretical rationale and previous informant-rated measures of similar constructs (e.g., Bell, Hardy, & Beattie, 2013; Gould et al., 1993; Hardy et al., 1996). The coping effectiveness - performance scale focuses on the behavioural outcome of coping (e.g., "Person X is able to maintain a high level of performance effectiveness in everyday life, when s/he has been under pressure"). The coping effectiveness – health scale focuses on the health consequences of coping (e.g., "Person X is able to maintain a high level of personal health in everyday life, when s/he has had limited control over a situation"). Items scored on a Likert scale ranging from 1 (*never)* to 7 (*always)*. Higher scores are indicative of a higher level of coping effectiveness.

Procedure

We recruited participants using advertisements placed on outdoor-related websites and forums (e.g., UK Climbing). Participants competed the survey online via electronic versions of the inventories created using survey software (Qualtrics, 2012). We chose online data collection for the present study as large sample sizes could be accessed over a wide geographical area (Denscombe, 2006). Furthermore, research has shown that the anonymous nature of the online method can result in greater disclosure towards sensitive issues and lower social desirability scores compared to traditional pen and paper methods (Joinson, 1999; Stanton, 1998). Despite its advantages, online data collection is not without its shortcomings. The anonymity of the method can attract individuals who participate with the sole intention of contaminating data or for financial gain (Kraut et al., 2004). We screened the data to identify spurious data (e.g., response patterns) before statistical analyses. We removed participants who had responded with the same value for all items on a reverse-scored measure, as some variation in response values was expected. We also removed multiple responses from the same individual, which was identified through checking email addresses.

Recruitment adverts led participants to a Web page that informed participants that all data collected would be treated in accordance with data protection and confidentiality regulations. We notified participants that informed consent to participate would be

indicated by proceeding to the next Web page. If participants chose to continue, they completed demographic data (see Appendix A) followed by the Emotion Regulation and Agency Scale (see Appendix B), Basic Psychological Needs Satisfaction – General (see Appendix C), and Self-Esteem measure (see Appendix D).

In the final section, participants completed the coping effectiveness outcome inventories (i.e., performance, health) in relation to someone else that they knew well (referred to as X). Participants completed demographic data about X (see Appendix E) followed by the coping effectiveness – performance measure (see Appendix F), and coping effectiveness – health measure (see Appendix G). The whole procedure took approximately 25 minutes.

Statistical Analyses

We used PRELIS 2.54 (Jöreskog & Sörbom, 2003a) to generate covariance matrices and LISREL 8.54 (Jöreskog & Sörbom, 2003b) to test the underlying factor structure of each measure. In line with recommendations by Jöreskog (1993) we examined the factorial validity of the coping outcomes measures (i.e., performance, health) in an exploratory fashion. We adopted a three-phase approach when a measure consisted of multiple latent variables (Jöreskog, 1993). First, we analysed the subscales separately to assess the convergent validity of each latent variable and to identify items with poor factor loadings. We then examined factor pairs to identify any ambiguity among items. In the final phase, we tested the whole model. We assessed model fit through the χ^2 likelihood ratio test statistic and a combination of goodness-of-fit indices. Where initial analysis using PRELIS 2.54 indicated non-normality (denoted by a significant Mardia's coefficient) we generated asymptotic covariance matrices and used the Satorra-Bentler scale χ^2 (S-B χ^2; Satorra & Bentler, 2001) as it adjusts χ^2 under conditions of non-normality and produces robust standard errors (Chou & Bentler, 1995).

We used the following criteria to assess whether the model had good fit: Satorra-Bentler χ^2 / *df* ratio less than 2.00 ($p > .05$); the root-mean-square residual (RMSEA; Steiger, 1990) less than or equal to 0.06 ($p > .05$); the Non-Normed Fit Index (NNFI; Tucker & Lewis, 1973) and Comparative Fit Index (CFI; Bentler, 1990) greater than or equal to 0.95; and the standardised root-mean-square residual (SRMR) less than or equal to 0.08 (Hu & Bentler, 1999). For the exploratory analyses, we made post hoc modifications to the model by removing items when the fit indices did not meet the cut-off criteria and one or more of the following conditions: 1) items had sizable factor loadings (>.40) on the intended factor; 2) items had modest standardised residuals (< 3.00); 3) items

had reasonable modification indices (single figure numerical value); 4) items theoretically unambiguous. When we made modifications, the model fit was reassessed (Jöreskog, 1993).

Results

Sense of Emotion Regulation and Agency Measure

Initial analysis revealed that the data was non-normally distributed (Mardia's coefficient = 207.86, $p < .01$). The Satorra-Bentler scale χ^2 was used. Single-factor analyses of the emotion regulation (ER) scale indicated adequate fit statistics, S-B χ^2 (9) = 19.16, RMSEA = .06, NNFI = .99, CFI = .99, SRMR = .03. Single factor analysis of the agency (AG) scale indicated inadequate fits statistics S-B χ^2 (9) = 41.07, RMSEA = .09, NNFI = .95, CFI = .97, SRMR = .04. A post hoc model modification was made by removing one item from the AG scale, and the resulting five-item scale demonstrated good fit statistics, S-B χ^2 (5) = 13.92, RMSEA = .07, NNFI = .97, CFI = .98, SRMR = .05. The resulting two-factor model fit statistics (S-B χ^2 (43) = 142.27, RMSEA = .08, NNFI = .96, CFI = .97, SRMR = .05) indicated that the fit of the model could be improved by removing one item from the ER scale. The resulting ten-item two-factor model indicated adequate fit statistics, S-B χ^2 (34) = 98.94, RMSEA = .07, NNFI = .97, CFI = .98, SRMR = .05. The factor-factor correlation between ER-AG was moderately high (.81). Standardised factor loadings for the model were all greater than .60 and composite reliability for the resulting measure was 0.85 for both ER and AG. The item-factor loadings for each subscale are displayed in Table 1. The mean score for ER and AG was 3.25 (*SD* = 1.45) and 2.90 (*SD* = 1.43), respectively.

Rosenberg Self-Esteem Scale

Initial analysis revealed that the data was non-normally distributed (Mardia's coefficient = 150.63, $p < .01$). The fit statistics for the 10-item model was not acceptable, S-B χ^2 (35) = 185.54, RMSEA = .11, NNFI = .94, CFI = .96, SRMR = .06. Post hoc modifications were made removing three items, and the resulting seven-item model demonstrated good fit statistics, S-B χ^2 (14) = 24.11, RMSEA = .04, NNFI = .99, CFI = .99, SRMR = .03. Standardised factor loadings for the model were all greater than .60 and composite reliability for the resulting measure was 0.87. The item-factor loadings are displayed in Table 2. The mean score for participants' ratings of self-esteem was 22.12 (*SD* = 4.08).

Table 1

Item-Factor Loadings for the Original and Modified Between Participation Emotion Regulation and Agency Scale for Study 1 (n = 363) and Study 2 (n = 1201)

	Factor Loadings		
Items	Original	Modified	Study 2
Difficulty with emotion regulation			
1. I have worried about other aspects of my life, not related to the task I was doing	0.79		
2. The emotional elements of my life have been difficult to deal with	0.72	0.73	0.82
3. I have not been able to work out which emotions I have been experiencing *	0.80	0.81	0.71
4. I have struggled to deal with the stressful situations in my life *	0.70	0.71	0.81
5. I have been emotional (e.g. anxious, angry) without understanding why *	0.85	0.83	0.74
6. I have found that emotional elements in my life stress me out *	0.60	0.59	0.83
Diminished sense of agency			
1. I have felt like people or circumstances have been trying to impose limits on me *	0.74	0.76	0.58
2. I have felt like my life 'belongs' to other people *	0.75	0.72	0.65
3. I have felt trapped in my life *	0.64	0.64	0.84
4. I have been prevented from achieving my goals in life *	0.67	0.68	0.75
5. I have felt like a passive observer of my life rather than a major "actor" *	0.82	0.86	0.74
6. I have had little belief in my ability to influence some important aspects of my life	0.79		

Note. * Items retained

Table 2

Item-Factor Loadings for the Original and Modified Rosenberg Self-Esteem Scale for Study 1(n = 360) and Study 2 (n = 1193)

Items		Factor Loadings		
		Original	Modified	Study 2
1.	On the whole, I have felt satisfied with myself *	0.62	0.63	0.74
2R.	At times, I have thought I am no good at all *	0.76	0.74	0.71
3.	I have felt that I have a number of good qualities	0.65		
4.	I have been able to do things as well as most other people	0.58		
5R.	I have felt that I do not have much to be proud of *	0.71	0.72	0.73
6R.	I have certainly felt useless at times	0.69		
7.	I have felt that I'm a person of worth, at least on an equal plane with others *	0.68	0.63	0.68
8R.	I have wished I could have had more respect for myself *	0.60	0.63	0.64
9R.	All in all, I have been inclined to feel that I am a failure *	0.77	0.81	0.79
10.	I have taken a positive attitude towards myself *	0.71	0.71	0.77

Note. * Items retained. R = Reverse-scored items.

Basic Psychological Need Satisfaction Scale – General

Initial analysis revealed that the data was non-normally distributed (Mardia's coefficient = 570.27, $p < .01$). The full three-factor model resulted in inadequate fit, S-B χ^2 (186) = 677.13, RMSEA = .06, NNFI = .91, CFI = .92, SRMR = .07. Separate single factor analyses were conducted to identify issues in the underlying factor structure. Single factor analysis of the autonomy scale (AUT) indicated inadequate fit statistics, S-B χ^2 (14) = 42.25, RMSEA = .07, NNFI = .93, CFI = .95, SRMR = .05. A post hoc model modification was made by removing one item from the scale, and the resulting six-item scale demonstrated adequate fit statistics, S-B χ^2 (9) = 26.11, RMSEA = .07, NNFI = .94, CFI = .96, SRMR = .04. Single factor analysis of the relatedness scale (REL) indicated poor fit statistics S-B χ^2 (20) =76.99, RMSEA = .09, NNFI = .92, CFI = .94, SRMR = .06. A post hoc model modification was made by removing one item from the scale, and the resulting seven-item scale demonstrated adequate fit statistics, S-B χ^2 (14) = 33.92, RMSEA = .06, NNFI = .95, CFI = .97, SRMR = .04. Single-factor analysis of the

competence scale (COM) indicated very poor fits statistics S-B χ^2 (9) =101.03, RMSEA = .17, NNFI = .63, CFI = .78, SRMR = .10, and post hoc modifications resulted in no improvement in fit.

Researchers have suggested that measures with both negatively and positively worded items can result in items loading on separate factors (Marsh, 1996). Each of the three factors were separated into two factors (i.e., positively and negatively worded items), which yielded a six-factor model. The resulting model demonstrated good fit statistics, S-B χ^2 (174) = 330.22, RMSEA = .05, NNFI = .96, CFI = .96, SRMR = .05. It seems likely that the poor fit of the 21-item three-factor model was a result of a measurement artefact due to the positively and negatively worded items rather than there being separate constructs (Roberts, Lewinshon, & Seeley, 1993). The factor-factor correlations of the 21-item three-factor model were moderately high between AUT-COM (.84) and REL-COM (.83). The factor-factor correlations between AUT-REL (.69) support the discriminant validity between the two factors. Standardised factor loadings were all greater than .40 except for AUT item four (.33) and seven (.36). The item factor loadings for each subscale are displayed in Table 3. Composite reliabilities were COM (0.71), AUT (0.72), and REL (0.83). The mean scores for COM, AUT and REL were 5.07 (*SD* = 0.98), 4.93 (*SD* = 0.93) and 5.54 (*SD* = 0.87), respectively.

Informant-Rated Coping Effectiveness – Performance Measure

Initial analysis revealed that the data was non-normally distributed (Mardia's coefficient = 462.28, $p < .01$) and the fit statistics were not acceptable, S-B χ^2 (104) = 423.70, RMSEA = .09, NNFI = .98, CFI = .98, SRMR = .05. Post hoc modifications were made removing seven items, and the resulting nine-item model demonstrated good fit statistics, S-B χ^2 (27) = 45.44, RMSEA = .04, NNFI = .99, CFI = .99, SRMR = 0.03. Standardised factor loadings for the model were all greater than .70 and composite reliability for the resulting measure was 0.93. The item-factor loadings are displayed in Table 4. The mean score for participants' ratings of an informant was 4.79 (*SD* = 1.18).

Informant-Rated Coping Effectiveness - Health Measure

Initial analysis revealed that the data was non-normally distributed (Mardia's coefficient = 718.430, $p < .01$) and the fit statistics were not acceptable, S-B χ^2 (119) = 305.93, RMSEA = .07, NNFI = .99, CFI = .99, SRMR = .04. Post hoc modifications were made by removing six items, and the resulting eleven-item model demonstrated good fit statistics, S-B χ^2 (44) = 60.07, RMSEA = .03, NNFI = .99, CFI = .99, SRMR = .02. Standardised factor loadings for the model were all greater than .70 and composite

Table 3

Item-Factor Loadings for the Basic Psychological Needs Satisfaction – General Scale for Study 1 (n= 360) and Study 2 (n = 1191)

Items		Factor Loadings	
		Study 1	Study 2
Autonomy			
1.	I have felt free to decide for myself how to live my life	0.58	0.59
2R.	I have felt pressured in my life	0.41	0.36
3.	I have generally felt free to express my ideas and opinions	0.65	0.66
4R.	In my daily life, I have had to frequently do what I was told	0.33	0.28
5.	People I have interacted with on a daily basis have tended to take my feelings into consideration	0.59	0.58
6.	I have felt like I could pretty much be myself in my daily situations	0.66	0.64
7R.	There have not been many opportunities for me to decide for myself how to do things in my daily life	0.36	0.35
Relatedness			
1.	I have really liked the people I have interacted with	0.62	0.65
2.	I have got along with people I have come in contact with	0.66	0.63
3R.	I have pretty much kept to myself and have not had a lot of social contact	0.55	0.50
4.	I have considered the people I have regularly interacted with to be my friends	0.65	0.65
5.	People in my life have cared about me	0.61	0.62
6R.	There have not been many people that I have been close to	0.51	0.47
7R.	The people I have interacted with regularly have not seemed to like me much	0.52	0.65
8.	People have generally been pretty friendly towards me	0.75	0.71
Competence			
1R.	Often, I have not felt very competent	0.55	0.45
2.	People I know have told me I have been good at what I do	0.41	0.43
3.	I have been able to learn interesting new skills	0.48	0.49
4.	Most days I have felt a sense of accomplishment from what I have done	0.66	0.69
5R.	In my life I have not had much of a chance to show how capable I am	0.51	0.54
6R.	I have often not felt very capable	0.62	0.58

Note. R = Reverse-scored items.

Table 4

Item-Factor Loadings for the Developed and Modified Coping Effectiveness – Performance Measure for Study 1 (n = 352) and Study 2 (n = 389)

Items	Factor Loadings		
	Developed	Modified	Study 2
1. When s/he has had important upcoming deadlines	0.71		
2. When s/he has had a setback *	0.82	0.81	0.77
3. When s/he has not been getting along with significant others	0.71		
4. When s/he has been working non-stop all week *	0.74	0.73	0.75
5. When s/he has been suffering from minor illness/sickness	0.71		
6. When significant others have been relying on him/her *	0.75	0.74	0.67
7. When s/he has been under pressure	0.79		
8. When s/he has not had much sleep *	0.73	0.71	0.71
9. When s/he has been faced with daunting challenges	0.83		
10. When his/her preparation has not going to plan *	0.81	0.80	0.77
11. When s/he has had limited control over a situation	0.82		
12. When s/he has had a change in personal circumstances (e.g. career, financial, family, residence etc.) *	0.74	0.73	0.76
13. When s/he has had a large number of demands placed on him/her *	0.84	0.83	0.82
14. When other activities have been interfering with what s/he has needed to get done *	0.80	0.83	0.79
15. When s/he has been faced with a situation that gets worse instead of better	0.81		
16. When s/he has been faced with unexpected problems *	0.83	0.83	0.76

Note. * Items retained.

reliability for the resulting measure was 0.97. The item-factor loadings are displayed in Table 5. The mean score for participants' ratings of an informant was 5.13 (*SD* = 1.29).

Discussion

The main purpose of Study 1 was to develop new informant-rated scales to measure coping effectiveness outcomes (i.e., performance, health), as there were no suitable measures available in current literature (Zeidner & Endler, 1996). In relation to the present research program the measure will allow us to assess individuals' coping dispositions as perceived by others (i.e., informants). However, the measure can be used for a plethora of research relating to coping outcomes and potential health costs of coping efforts. Both coping measures had a good fit to the data following item elimination, resulting in a nine-item informant-rated coping effectiveness - performance measure, and an eleven-item informant-rated coping effectiveness - health measure.

We had modified the wording of existing measures of emotion regulation, agency, self-esteem, and basic psychological needs satisfaction, therefore, we also examined the model fit of those measures. The SEAS and the RSES indicated good fit statistics following item elimination. The factor-factor correlations between the ER and AG scales were notably high. In the development of the measure Barlow et al. (2013) noted similarly high factor-factor correlations. The authors attributed this to the constructs being conceptually interdependent, moderate-high correlations between these scales are to be expected (Barlow et al., 2013).

The basic psychological needs satisfaction fit statistics were problematic. However, when the model was tested as a 21-item six-factor model with each factor separated into positively and negatively worded items, the resulting model demonstrated good fit statistics. The poor fit of the 21-item three-factor model was thus likely a measurement artefact due to the positively and negatively worded items rather than there being separate constructs (Roberts, Lewinshon & Seeley, 1993). The factor-factor correlations of the 21-item three-factor model were moderately high for AUT-COM and REL-COM, which was not expected, as these scales are conceptually independent. These results suggested that these scales are somewhat related which may be the reason for the poor fit of the single-factor COM scale. Further, some factor loadings on the AUT scale were < .40, although greater than .30.

Overall, the newly developed informant-rated coping effectiveness measures (i.e., performance, health) demonstrated good fits statistics. However, in the present study we did not administer the measure to informants, therefore confirmation of the psychometric

Table 5

Item-Factor Loadings for the Developed and Modified Coping Effectiveness - Health Measure for Study 1(n = 352) and Study 2 (n = 389)

Items	Factor Loadings		
	Developed	Modified	Study 2
1. When s/he has had important upcoming deadlines *	0.83	0.79	0.70
2. When s/he has had a setback	0.89		
3. When s/he has had a number of personal issues	0.86		
4. When s/he has not been getting along with significant others *	0.86	0.83	0.79
5. When s/he has been working non-stop all week	0.80		
6. When his/her preparation has not gone to plan	0.87		
7. When s/he has been under pressure	0.85		
8. When significant others have been demanding *	0.88	0.89	0.84
9. When s/he has not had much sleep *	0.79	0.79	0.79
10. When s/he has been faced with daunting challenges *	0.91	0.91	0.89
11. When significant others have been relying on him/her *	0.87	0.89	0.84
12. When s/he has limited control over a situation *	0.89	0.89	0.84
13. When s/he has had a change in personal circumstances (e.g. career, financial, family, residence etc.) *	0.81	0.81	0.80
14. When other activities have been interfering with what s/he has needed to get done *	0.85	0.86	0.79
15. When s/he has been faced with a situation that gets worse instead of better	0.87		
16. When s/he has had a large number of demands placed on him/her *	0.90	0.91	0.87
17. When s/he has been faced with unexpected problems *	0.91	0.92	0.85

Note. * Items retained

properties with an informant sample is required. Furthermore, validation of the measures with a wider demographic (i.e., non-high risk sport participants) would be advantageous.

Study 2

The aim of Study 2 was to confirm that the new measures of coping effectiveness outcomes (i.e., performance, health) had good structural integrity. In Study 1 we developed the informant-rated measures but the measures were not administered to a separate informant sample. In the present study an informant sample was also recruited. The psychometric properties of the modified self-report outcomes measures (i.e., sense of emotion regulation and agency, self-esteem, basic psychological needs satisfaction) were examined using a wider demographic sample (i.e., including low-risk sport participants, non-sporting individuals). In Study 1 we had only recruited outdoor sports participants.

Method

Participants

We recruited two types of participants in Study 2 (i.e., activity participants and informants of those participants). The activity participant sample consisted of 1261 new individuals participating in a diverse range of recreational activities (e.g., rock climbing, running, music). The chance to win £50 and a two-hour outdoor activity session at an outdoor pursuits company was offered to activity participants as an incentive upon completion of the online inventories. We screened the data to identify spurious data as outlined in Study 1. Twenty-three individuals were removed, as they had previously submitted data for Study 1. We identified further 25 individuals who had submitted two or more responses by checking the email addresses submitted with responses. The first response was retained whilst any further responses were removed resulting in the removal of 26 responses. We removed a further 11 individuals due to not providing a valid recreational activity. We screened the data relating to each measure to check for distinct pattern responses (e.g., responding to all items with the same value). Eight and 10 participants were removed from the *self-esteem* and *basic psychological needs satisfaction* inventories, respectively, as individuals had responded to all the items in the measures with the same value. Both inventories have reverse-scored items, therefore one would expect there to be some variation in response values across the inventory. The final sample analysed for each self-report inventory were: sense of emotion regulation and agency n = 1201 (801 men, 400 women; M_{age} = 30.91, SD = 13.46); self-esteem n = 1193 (794 men, 399 women; M_{age} = 30.93, SD = 13.48); basic psychological needs satisfaction n =1191 (792 men, 399 women; M_{age} = 30.93, SD = 13.47).

We recruited a separate sample of 393, who were informants of the activity participants. Participants provided contact details of an informant, whom we contacted separately. We identified four informants who had submitted two responses. We retained the first response and removed the four duplicate responses. The final sample analysed for both of the informant rated coping outcome measures were: coping effectiveness - performance and coping effectiveness - health n = 389 (222 men, 167 women; M_{age} = 30.49, SD = 13.44).

Measures

The activity participants completed the original modified measures of sense of emotion regulation and agency, self-esteem, and basic psychological needs satisfaction from Study 1. However, we analysed the reduced-item measures from Study 1.

The informants of the activity participants completed the reduced-item coping effectiveness – performance (see Appendix H) and coping effectiveness – health (see Appendix I) measures from Study 1.

Procedure

We used the same online data collection software outlined in Study 1. However, as we targeted a wider demographic than in Study 1 (e.g., low-risk sports participants) and we recruited informants of the activity participants the procedure was slightly altered.

Activity participants. Recruitment adverts led participants to a Web page that informed participants that all data collected would be treated in accordance with data protection and confidentiality regulations. We notified participants that informed consent to participate would be indicated by proceeding to the next Web page. If participants chose to continue, they completed demographic data (see Appendix J) followed by the Emotion Regulation and Agency Scale (see Appendix B), Basic Psychological Needs Satisfaction – General (see Appendix C), and Self-Esteem measure (see Appendix D). In the final section, participants were asked to provide contact details (i.e., name, email address or phone number) of someone to be an informant for the study. The whole procedure took approximately 15 minutes.

Activity participants nominated informants. The present author contacted the activity participants nominated informants to ask if they would be willing to take part in the study. If they agreed informants were emailed a link to a Web page that outlined that all data collected would be treated in accordance with data protection and confidentiality regulations. We notified informants that informed consent to participate would be indicated by proceeding to the next Web page. On the next Web page informants entered a

unique ID that was emailed along with the Web page link. The ID number allowed us to match the data the informant completed with that of the participant. Informants then completed demographic data (see Appendix K) followed by the coping effectiveness – performance measure (see Appendix H), and coping effectiveness – health measure (see Appendix I). We asked informants to respond to the items in each inventory in relation to X (i.e., the activity participant that had nominated them). The whole procedure took approximately 10 minutes.

Statistical Analyses

We used the same model-fit analyses conducted in Study 1 to confirm the factor structure of the two newly developed coping effectiveness outcome measures (i.e., performance, health) and the modified versions of the established measures (i.e., emotion regulation and agency, self-esteem, basic psychological needs satisfaction). We used a newer version of the software (i.e., PRELIS 2.72 and LISREL 8.72) to conduct the analyses.

Results

Sense of Emotion Regulation and Agency

Initial analysis revealed that the data was non-normally distributed (Mardia's coefficient = 199.89, $p < .01$). The Satorra-Bentler scale χ^2 was used. Results revealed adequate fit statistics for the ten-item two-factor model, S-B χ^2 (34) = 281.39, RMSEA = .08, NNFI = .98, CFI = .98, SRMR = .04. The factor-factor correlation between ER-AG was .79. Standardised factor loadings were all greater than .50 and composite reliability for the measure was 0.89 for ER and 0.84 for AG. The item-factor loadings for each subscale are displayed in Table 1. The mean score for ER and AG was 3.39 (*SD* = 1.60) and 3.12 (*SD* = 1.42), respectively.

Rosenberg Self-Esteem Scale

Initial analysis revealed that the data was non-normally distributed (Mardia's coefficient = 153.27, $p < .01$). Results revealed good fit for the seven-item model, S-B χ^2 (14) = 67.44, RMSEA = .06, NNFI = .99, CFI = .99, SRMR = .03. Standardised factor loadings were all greater than .60, and composite reliability for the measure was 0.88. The item-factor loadings are displayed in Table 2. The mean score for participants' ratings of self-esteem was 21.29 (*SD* = 4.49).

Basic Psychological Need Satisfaction Scale – General

Initial analysis revealed that the data was non-normally distributed (Mardia's coefficient = 625.12, $p < .01$). As in Study 1 the 21-item three-factor model demonstrated

poor fit statistics, S-B χ^2 (186) = 1668.82, RMSEA = .08, NNFI = .92, CFI = .93, SRMR = .07. When the model was tested separating the AUT, COM and REL scales into positively and negatively worded items as in Study 1, the resulting model demonstrated improved fit statistics, S-B χ^2 (174) = 911.40, RMSEA = .06, NNFI = .96, CFI = .96, SRMR = .05. The factor-factor correlations for the 21-item three-factor model were moderately high between AUT-COM (.89) and REL-COM (.84). The factor-factor correlations between AUT-REL (.73) support the discriminant validity between the two factors. Standardised factor loadings were all greater than .40 except for AUT item two (.36), four (.28), and seven (.35). The item factor loadings for each subscale are displayed in Table 3. Composite reliabilities were COM (0.70), AUT (0.70), and REL (0.83). The mean score for COM, AUT, and REL was 5.00 (*SD* = 1.01), 4.86 (*SD* = 0.91), and 5.45 (*SD* = 0.90), respectively.

Informant-Rated Coping Effectiveness – Performance Measure

Initial analysis revealed that the data was non-normally distributed (Mardia's coefficient = 387.62, $p < .01$). Results confirmed a good model-fit for the nine-item model, S-B χ^2 (27) = 68.93, RMSEA = .06, NNFI = .99, CFI = .99, SRMR = .03. Standardised factor loadings were all greater than .60 and composite reliability for the measure was 0.92. The item-factor loadings are displayed in Table 4. The mean score for informants' ratings of participants' coping effectiveness was 5.12 (*SD* = 1.07).

Informant-Rated Coping Effectiveness – Health Measure

Initial analysis revealed that the data was non-normally distributed (Mardia's coefficient = 578.92, $p < .01$). Results revealed a good fit for the eleven-item model, S-B χ^2 (44) = 97.01, RMSEA = .06, NNFI = .99, CFI = .99, SRMR = .03. Standardised factor loadings were all greater than .70 and composite reliability for the measure was 0.96. The item-factor loadings are displayed in Table 5. The mean score for informants' ratings of participants' coping health was 5.47 (*SD* = 1.12).

Discussion

The model fit indices for the newly developed coping effectiveness outcome measures – performance and health – indicated that the data for the reduced nine-item and eleven-item models fitted the data well. The modified versions of measures of emotion regulation and agency, self-esteem, and basic psychological needs satisfaction demonstrated adequate fit, although chi-square values for the scales were large. Researchers have questioned the interpretability of chi-square when samples are relatively large (Bagozzi, 1981; Bentler & Bonett, 1980) particularly as researchers have recognised

that larger samples are more likely to reveal significant chi-square values (Bentler & Bonett, 1980). Researchers recommend examining and reporting a range of fit indices to evaluate model fit (Hu & Bentler, 1995; Jöreskog, 1993). Evaluation of the RMSEA, NNFI, CFI, and SRMR for the measures indicated adequate fit and the inflated chi-square is likely an artefact of the large participant sample.

Study 3

The outdoor sport literature largely consists of research relating to the outcomes of participation. Empirical research generally supports the beneficial outcomes of participating in outdoor sports (Hattie et al., 1997). However, the research is not without shortcomings (i.e., poor methodological rigor), and considerable variability in the research findings exists (Gibson, 1979; Hattie et al., 1997). Furthermore, the types of outcomes previously examined are not exhaustive. For example, scant research has examined whether participation in outdoor sports can influence individuals' ability to regulate emotions (Barlow et al., 2013). Other outcomes that have received less research attention include the degree to which participation in outdoor sports help individuals to effectively cope with stressors in everyday life.

Additionally, few studies have examined how specific outcomes are achieved (Hattie et al., 1997; McKenzie, 2000; Willig, 2008). In other words, scant research has addressed what specifically occurs during participation that leads to positive benefits (McKenzie, 2000). Outdoor sports involve a degree of challenge, risk, and uncertainty (Breivik, 1996). Consequently, participants experience feelings of anxiety and fear during participation that need to be dealt with effectively in order for individuals to safely participate (Breivik, 1996). Researchers recently found that high-risk sport participants (e.g., mountaineers) are motivated by the emotion regulatory and agentic opportunities outdoor sports provide during participation (Barlow et al., 2013). The experience of emotion regulation and agency during participation may be key to understanding *why* and *how* changes in outcomes occur.

The aim of Study 3 was to address some of the gaps in current knowledge relating to participation in outdoor sports. Specifically, the aim was to examine outcomes that have received less research attention (e.g., coping effectiveness outcomes, sense of emotion regulation and agency, basic psychological need satisfaction) and to uncover some of the potential underlying mechanisms (e.g., experience of emotion regulation and agency during participation).

We sought to use the modified versions of existing outcome measures and the two informant-rated coping effectiveness outcome measures developed in Study 1 and Study 2 to examine whether differences existed in the outcomes of participation between a high-risk sport group and a low-risk sport group. Seeing as both high-risk sports and low-risk sports involve physical activity, we also included a low-activity control group that comprised of individuals who did not take part in physical activity.

Outcomes of Participation

The traditional rock-climbing domain shares similarities with the mountaineering domain in terms of requiring individuals to regulate intense emotions and take control of their actions, as failure to do so can have life-threatening consequences (Barlow et al., 2013). Such requirements are not prevalent in mainstream sports and activities, as they typically take place in man-made environments that are managed and regulated to ensure safety and prevent injury (Breivik, 2010). Based on the theoretical standpoint in the present study and the findings of previous research (Barlow et al., 2013), traditional rock climbers should report a greater sense of emotion regulation and agency than both low-risk sport participants and low-activity controls.

The merits of participating in outdoor sports in relation to increasing self-esteem is supported in the literature (Hattie et al., 1997). However, researchers have reported mixed findings regarding the link between exercise and increased self-esteem (Fox, 2000). Researchers suggest that the exercise experience would need to be particularly powerful to have significant effects (Fox, 2000). It is expected that rock climbers should experience greater self-esteem than both low-risk sport participants and low-activity controls, as the benefits of participation are not constrained to the outdoor domain; they influence other aspects of everyday life. Rock climbers will not only benefit from the experience of emotion regulation and agency during participation, but the transfer of these benefits into other life domains is likely to influence their everyday functioning and personal evaluations of their worth (i.e., self-esteem).

It is not uncommon for individuals to face challenging and stressful situations during a rock climb, as objective danger and the element of the unknown is an inherent part of outdoor sport environments (Breivik, 1996). In such situations individuals face challenges head on and effectively cope with stressful situations, as not coping well can have real life-threatening consequences (Breivik, 1996, 2010). Other activities (e.g., low-risk sports) take place in regulated and controlled environments where individuals are less likely to have to cope with difficult situations. It is expected that due to the greater

exposure to risk and challenge associated with outdoor sports, rock climbers will display a greater coping effectiveness (i.e., performance, health) when dealing with challenges in life than individuals participating in other activities (e.g., low-risk sports).

Underlying Mechanisms

As well as examining the outcomes of participation, in Study 3 we also sought to examine the underlying mechanisms (i.e., the experience of emotion regulation and agency while participating). Previous research has reported that high-risk sport participants experience greater emotion regulation and agency during participation (Barlow et al., 2013). Traditional rock climbers should experience greater agency and emotion regulation during participation than both low-risk sport participants and low-activity controls.

Other Variables

One might argue from a self-determination theory perspective (Deci & Ryan, 1985, 2002) that outcomes are due to individuals experiencing fulfilment of their basic psychological needs. Research by Ryan & Deci (2001) has shown that individuals who experiences considerable support for autonomy, competence, and relatedness, also report high self-esteem. From a self-determination theory standpoint (Deci & Ryan, 1985, 2002) a variety of activities are suggested to foster need satisfaction including physical activity (Wilson, Rogers, Rodgers, & Wild, 2006), therefore, in the present study we do not expect basic psychological needs satisfaction to discriminate between the two exercise groups (i.e., high-risk and low-risk sports). We would expect both exercise groups to report greater need satisfaction than the low-activity control group.

Research suggests that the psychological profiles (Cazenave et al., 2007) and personality characteristics (Barlow et al., 2013; Levenson, 1990) discriminate between high-risk sport and low-risk sport participants. We also examined whether differences between groups remained once personality was accounted for.

Hypotheses

In relation to the processes that are thought to occur during participation, we hypothesised that rock-climbers will report significantly greater experience of emotion regulation and agency during participation than both low-risk sportspeople and low-activity controls. Low-risk sportspeople and low-risk control will not differ significantly from one another.

In terms of outcomes of participation, we hypothesised that rock-climbers will report significantly greater self-esteem, less difficulty with emotion regulation and less diminished sense of agency than both low-risk sportspeople and low-activity controls who

will not differ significantly from one another. We further hypothesised that basic psychological need satisfaction (i.e., autonomy, competence, relatedness) will not discriminate between the two exercise groups (i.e., high-risk, low-risk). We hypothesised that both groups will report significantly greater basic psychological needs satisfaction than the low-activity control group.

Finally, we hypothesised that informant-ratings of coping effectiveness (i.e., performance and health) will be greater for rock-climbers than both low-risk sportspeople and low-activity controls who will not differ significantly from one another.

Method

Participants

We selected activity participants and their nominated informants from the Study 2 sample pool based on the demographic information that participants provided.

Rock-climbers were defined as individuals who had participated in traditional lead rock-climbing at least once a fortnight in the previous 12 months. We removed instructors from the rock-climbing sample as research has shown that high-risk sport instructors have a different risk-taking profile to individuals who take part in high-risk sports recreationally (Cazenave et al., 2007). Eighty-four activity participants met these criteria (70 men, 14 women; M_{age} = 32.73, SD = 12.02; $M_{years'\ participation}$ = 10.90, SD = 12.14).

Low-risk sportspeople were defined as individuals who had participated in a sport or physical activity with a low risk of death (e.g., badminton, running) at least once a fortnight in the previous 12 months. In addition, participants had not participated in activities defined as high-risk (e.g., surfing, kayaking) in the previous 12 months. Sixty-five activity participants met these criteria (24 men, 41 women; M_{age} = 27.25, SD = 12.60; $M_{years'\ participation}$ = 8.36, SD = 10.98).

Low-activity individuals were defined as individuals who had not participated in sport or physical activity in the previous 12 months. Individuals instead participated in a non-exercise recreational activity (e.g., reading, photography, playing musical instruments). Forty-five activity participants met these criteria (25 men, 20 women; M_{age} = 24.42, SD = 11.75; $M_{years'\ participation}$ = 12.29, SD = 9.25).

The informant sample consisted of 60 individuals (26 men, 34 women; M_{age} = 30.52, SD = 13.24; $M_{years\ known\ participant}$ = 8.35, SD = 9.78; $M_{hours\ per\ week\ with\ participant}$ = 46.21, SD = 44.44). We grouped informants based on the participant activity; 26 were informants for rock-climbers, 24 informants for low-risk individuals, and 10 informants for low-activity controls.

Measures

We used the same measures as Study 2, with the addition of two measures for the purpose of the Study 3 analyses.

Experience of emotion regulation and agency while participating. We used the six emotion regulation (e.g., "I have to deal with stressful situations") and six agency (e.g., "No one can force me to do something I don't want to do") items from the *while participation* inventory of the Sensation Seeking, Emotion Regulation, and Agency Scale (SEAS; Barlow et al., 2013). Items scored on a Likert scale ranging from 1 (*completely disagree*) to 7 (*completely agree*). Higher scores are indicative of greater experience during participation. Cronbach's alpha was 0.84 for emotion regulation and 0.74 for agency.

Personality. We used the Ten Item Personality Inventory (TIPI; Gosling, Rentfrow, & Swann, 2003), which measures the Big Five personality constructs of extraversion (e.g., "extraverted, enthusiastic"), conscientiousness (e.g., "dependable, self-disciplined"), openness to new experiences (e.g., "open to new experiences, complex"), emotional stability (e.g., "calm, emotionally stable"), and agreeableness (e.g., "sympathetic, warm"). The scale has two items for each of the five factors and one item for each factor is reverse scored. Items scored on a Likert scale ranging from 1 (*disagree strongly*) to 7 (*agree strongly*). Cronbach's alpha was 0.66 for extraversion, 0.34 for conscientiousness, 0.34 for openness to new experiences, 0.68 for emotional stability, and 0.24 for agreeableness.

Procedure

The procedure for the present study is as detailed in Study 2. The activity participants also completed a measure of personality and a measure regarding their experience of emotion regulation and agency while participating in their recreational activity. These measures were added for the purposes of Study 3 analyses. No additional data collection was required.

Statistical Analyses

We conducted separate univariate analyses of variance (ANOVAs) to compare the three groups (rock-climbers, low-risk sportspeople, low-activity controls) on self-report outcome ratings of self-esteem, sense of emotion regulation and agency, and self-report processes (experience of emotion regulation and agency while participating). We also examined the informant-rated coping effectiveness outcome ratings (i.e., performance, health) using separate ANOVAs. Univariate analyses were favoured over multivariate

analyses for the variables, as the dependent variables were not considered linear combinations of each other. We conducted Bonferroni post-hoc tests following significant ANOVA omnibus results, as group sizes were unequal. We analysed the self-report outcomes ratings of basic psychological needs satisfaction (autonomy, competence, relatedness) using multivariate analysis of variance (MANOVA) and multiple ANOVAs. Bonferroni post-hoc tests were conducted following significant MANOVA omnibus results.

We transformed the data when variances were identified as non-homogeneous to reduce variance heterogeneity before carrying out the analyses. We reflected the data before applying the relevant data transformation when distributions were identified as being negatively skewed. The specific transformation to be applied depended on the severity of the skewness, and was determined in accordance with recommendations by Tabachnick and Fidell (2013). We used Statistical Package for the Social Sciences (SPSS) software to conduct the analyses (SPSS version 20.0 for Windows).

We also used the Big Five personality traits as covariates to examine whether significant differences still held when controlling for personality characteristics. We conducted analysis of covariance (ANCOVA) for significant ANOVA results and multivariate analysis of covariance (MANCOVA) for significant MANOVA results.

Results

Correlations

The correlations are displayed in Table 6. Experience of agency during participation positively correlated with self-esteem, while difficulty with emotion regulation and diminished sense of agency negatively correlated with self-esteem. Experience of emotion regulation and agency during participation did not significantly correlate with either difficulty with emotion regulation or diminished sense of agency. Autonomy, competence, and relatedness positively correlated with self-esteem and negatively correlated with difficulty with emotion regulation and diminished sense of agency.

Experience of Emotion Regulation During Participation

ANOVA revealed a significant difference between the groups in the experience of emotion regulation during participation. Bonferroni post-hoc tests revealed that high-risk

Table 6

Correlations Between Self-Report Dependent Variables and Personality Covariates in Study 3 (n = 194)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Experience of emotion regulation during	.84												
2. Experience of agency during	.41***	.74											
3. Self-esteem	.01	.14*	.91										
4. Difficulty with emotion regulation	.04	-.12	-.60***	.87									
5. Diminished sense of agency	.01	-.12	-.57***	.69***	.83								
6. Autonomy	.01	.20**	.64***	-.42***	-.63***	.67							
7. Competence	.03	.16*	.67***	-.40***	-.52***	.66***	.72						
8. Relatedness	.05	.08	.52***	-.26***	-.35***	.58***	.62***	.80					
9. Extraversion	.04	.08	.33***	-.14	-.22**	.24**	.30***	.34***	.66				
10. Agreeableness	-.24**	-.17*	.12	-.13	-.19***	.18*	.14	.29***	-.18*	.24			
11. Conscientiousness	.06	.17*	.29***	-.18*	-.23**	.31***	.16*	.17*	.07	.08	.34		
12. Openness to experiences	.12	.19**	.17*	-.04	-.09	.18*	.22**	.22**	.30***	.02	-.04	.38	
13. Emotional stability	-.04	.14	.48***	-.57***	-.29***	.28***	.30***	.25***	.08	.09	.17*	.04	.68

Note. Standardised within groups. Coefficient alphas are in the diagonal. Experience of emotion regulation during and experience of agency during from Barlow et al. (2013) SEAS scale; Self-Esteem from modified Rosenberg Self-Esteem Scale (Rosenberg, 1965); Difficulty with emotion regulation and diminished sense of agency from modified between participation SEAS scale; autonomy, competence, and relatedness from modified Gagné (2003) Basic Psychological Needs Satisfaction - General; extraversion, conscientiousness, openness, emotional stability, and agreeableness from Gosling et al. (2003) Ten-Item Personality Inventory. * $p < .05$. ** $p < .01$. *** $p < .001$.

sportspeople reported significantly greater experience of emotion regulation while participating than both low-risk sportspeople ($p < .01$) and low-activity individuals ($p < .01$) who did not differ from each other ($p > .05$). See Table 7.

Experience of Agency During Participation

ANOVA revealed a significant difference between the groups in the experience of agency participation. Bonferroni post-hoc tests revealed that high-risk sportspeople reported significantly greater experience of agency while participating than both low-risk sportspeople ($p < .01$) and low-activity individuals ($p < .01$), who did not differ from each other ($p > .05$). See Table 7.

Self-Esteem

ANOVA revealed a significant difference between the groups in self-esteem. Bonferroni post-hoc tests revealed that high-risk sportspeople reported significantly greater self-esteem than both low-risk sportspeople ($p < .01$) and low-activity individuals ($p < .01$), who did not differ from each other ($p > .05$). See Table 7.

Sense of Emotion Regulation

ANOVA revealed a significant difference between the groups in difficulty with emotion regulation. Bonferroni post-hoc tests revealed that high-risk sportspeople reported significantly less difficulty with emotion regulation than both low-risk sportspeople ($p < .01$) and low-activity individuals ($p < .05$) who did not differ from each other ($p > .05$). See Table 7.

Sense of Agency

ANOVA revealed a significant difference between the groups in diminished sense of agency. Bonferroni post-hoc tests revealed that high-risk sportspeople reported significantly less diminished sense of agency than low-activity individuals ($p < .05$). There were no significant differences between high-risk sportspeople and low-risk sportspeople ($p > .05$), or low-risk sportspeople and low-activity individuals ($p > .05$). See Table 7.

Basic Psychological Needs Satisfaction

MANOVA revealed a significant difference in basic psychological needs satisfaction between high-risk sportspeople, low-risk sportspeople, and low-activity individuals. Follow up ANOVAs revealed a significant difference between groups in autonomy ($F_{2, 191} = 3.67$, $p < .05$), competence ($F_{2,191} = 5.04$, $p < .01$), and relatedness ($F_{2,191} = 3.43$, $p < .05$). Bonferroni post-hoc test revealed high-risk sportspeople reported significantly greater autonomy and competence than low-activity individuals (p's $< .05$) and low-risk sportspeople reported significantly greater relatedness than low-activity

Table 7

Differences Between Rock-Climbers, Low-Risk Sportspeople, and Low-Activity Controls for Self-Report Dependent Variables (n = 194)

Variable	High-Risk (n = 84)	Low-Risk (n = 65)	Low-Activity (n = 45)	Omnibus
Experience of emotion regulation	5.64 (1.03)[a]	3.87 (1.45)	3.99 (1.26)	$F_{2,191} = 48.22$, $p < .001$, $\eta^2 = 0.34$
Experience of agency	6.13 (0.61)[a]	5.29 (0.93)	4.91 (1.24)	$F_{2,191} = 29.95$, $p < .001$, $\eta^2 = 0.24$
Self-Esteem	31.44 (4.77)[a]	27.59 (6.30)	27.11 (6.77)	$F_{2,191} = 10.05$, $p < .001$, $\eta^2 = 0.10$
Difficulty with emotion regulation	3.54 (1.42)[a]	4.32 (1.48)	4.21 (1.55)	$F_{2,191} = 5.93$, $p < .01$, $\eta^2 = 0.06$
Diminished sense of agency	3.06 (1.28)[b]	3.56 (1.49)	3.74 (1.45)	$F_{2,191} = 4.21$, $p < .05$, $\eta^2 = 0.04$
Multivariate basic psychological needs satisfaction				
Autonomy	4.82 (0.80)[b]	4.76 (0.96)	4.39 (0.96)	
Competence	5.04 (0.99)[b]	4.64 (1.15)	4.47 (1.09)	$F_{6,378} = 3.37$, $p < .01$ Wilks' Λ = .90, $\eta^2 = 0.05$
Relatedness	5.33 (0.94)	5.40 (0.90)[b]	4.95 (1.06)	

Note. Data shown for high-risk, low-risk and low-activity controls are means and standard deviations (in parentheses)
[a] Significantly different than other two groups [b] Significantly different than the low-activity control group

controls ($p < .05$). No significant differences between high-risk sportspeople and low-risk sportspeople for autonomy, competence, and relatedness ($p's > .05$) emerged. No significant differences between low-risk sportspeople and low-activity individuals for autonomy and competence ($p's > .05$) emerged. See Table 7.

Coping Effectiveness – Performance

ANOVAs revealed no significant difference between groups in informant-rated coping effectiveness - performance. See Table 8.

Coping Effectiveness – Health

ANOVAs revealed no significant difference between groups in informant-rated coping effectiveness - health. See Table 8.

Covariates

The purpose of the covariate analyses was to examine whether significant differences between groups held when controlling for personality traits. The outcomes *self-esteem* and *competence* correlated with all personality traits except *agreeableness*, and a*utonomy* and *relatedness* correlated with all personality traits. The outcome *difficulty with emotion regulation* negatively correlated with *conscientiousness* and *emotional stability,* whilst the outcomes *diminished sense of agency* negatively correlated with all personality traits, except *openness. Experience of emotion regulation during participation* negatively correlated with *agreeableness,* whilst *experience of agency during participation* correlated with *agreeableness, conscientiousness*, and *openness*. Correlations of the personality covariates are displayed in Table 6.

ANOVAs revealed that rock-climbers reported significantly greater *emotional stability* than both low-risk sportspeople and controls. Rock-climbers also reported significantly greater *openness to experiences* than the low-risk sports group. See Table 9.

ANCOVAs revealed that significant differences between groups remained for *self-esteem, experience of emotion regulation during participation, and experience of agency during participation* when controlling for personality. For *difficulty with emotion regulation* and *diminished sense of agency*, analyses revealed that significant differences remained between groups when controlling for personality except for when controlling for *emotional stability*. MANCOVAs revealed that significant differences between groups remained for *basic psychological needs satisfaction* when controlling for personality. See Table 10.

Table 8

Differences Between Rock-Climbers, Low-Risk Sportspeople, and Low-Activity Controls for Informant Ratings of Coping Effectiveness – Performance and Coping Effectiveness - Health (n = 60)

Variable	High-Risk (n = 26)	Low-Risk (n = 24)	Low-Activity (n = 10)	Omnibus
Coping Effectiveness - Performance	5.08 (0.84)	4.90 (1.07)	4.76 (1.07)	$F_{2,57} = 0.45$, $p > .05$, $\eta^2 = 0.02$
Coping Effectiveness - Health	5.65 (0.95)	5.44 (1.10)	5.90 (1.30)	$F_{2,57} = 1.75$, $p > .05$, $\eta^2 = 0.06$

Note. Data shown for high-risk, low-risk and low-activity controls are means and standard deviations (in parentheses)

Table 9

Differences Between Rock-Climbers, Low-Risk Sportspeople, and Low-Activity Controls for Personality (n = 194)

Variable	High-Risk (n = 84)	Low-Risk (n = 65)	Low-Activity (n = 45)	Omnibus
Extraversion	4.36 (1.31)	4.10 (1.42)	3.92 (1.74)	$F_{2,191} = 1.46$, $p > .05$, $\eta^2 = 0.02$
Agreeableness	4.52 (1.20)	4.78 (1.14)	4.80 (1.18)	$F_{2,191} = 1.19$, $p > .05$, $\eta^2 = 0.01$
Conscientiousness	5.42 (1.09)	5.17 (1.28)	5.03 (1.16)	$F_{2,191} = 1.77$, $p > .05$, $\eta^2 = 0.02$
Emotional Stability	5.41 (1.14)[a]	4.44 (1.53)	4.44 (1.67)	$F_{2,191} = 10.40$, $p < .001$, $\eta^2 = 0.10$
Openness	5.42 (0.92)[b]	4.99 (1.25)	5.26 (1.08)	$F_{2,191} = 3.07$, $p < .05$, $\eta^2 = 0.03$

Note. Data shown for high-risk, low-risk and low-activity controls are means and standard deviations (in parentheses)
[a] Significantly different to other groups' [b] Significantly different to the low-risk group.

Table 10

Covariance Analyses for Significant Dependent Variables (n = 194)

Variable	Omnibus
Experience of emotion regulation during participation	
Extraversion	$F_{2,190} = 46.80$, $p < .001$, $\eta^2 = 0.33$
Agreeableness	$F_{2,190} = 46.45$, $p < .001$, $\eta^2 = 0.33$
Conscientiousness	$F_{2,190} = 46.43$, $p < .001$, $\eta^2 = 0.33$
Openness to experiences	$F_{2,190} = 44.98$, $p < .001$, $\eta^2 = 0.32$
Emotional stability	$F_{2,190} = 45.63$, $p < .001$, $\eta^2 = 0.32$
Experience of agency during participation	
Extraversion	$F_{2,190} = 28.38$, $p < .001$, $\eta^2 = 0.23$
Agreeableness	$F_{2,190} = 28.29$, $p < .001$, $\eta^2 = 0.23$
Conscientiousness	$F_{2,190} = 27.66$, $p < .001$, $\eta^2 = 0.23$
Openness to experiences	$F_{2,190} = 27.81$, $p < .001$, $\eta^2 = 0.23$
Emotional stability	$F_{2,190} = 23.02$, $p < .001$, $\eta^2 = 0.20$
Self-esteem	
Extraversion	$F_{2,190} = 8.60$, $p < .001$, $\eta^2 = 0.08$
Agreeableness	$F_{2,190} = 10.64$, $p < .001$, $\eta^2 = 0.10$
Conscientiousness	$F_{2,190} = 8.36$, $p < .001$, $\eta^2 = 0.08$
Openness to experiences	$F_{2,190} = 8.63$, $p < .001$, $\eta^2 = 0.08$
Emotional stability	$F_{2,190} = 3.09$, $p < .05$, $\eta^2 = 0.03$
Difficulty with emotion regulation	
Extraversion	$F_{2,190} = 5.23$, $p < .01$, $\eta^2 = 0.05$
Agreeableness	$F_{2,190} = 6.57$, $p < .01$, $\eta^2 = 0.06$
Conscientiousness	$F_{2,190} = 5.01$, $p < .01$, $\eta^2 = 0.05$
Openness to experiences	$F_{2,190} = 5.46$, $p < .01$, $\eta^2 = 0.05$
Emotional stability	$F_{2,190} = 0.47$, $p > .05$, $\eta^2 = 0.01$
Diminished sense of agency	
Extraversion	$F_{2,190} = 3.25$, $p < .05$, $\eta^2 = 0.03$
Agreeableness	$F_{2,190} = 5.16$, $p < .01$, $\eta^2 = 0.05$
Conscientiousness	$F_{2,190} = 3.15$, $p < .05$, $\eta^2 = 0.03$
Openness to experiences	$F_{2,190} = 3.75$, $p < .05$, $\eta^2 = 0.04$
Emotional stability	$F_{2,190} = 1.43$, $p > .05$, $\eta^2 = 0.02$
Basic psychological needs satisfaction	
Extraversion	$F_{6,376} = 2.99$, $p < .01$ Wilks' $\Lambda = .91$, $\eta^2 = 0.05$
Agreeableness	$F_{6,376} = 3.55$, $p < .01$ Wilks' $\Lambda = .90$, $\eta^2 = 0.05$
Conscientiousness	$F_{6,376} = 3.09$, $p < .01$ Wilks' $\Lambda = .91$, $\eta^2 = 0.05$
Openness to experiences	$F_{6,376} = 3.33$, $p < .01$ Wilks' $\Lambda = .90$, $\eta^2 = 0.05$
Emotional stability	$F_{6,376} = 2.51$, $p < .05$ Wilks' $\Lambda = .92$, $\eta^2 = 0.04$

Discussion

The purpose of Study 3 was to examine whether differences between groups (traditional rock climbing, low-risk sports, low-activity controls) existed in relation to the processes and outcomes of participation. For the participant data, the results in the present study largely supported the hypotheses. Rock-climbers reported significantly greater experience of emotion regulation and agency during participation than both low-risk sports participants and controls. They also reported significantly greater self-esteem and less difficulty with emotion regulation than both low-risk sports participants and controls. As hypothesised there were no significant differences between rock-climbers and low-risk sports participants on ratings of basic psychological needs satisfaction. Counter to the original hypotheses there were no differences between rock-climbers and low-risk sports participants on ratings of diminished sense of agency. For the informant data, the hypotheses were not supported. There were no significant differences between groups on informant-ratings of coping effectiveness - performance and coping effectiveness - health.

The results are in line with previous research that supports the association between outdoor activities and increases in self-esteem (Cason & Gillis, 1994; Hattie et al., 1997; Wilson & Lipsey, 2000). Furthermore, rock-climbers reported significantly less difficulty with emotion regulation than low-risk sports participants and controls. When considered in relation to previous research by Barlow and colleagues (2013) who examined difficulty with emotion regulation between participation, experience of emotion regulation during participation, and sense of emotion regulation after participation. The results in the present study could be misinterpreted as being the opposite to the findings of Barlow et al. (2013) as the authors found that high-risk sport participants reported greater difficulty with emotion regulation. However, in the present study responses related to a period of time when participants were regularly involved in high-risk sport, as opposed to a period of time when they were not regularly involved in high-risk sports (i.e., in Barlow et al., 2013). The results are closely aligned to the after participation results of the Barlow et al. (2013) studies in which mountaineers reported significantly greater emotion regulatory transfer than low-risk sport participants. The fact that rock-climbers reported less difficulty with emotion regulation than the other two groups, suggests that the beneficial emotion regulation outcomes outdoor sports provide can transfer from the high-risk sport domain back into everyday life.

Contrary to the hypotheses there were no differences between rock-climbers and low-risk sports participants in sense of agency. The theoretical underpinning to the present

study is that the experience of agency during participation would translate into rock-climbers reporting less diminished sense of agency (Barlow et al., 2013). The fact that both sport groups reported less diminished sense of agency than controls would suggest that both groups feel capable in exercising control over events that affect their lives (Bandura, 2006). However, as only the rock-climbers reported greater experience of agency during participation than the control group, the agentic outcome for rock-climbers could be attributed to the high-risk sports participants' greater experience of agency during participation.

Alternatively, the non-significant finding in sense of agency between rock-climbers and low-risk sportspeople could be due to the short duration of rock-climbing compared to previous sports examined using the agentic theoretical framework (i.e., mountaineering). For example, Barlow et al. (2013) found that while both mountaineers and skydivers reported a greater experience of agency during the activity, only the mountaineers reported significantly greater transfer than the control group. The experience of agency during participation in rock-climbing may be too short to lead to any transfer effects.

In line with previous research, rock-climbers reported significantly greater experience of emotion regulation and agency during participation than low-risk sports participants (Barlow et al., 2013). Rock-climbers were the only group to report significantly greater self-esteem and sense of emotion regulation than the control group. The findings suggest that the experiences of emotion regulation during participation are mechanisms by which changes in sense of emotion regulation and self-esteem occur. The findings are further supported by the fact that basic psychological need satisfaction did not differentiate between the two activity groups (i.e., high-risk and low-risk). Consequently, basic psychological need satisfaction cannot explain the differences in self-esteem and emotion regulation outcomes.

In the present study we examined coping outcomes in an exploratory fashion using the informant-rated measures developed in Study 1 and Study 2. The statistical analyses did not reveal any significant differences between the groups. Although high-risk sport participants may be more likely to have to deal with challenging situations during participation due to the risk and uncertainty associated with such sports (Breivik, 1996, 2010) this does not appear to impact on coping with stressful situations in everyday life. The results suggest that high-risk sportspeople are no different in terms of coping effectiveness – performance and coping effectiveness - health outcomes to low-risk sportspeople and controls. However, the effect sizes were small to medium (Cohen, 1988)

and direction of the means of the coping effectiveness – performance outcomes support the hypothesis suggesting that there may be some difference between the groups. In Study 1 and Study 2 the coping outcome measures demonstrated good psychometric properties. The absence of statistical differences could be due to a lack of statistical power due to the small informant sample. The coping measures are in their infancy. Further validity tests are required to confirm it is a valid and reliable measure.

When personality traits were taken into account, all results remained the same except for difficulty with emotion regulation and diminished sense of agency when emotional stability was controlled for. Rock-climbers reported greater emotional stability than low-risk sport people did, which is similar to the findings of Barlow et al. (2013) in which both mountaineers and skydivers reported significantly greater emotional stability than low-risk controls.

The findings in Study 3 suggest that the experience of emotion regulation and agency during participation in high-risk sports are potential mechanisms in which changes in other outcomes such as self-esteem occur. This is further highlighted by the fact that the differences in self-esteem cannot be explained by basic psychological needs satisfaction. In the present study we found no significant differences between groups in coping effectiveness - performance and coping effectiveness - health outcomes. However, these results are likely due to the small informant sample, as the results did reveal small to medium effect sizes. Overall, Study 3 provides useful insights into the potential mechanisms and outcomes associated with engaging in high-risk sports. The high-risk sport domain provides useful opportunities for individuals to experience emotion regulation and agency during participation, which consequently has a positive impact on their everyday functioning.

General Discussion

There are aspects associated with outdoor environments that are central to participation (e.g., challenge, risk; Breivik, 2010). Yet, scant research has explored the mechanisms that might underlie specific outcomes. The aim of the present research was to address the gap in the literature through examining the processes and outcomes most prevalent to participating in high-risk sports.

In Study 1 and Study 2, we developed and validated two new informant-rated measures of coping outcomes, as no suitable measure existed. We confirmed the factor structure for the informant-rated coping effectiveness – performance and coping effectiveness - health outcome measures in Study 1 and Study 2. We also confirmed the

factor structure of the modified versions of existing measures of emotion regulation and agency, self-esteem, and basic psychological needs satisfaction. In Study 3, we used the measures to examine the processes and outcomes associated with participating in high-risk sports, and compared them to the results of low-risk sport participants and low-activity controls. Study 3 revealed that certain experiences during participation (i.e., emotion regulation and agency) are unique to high-risk sports, and may explain differences in outcomes between groups (e.g., self-esteem).

The present research demonstrates that the experience during participation in high-risk sports is different to that of low-risk sports and other activities. High-risk sport participants experience a significantly greater degree of emotion regulation and agency during participation than other activities, which is in line with previous research (Barlow et al., 2013). Furthermore, the unique experiences that high-risk sports provide may explain why they report greater beneficial psychological outcomes (e.g., emotion regulation, self-esteem). This is further supported by the fact that basic psychological needs satisfaction, which is suggested to be essential to well-being (Deci & Ryan, 2000), did not differentiate between the two sport groups.

Implications, Limitations, and Directions for Future Research

The results have important implications for high-risk sport research. Whilst a plethora of research has examined the motives and outcomes of engaging in high-risk sport, scant research has examined the underlying processes that might yield such outcomes. Given that in the present study there were differences between the groups in both processes and outcomes, researchers should investigate the underlying mechanisms of engagement in conjunction with expected outcomes. In doing so we will develop a better understanding of what it is specifically about outdoor sports that allows participants to enjoy beneficial outcomes such as self-esteem. Such research will allow us to inform practitioners how to target more specifically the processes that are likely to yield such positive outcomes.

Although the measures are in their infancy, the coping outcome measures of coping effectiveness – performance and coping effectiveness - health have potential merit beyond the high-risk sport literature. With further validation, the measures could help to inform the coping literature in terms of the performance and health trade-off of coping. The measures are informant-rated, therefore can help to provide a useful insight into coping behaviours (Vazire, 2006). Informant reports are advantageous in the study of coping effectiveness outcomes as informants have often observed individuals' behaviours across a

number of situations in everyday life (McDonald, 2008). Furthermore, individuals may display behaviours of which they may not be aware (Vazire, 2006). Informants have the ability to provide an overall conception of the individual based on the behaviours they have observed (Vazire, 2006).

A limitation of the present research is the cross-sectional design of the study. Although the method allowed us to examine the prevalence of processes and outcomes in high-risk sports, causal inferences cannot be made regarding the data. Given that the results demonstrated that there were distinct differences between the groups, future research should examine the variables using an experimental study design. Such studies would allow us examination of the time-line from experiencing the processes to having beneficial outcome effects. Some outcomes (e.g., self-esteem, coping) are relatively stable traits and it may take some time or repeated exposure to lead to positive effects.

Conclusion

The findings in the present research provide useful insights into the potential mechanisms and outcomes associated with engaging in high-risk sports. In line with previous research, high-risk sport participants reported positive self-esteem benefits. The high-risk sport domain provides opportunities during participation (e.g., experience of emotion regulation) that are not prevalent in other activities (e.g., low-risk sports). Such opportunities have a positive impact on individuals' everyday functioning through gleaning a sense of control over their emotions and their lives during the activity.

Chapter 3

Wild Swimming: The processes and Outcomes of Swimming in Open Water

In every walk with nature one receives far more than he seeks.

- John Muir, 1877

Outdoor sports encompass a wide variety of activities with varying degrees of danger and risk associated with them (e.g., mountaineering, canoeing, surfing, hiking, mountain biking) (Brymer, 2010; Castanier et al., 2011; Kerr & Mackenzie, 2012). Initial involvement in such sports tends to take place in less risky and dangerous environments, progressing towards greater risk and danger as the individual advances within the sport (Barlow et al., 2015). For example, when individuals learn to rock-climb they start on a top-rope, and as they gain more experience individuals can choose to participate in riskier forms of rock-climbing such as traditional lead rock-climbing.

For many years, people who took part in outdoor sports were perceived as a homogenous risk-taking population (Zuckerman, 1979, 2007) whereby the purpose of participation was regarded to be little more than satisfaction of their need for varied, novel, and intense experiences (Zuckerman, 1994). In recent years researchers have explored the possibility that engaging in such sports may in fact have more far-reaching beneficial psychological effects, and thus researchers have viewed participation in outdoor sports in a more positive light (Barlow et al., 2013; Cazenave et al., 2007; Woodman et al., 2008).

Empirical research generally supports the beneficial outcomes of participating in outdoor sports (Hattie et al., 1997). For example, Willig (2008) reported that participating in high-risk sports had a positive impact on self-esteem and self-confidence. More recently, Barlow et al. (2013) found that participation in high-risk sports (e.g., mountaineering) lead to greater feelings of agentic emotion regulation in everyday life. Furthermore, in Study 3 rock-climbers reported less difficulty with emotion regulation and greater self-esteem. However, the types of outcomes previously examined are not exhaustive. For example, scant research has explored the degree to which participation in outdoor sports help individuals to effectively cope with stressors in everyday life.

Little research has explored the mechanisms that underpin the outcomes of participation in outdoor sports (Barlow et al., 2013). Identifying the mechanisms that underpin beneficial outcomes, would allow us to tailor participation in outdoor sports to maximise benefits. Risk and uncertainty is a common feature of all outdoor sports (Breivik, 1996), and may be key to understanding the link between the processes occurring during the activity and the subsequent outcomes.

Participation in outdoor sports evokes emotions that are typically more intense and more externalised than in everyday life (Castanier et al., 2011). Individuals have to deal with the emotions they experience during participation effectively, as emotion dysregulation in the outdoor domain could compromise safety. Individuals also have to take control of and dictate the course of their life (Barlow et al., 2013; Woodman et al., 2010), as not doing so in the outdoor domain could have serious consequences. Research suggests that emotion regulation and agency are important for mental health (Gross & Muñoz, 1995) and psychological well-being (Smith et al., 2000). Consequently, the experience of emotion regulation and agency during participation is important to consider in relation to the outcomes of participation, particularly as the experience of emotion regulation and agency during participation may influence psychological outcomes such as self-esteem.

Individuals are regularly confronted with opportunities to challenge themselves, allowing them to push their limits and discover new personal boundaries (Willig, 2008). Successful emotion regulation can diminish fear (Cisler, Olatunji, Feldner, & Forsyth, 2010) and effective emotional regulatory processes are fundamental to good mental health (Gross & Muñoz, 1995; Gross, 1998). Outdoor sports may provide an ideal opportunity for individuals to learn how to effectively regulate their emotions and successfully cope with change and uncertainty (Barlow et al., 2013). Recently researchers have shown that through prolonged participation outdoor sports (e.g., expeditionary mountaineering), individuals become more capable in managing and influencing their emotions, and the effects can transfer over into their everyday lives – benefiting their everyday functioning (Barlow et al., 2013).

The dynamic environment that nature provides is thus an important aspect to consider, particularly as many of the potential benefits of participating may be derived due to all these activities taking place in the outdoors. In the present study, we are interested specifically in the role that the environment plays on influencing psychological processes and outcomes, by comparing the effects of participating in the same sport indoors and outdoors.

The comparison between outdoor and indoor exercise settings has become the focus of a number of research studies in recent years (e.g., Gladwell et al., 2013; Pretty et al., 2005). In a systematic review of the effects on mental health and physical wellbeing of participating in physical activity in natural environments compared to physical activity

indoors, Thompson and colleagues (2011) reported that most studies included showed a positive improvement in outcome measures (e.g., self-esteem).

Although some studies have demonstrated positive mental health benefits relating to exercise in natural environments (Barton & Pretty, 2010; Bowler et al., 2010; Thompson et al., 2011) the element of danger and risk associated with outdoor environments versus the relatively safe and sterile indoor environment has had scant research attention. Studies typically examine the mental health outcomes of relatively safe activities such as walking or running in green spaces such as parks and nature reserves (e.g., Focht, 2009; Kerr et al., 2006; Pretty et al., 2005). The types of activities examined in previous research do not lend themselves well to explore the differences between outdoor and indoor environments from the emotion regulatory and agentic theoretical standpoint adopted in the present study.

The popularity of open water swimming in Britain has increased. A survey by H2Open Magazine estimates that from 2010 to 2011 the number of people taking part in outdoor swimming events doubled to over 44,000. Despite the recent growth, no studies to date have investigated the psychological processes or outcomes associated with swimming in natural aquatic environments. Open water swimming is an ideal milieu for the present study, as individuals are required to respond to an ever-changing environment with currents, unknown depths, wind, and waves, and consequently there is a degree of perceived risk associated with participating in the activity. Additionally, depending on route choice, open water swimming can involve committing crossings (e.g., across an inland bay, across a lake) where individuals can find themselves a considerable distance from land at times during participation. The outdoor swimming environment also shares some similarities with high-risk sport environments (e.g., rock climbing) in that it takes place in a dynamic setting, where environmental factors such as the weather can bring its own challenges to the activity (e.g., strong winds leading to the formation of waves on a lake).

In Study 3, we found that individuals regularly involved in high-risk sports reported a greater sense of control over their emotions and their lives as a consequence of participating in the activity, which then benefited their everyday functioning (see Chapter 2). The environmental factors associated with swimming in open water (e.g., unknown depths) means that individuals face challenges head on and deal with intense unpleasant emotions (e.g., fear; Barlow et al., 2013) during participation that they have to overcome in order to complete the swim. In gleaning a sense of control over challenging situations and their emotions during the open water swimming session individuals are likely to

develop strategies for dealing with challenges and uncertainty in everyday life, which will then positively impact well being outcomes such as self-esteem.

The three innate psychological needs for competence, autonomy, and relatedness are also important to consider in the context of the present study as according to self-determination theory (Deci & Ryan, 1985, 2002), need satisfaction is essential for psychological growth and well being (Deci & Ryan, 2000). The relationship between physical activity and psychological need satisfaction is documented in the literature (Wilson et al., 2006) and environments can either encourage or discourage need satisfaction (Deci & Ryan, 2000).

The need for competence is satisfied through mastering tasks in complex and challenging environments, and feeling effective in interacting with the environment (Ryan & Deci, 2000; White, 1959), which is a central feature of taking part in sports in outdoor environments (Willig, 2008). The need for autonomy is satisfied through the subjective experience of psychological freedom and choice during activity engagement (deCharms, 1968; Ryan & Deci, 2000). The dynamic outdoor environment forces individuals to make causal decisions during participation (Brymer & Schweitzer, 2013b). The need for relatedness is satisfied through developing close relationships with others (Baumeister & Leary, 1995; Ryan & Deci, 2000). The risks associated with the outdoor environment encourages individuals to work together in challenging circumstances and long-term engagement may encourage feelings of relatedness (Allman, Mittelstaedt, Martin, & Goldenberg, 2009).

In the present study, we do not expect basic psychological needs satisfaction to discriminate between the two exercise groups (i.e., open water swimming and pool swimming) as from a self-determination theory perspective (Deci & Ryan, 1985, 2002) physical activity generally, regardless of risk, should foster need satisfaction.

Hypotheses

The focus of the present study was to examine the role that the exercise environment plays in relation to the processes and outcomes of participation in outdoor sports. Specifically, we hypothesised that due to the challenges that are inherent in open water (e.g., waves, currents), individuals swimming in a natural aquatic environment would report greater experience of emotion regulation and agency during the activity than individuals swimming in an indoor pool swimming environment.

Furthermore, we hypothesised that the open water-swimming group would report a decrease in difficulty with emotion regulation and agency, and greater self-esteem

following a six-week swimming program compared to individuals swimming in an indoor swimming pool. Additionally, we hypothesised that the effects would be retained at three-month follow-up. We hypothesised that there would be no differences between the two groups on basic psychological needs satisfaction.

In relation to the informant-ratings, we hypothesised that informants would report that individuals in the open water-swimming group would demonstrate greater coping effectiveness (i.e., performance and health) following the six-week swimming program than individuals in the indoor pool-swimming group. We also hypothesised that the effects would be retained at three-month follow-up.

Method

Participants

We recruited 24 individuals who had not previously participated in open water swimming and who did not participate in sports regarded as high risk (e.g., rock climbing). We matched participants for age and gender and randomly assigned them to either swimming in a natural lake or in an indoor swimming pool (Figure 1). We provided the swimming sessions free of charge and a monetary reward of £40 was given upon completion of the study. We assigned 12 individuals to the indoor pool-swimming group (3 men, 9 women; M_{age} = 27.58, *SD* = 8.26) and 12 individuals to the open water-swimming group (2 men, 10 women; M_{age} = 26.50, *SD* = 6.71). Twenty participants completed the post-intervention and three-month follow-up questionnaires.

Participants nominated one informant who completed questionnaires about them during the study. Informants (M_{age} = 28.04, *SD* = 8.62) consisted of: partners (*n* = 16), friends (*n* = 6), relatives (*n* = 1), or co-workers (*n* = 1). Informants had known participants for a mean of 6.52 years (*SD* = 8.62) and had regular contact with participants (everyday *n* = 19; four or more times a week *n* = 4; two or three times a week *n* = 1). We offered informants a monetary reward of £20 upon completion of the study.

Measures

Experience of emotion regulation and agency while participating. We used the six emotion regulation (e.g., “I have to deal with stressful situations”) and six agency (e.g., “No one can force me to do something I don’t want to do”) items from the *while participation* inventory of the Sensation Seeking, Emotion Regulation, and Agency Scale

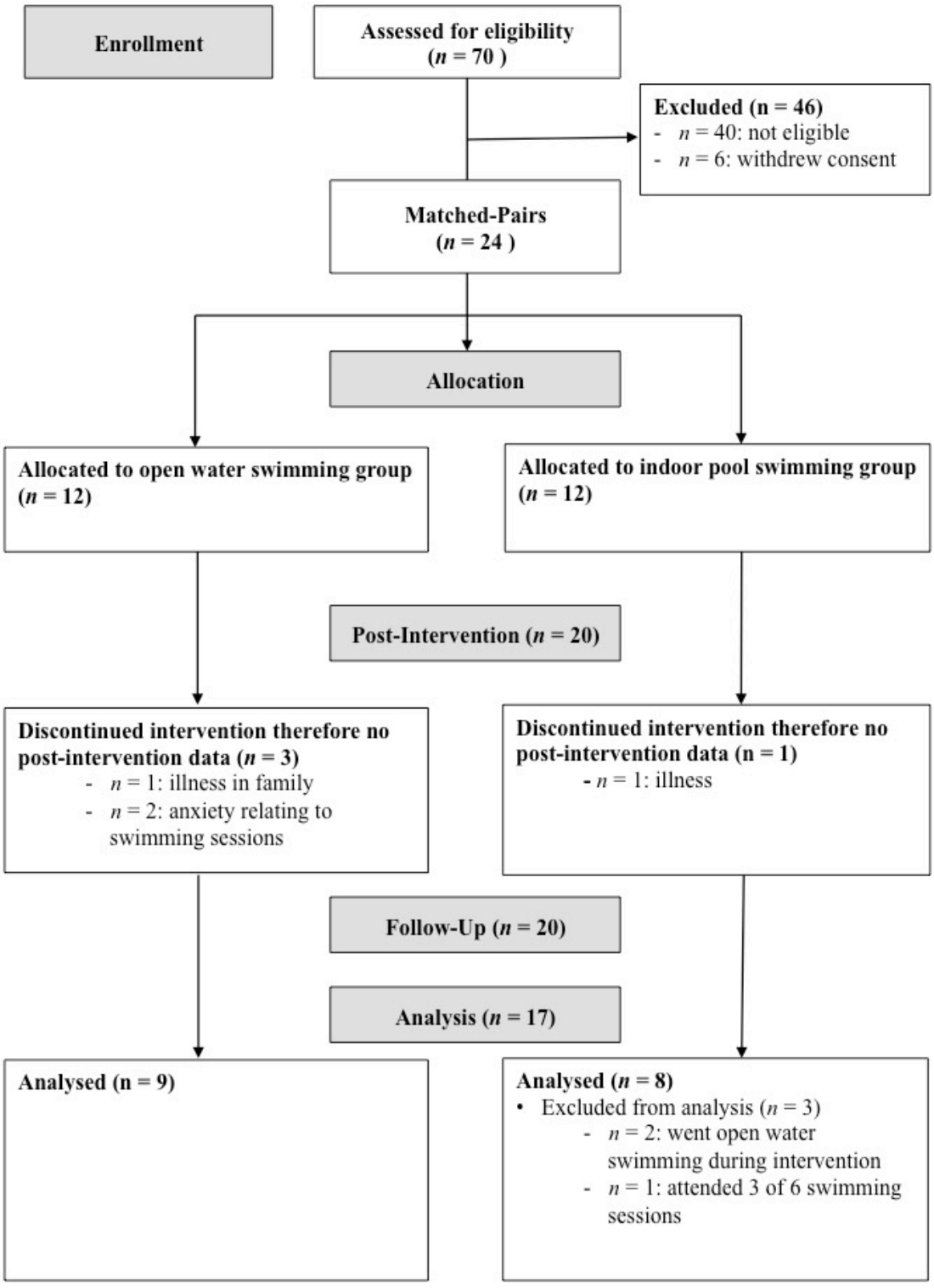

Figure 1. Flow of participants through each stage of the study

(SEAS; Barlow et al., 2013). Items scored on a Likert scale ranging from 1 (*completely disagree*) to 7 (*completely agree*). Higher scores are indicative of greater experience during participation. Cronbach's alpha for the current study was 0.52 and 0.76 for emotion regulation and agency respectively for week one, 0.72 and 0.83 for week two, 0.59 and 0.90 for week three, 0.80 and 0.87 for week four, 0.77 and 0.75 for week five, and 0.75 and 0.76 for week six.

Sense of emotion regulation and agency. We used the six emotion regulation (e.g., "The emotional elements of my life have been difficult to deal with") and six agency (e.g., "I have felt like people or circumstances have been trying to impose limits on me") items from the *between participation* inventory of the Sensation Seeking, Emotion Regulation, and Agency Scale (SEAS; Barlow et al., 2013) that we modified in Study 1 (Chapter 2). Items scored on a Likert scale ranging from 1 (*completely disagree*) to 7 (*completely agree*). Higher scores are indicative of greater difficulty with emotion regulation and diminished sense of agency. The scale was shown to be psychometrically sound in Study 1 and Study 2 (Chapter 2). Cronbach's alpha for the current study was 0.87 and 0.88 for emotion regulation and agency respectively for pre-test, 0.95 and 0.96 for post-test, and 0.90 and 0.90 for three-month follow-up.

Self-esteem. We used the Rosenberg Self-Esteem Scale (RSES; Rosenberg, 1965), which comprises 10-items (e.g., "At times, I have thought I am no good at all") that we modified in Study 1 (Chapter 2). Items scored on a Likert scale from 1 (*strongly disagree*) to 4 (*strongly agree*). The scale contains an equal number of positively and negatively worded items. Higher scores are indicative of a higher level of self-esteem. Cronbach's alpha for the current study was 0.82 for pre-test, 0.85 for post-test, and 0.90 for three-month follow-up.

Basic psychological needs satisfaction. We used the 21-item Basic Psychological Needs Satisfaction – General (BPNS-G; Gagné, 2003) that we modified in Study 1 (Chapter 2). The measure comprises seven autonomy items (e.g., "I have felt that I was free to decide for myself how to live my life"), six competence items (e.g., "In my life I have not had much of a chance to show how capable I am"), and eight relatedness items (e.g., "I have really liked the people I have interacted with"). Nine of the 21 items are negatively worded. Items scored on a Likert scale ranging from 1 (*not at all true*) to 7 (*very true*). Higher scores are indicative of a higher level of satisfaction of needs. Cronbach's alpha for the current study was 0.53, 0.68 and 0.82 for autonomy, competence,

and relatedness respectively for pre-test, 0.64, 0.45, and 0.91 for post-test, and 0.78, 0.47, and 0.87 for three-month follow-up.

Personality. We used the Ten Item Personality Inventory (TIPI; Gosling et al., 2003), which measures the Big Five personality constructs of extraversion (e.g., "extraverted, enthusiastic"), conscientiousness (e.g., "dependable, self-disciplined"), openness to new experiences (e.g., "open to new experiences, complex"), emotional stability (e.g., "calm, emotionally stable"), and agreeableness (e.g., "sympathetic, warm"). The scale has two items for each of the five factors and one item for each factor is reverse scored. Items scored on a Likert scale ranging from 1 (*disagree strongly*) to 7 (*agree strongly*). Cronbach's alpha was 0.86 for extraversion, 0.67 for conscientiousness, 0.45 for openness to new experiences, 0.72 for emotional stability, and 0.22 for agreeableness.

Coping effectiveness – performance. We used the nine-item informant-rated coping effectiveness – performance scale developed in Study 1 (Chapter 2) to assess the behavioural outcome of coping (e.g., "Person X is able to maintain a high level of performance effectiveness in everyday life, when he/she has had a setback"). Items scored on a Likert scale ranging from 1 (*never)* to 7 (*always)*. Higher scores are indicative of a higher level of coping effectiveness. Cronbach's alpha for the current study was 0.90 for pre-test, 0.91 for post-test, and 0.93 for three-month follow-up.

Coping effectiveness – health. We used the 11-item informant-rated coping health scale developed in Study 1 (Chapter 2) to assess the health costs of coping (e.g., "Person X is able to maintain a high level of personal health in everyday life, when he/she has had important upcoming deadlines") across time. Items scored on a Likert scale ranging from 1 (*never)* to 7 (*always)*. Higher scores are indicative of a higher level of coping effectiveness. Cronbach's alpha for the current study was 0.96 for pre-test, 0.92 for post-test, and 0.95 for three-month follow-up.

Procedure

We recruited participants via advertisements placed in the local area. We invited eligible individuals to an introductory session to inform them of the study procedures and to obtain informed consent. We checked current health status to minimise the risk of medical problems due to the exercise sessions (see Appendix L). We asked participants to nominate an informant for the study who would complete informant-rated coping effectiveness outcome (i.e., performance, health) measures about them. We emailed participants a link to the first set of self-report psychological measures (i.e., personality, emotion regulation and agency, basic psychological needs satisfaction, self-esteem). We

matched participants for age and gender before randomly assigning them to one of two swimming conditions for the duration of the study (i.e., swimming in an indoor swimming pool, or swimming in a natural lake outdoors). Participants attended a group swimming session once per week for six consecutive weeks. The sessions took place on a weekday evening between 6pm and 7pm. We split participants into two groups as the total number of people in the study exceeded the number of people that each venue could accommodate. The sessions took place during a 10-week period (mid-July 2014 to mid-September 2014).

The *open water swimming* sessions took place on a natural lake in Snowdonia National Park. Participants swam for approximately 40 minutes at a self-selected speed. A local outdoor pursuits company provided equipment (e.g., swim specific wetsuit, goggles, swim cap) and safety cover (i.e., kayak assistance) for the sessions. The outdoor pursuits instructor gave participants a safety brief at the start of the first session. The swimming routes on the lake varied from week to week to better represent the dynamic and varied nature of swimming in natural aquatic environments (see Appendix M). Due to weather conditions on a couple of occasions the routes varied slightly between the two sessions. We recorded group time in the water, distance covered, and swim route for each session using the iPhone Strava GPS Tracker App. We also recorded the weather for each session. The average air temperature for the sessions was 16.75°C (range 13°C – 20°C) and the average wind speed 8.67 mph (range 6-18 mph).

The *pool swimming* sessions took place in a local indoor swimming pool. We put in place lane dividers to mimic a typical lane swimming session. Participants swam for approximately 40 minutes at a self-selected speed. We made available goggles and a swim cap, and a pool lifeguard was present throughout the session. We recorded group time in the water and distance covered by each participant in each session for safety.

Participants retrospectively completed the emotion regulation and agency while participating inventory within 10-15 minutes after each swimming session. Upon completion of the six swimming sessions, we emailed participants the same set of self-report psychological measures (except the personality measure) that they had completed pre-intervention. We emailed participants a minimum of 48 hours after the final swimming session. Three months after the final swimming session we emailed participants again with the final set of psychological measures. The sequence in which we administered the measures was the same on all occasions. We emailed informants the coping effectiveness – performance and coping effectiveness – health measures at the same time as participants.

Power Calculation and Statistical Analysis

We conducted power analyses before commencing the study using G*Power (Version 3.1; Faul, Erdfelder, Lang, & Buchner., 2007). It was estimated that we needed 28 participants at 80% power, to detect a medium effect size (Cohen, 1988). We conducted statistical analyses using Statistical Package for the Social Sciences (SPSS) version 20. We used independent-samples *t*-tests to check for equivalence between groups on demographic and outcome measures at pre-intervention. We conducted mixed-model analyses of variance (ANOVAs) to evaluate the effect of swimming environment on psychological mechanisms and outcomes across time between the two groups. Where analyses revealed differences at pre-intervention we conducted mixed-model analyses of covariance (ANCOVAs). Effect sizes were represented as partial η^2 and we used Cohen's (1988) guidelines for interpretation. Stevens (2009) suggests that where group sizes are small ($n \leq$ 20) one should consider using a more liberal α level (.10 or .15) to improve power.

We conducted multiple imputation (MI) analyses using the Multiple Imputation by Chained Equations (MICE) package (version 2.22) in R statistics (version 3.1.2) to replace missing item-values for the *whilst participating* SEAS scale (Barlow et al., 2013). In accordance with recommendations by Enders (2011) we created 20 imputed datasets with 20 iterations. The default imputation method predictive mean matching was used as it imputes values that are more plausible than other methods (Heitjan & Little, 1991; Schenker & Taylor, 1996). We imported the multiple imputed data into SPSS and performed mixed model ANOVAs. As there are no methods for pooling ANOVAs conducted with multiply imputed data sets in SPSS (van Ginkel & Kroonenberg, 2014) we computed the pooled ANOVA results using the procedure and SPSS syntax developed by van Ginkel (2014). The procedure allows the results to be combined according to Rubin's (1976) rules (Rubin, 1976) and uses effect coding to run the ANOVA as a regression analysis (Edwards, 1985; van Ginkel & Kroonenberg, 2014).

Results

Characteristics of the Study Sample

The distribution of the study participants is shown in Figure 1. Baseline characteristics of the 17 participants included in the statistical analyses are displayed in Table 11. The open water swimming group and indoor pool swimming group did not differ significantly with regard to age, gender, the number of occasions they went indoor pool swimming in the preceding 12 months, exercise duration, or personality. Results for each

Table 11

Baseline Characteristics of Study Participants Included in Analyses (n = 17)

Characteristics	Open Water (*N* = 9) N or Mean ± *SD*	Indoor Pool (N = 8) N or Mean ± *SD*	*df*	*T*	Sig	*d*
Age (years)	24.33 ± 4.44	26.75 ± 8.24	15	0.77	.46	0.37
Gender, male	2	2	15	0.13	.90	0.07
Gender, female	7	6				
Exercise duration (minutes)	51.67 ± 26.10	75.00 ± 48.11	15	1.26	.23	0.60
Exercise intensity						
Low	4	2	15	0.28	.78	0.14
Moderate	4	6				
Vigorous	1	0				
Exercise frequency						
Once per week	3	0				
2 – 3 times per week	2	5	10.59	0.14	.89	0.07
4 – 5 times per week	1	3				
> 5 times per week	3	0				
Pool swimming (number of occasions in past 12 months)	5.33 ± 5.32	6.25 ± 7.13	15	0.30	.77	0.15
Personality						
Extraversion	4.61 ± 1.65	4.81 ± 1.71	15	0.25	.81	0.12
Agreeableness	5.00 ± 0.90	5.06 ± 0.94	15	0.14	.89	0.07
Emotional stability	4.61 ± 1.34	4.63 ± 1.25	15	0.02	.98	0.02
Openness	5.39 ± 0.78	5.06 ± 1.08	15	0.72	.48	0.35
Conscientiousness	5.11 ± 1.45	6.06 ± 0.56	10.59	1.82	.10	0.86

Note. Personality measured using the Ten-Item Personality Inventory from Gosling et al. (2003).

analysis are reported in Table 11. The groups differed significantly at pre-test with regard to difficulty with emotion regulation. The groups did not differ significantly at pre-test with regard to all other outcome measures. The results are displayed in Table 12. The assumptions of all analyses conducted were satisfied for the present data set. The open water swimming ($M_{distance}$ = 5394.75 meters, *SD* = 396.11) and the indoor pool swimming ($M_{distance}$ = 5392.40 meters, *SD* = 1772.51) groups did not differ significantly in terms of the total swimming distance covered over the course of the intervention $t(4.25) = .01$, $p =$ > .05.

Experiences During the Swimming Sessions

Experience of emotion regulation and agency during participation. We conducted separate mixed-model ANOVAs to compare scores of the experience of agency and emotion regulation during participation between open water swimmers and indoor pool swimmers across the six swimming sessions. The pooled (van Ginkel & Kroonenberg, 2014) analyses revealed there were no significant group main effects or interactions for experience of emotion regulation ($p > .10$) or experience of agency ($p >$ .10) during the swimming sessions. There was a significant main effect for time on experience of agency during participation such that both groups reported increased experience of agency during participation across the swimming sessions. There was no main effect for time on experience of emotion regulation. Means, standard deviations, and results for each ANOVA are reported in Table 13.

Outcomes of Swimming in Different Environments

Sense of emotion regulation. To control for differences at pre-test, we conducted a mixed-model ANCOVA to compare scores of difficulty with emotion regulation between open water swimmers and indoor pool swimmers across three time periods (pre-intervention, post-intervention, three-month follow-up). Figure 2 illustrates the means across time. The analysis revealed no significant main effects ($p > .10$). There was a significant group-by-time interaction ($p < .05$). Bryant-Paulson post hoc comparisons indicated that the open water swimmers reported significantly greater difficulty with emotion regulation post-intervention than participants in the indoor pool-swimming group ($p < .05$). The analyses indicated no significant differences between the groups at three-month follow-up ($p > .05$). Original means, standard deviations, and analyses results are displayed in Table 14.

Table 12

Means, Standard Deviations, and t-test Results for Open Water Swimmers and Pool Swimmers on Outcome Measures Pre-Intervention (n = 17)

Variable	*n*	Open Water	Pool	*T*	*df*	Sig	*d*
Self-esteem	17	31.00 ± 3.87	28.63 ± 5.53	1.04	15	.32	0.50
Diminished sense of agency	17	2.52 ± 1.08	2.94 ± 1.77	0.57	11.32	.57	0.29
Difficulty with emotion regulation	17	2.80 ± 1.15	2.80 ± 1.15	2.12	15	.05*	1.05
Satisfaction of the need for autonomy	17	4.68 ± 0.78	4.68 ± 0.78	0.62	15	.55	0.30
Satisfaction of the need for competence	17	4.68 ± 0.78	4.68 ± 0.78	1.53	15	.15	0.74
Satisfaction of the need for relatedness	17	5.29 ± 0.72	5.29 ± 0.72	0.96	15	.35	0.46
Informant-rated coping effectiveness - performance	17	4.96 ± 0.92	4.72 ± 1.12	0.49	15	.63	0.24
Informant rated coping effectiveness - health	17	5.26 ± 1.18	4.97 ± 1.11	0.53	15	.60	0.26

Note. Self-esteem from modified version of Rosenberg (1965) Rosenberg Self-Esteem Scale; diminished sense of agency and difficulty with emotion regulation from modified Barlow et al. (2013) SEAS between participation inventory; satisfaction of the need for autonomy, competence, and relatedness from modified version of Gagné (2003) Basic Psychological Needs Satisfaction – General; informant-rated coping effectiveness - performance and coping effectiveness - health from new scales developed in Study 1.
* $p < .10$.

Table 13

Summary of Means, Standard Deviations, and Time by Group Mixed Model Analysis of Variance on Multiply Imputed Data for Experience of Emotion Regulation and Agency During the Swimming Sessions (n = 17)

Variable	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Omnibus	
Experience of emotion regulation							T	$F(5, 72.85) = 1.12$, $p = .36$
Open Water	4.15 ± 0.93	4.24 ± 1.32	4.56 ± 1.07	5.56 ± 1.35	4.48 ± 1.40	4.31 ± 1.44	G	$F(1,13.29) = 0.18$, $p = .68$
Pool	3.81 ± 1.03	4.21 ± 0.91	4.31 ± 0.68	4.08 ± 0.78	4.42 ± 0.72	4.38 ± 0.47	T x G	$F(5, 72.4) = 0.39$, $p = .86$
Experience of agency							T	$F(5, 73.02) = 5.80$, $p < .001$
Open Water	4.89 ± 1.14	5.19 ± 1.18	5.56 ± 1.33	6.04 ± 0.63	6.00 ± 0.70	6.05 ± 0.38	G	$F(1, 13.32) = 1.63$, $p = .22$
Pool	4.71 ± 1.02	5.04 ± 0.93	5.25 ± 0.79	4.97 ± 0.94	5.72 ± 0.81	5.40 ± 0.90	T x G	$F(5, 73.01) = 1.21$, $p = .31$

Note. Multiply imputed data (m = 20). T = Time. G = Group. Experience of emotion regulation and experience of agency from Barlow et al. (2013) SEAS while participating measure.

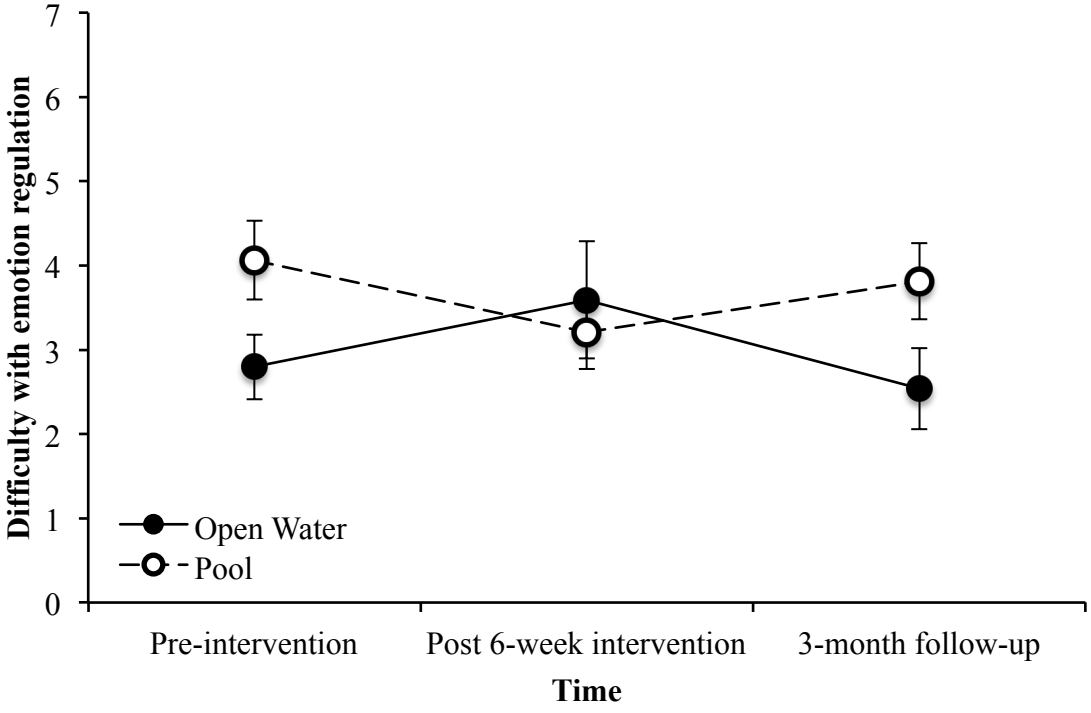

Figure 2. Means relating to difficulty with emotion regulation for each group across time. Error bars represent standard errors.

Table 14

Summary of Means, Standard Deviations, and Time by Group Mixed Model Analysis of Variance for Self-Esteem, Diminished Sense of Agency and Mixed Model Analysis of Covariance for Difficulty with Emotion Regulation Self-Report Outcomes (n = 17)

Variable	Pre-Intervention	Post-Intervention	3-Month Follow-Up		Omnibus
Self-esteem				T	$F(2,30) = 0.51$, $p = .60$, $\eta^2 = .03$
Open Water	31.00 ± 3.87	29.44 ± 5.46	30.78 ± 6.53	G	$F(1, 15) = 0.27$, $p = .61$, $\eta^2 = .02$
Pool	28.63 ± 5.53	32.13 ± 5.06	27.50 ± 6.35	T x G	$F(2,30) = 1.93$, $p = .16$, $\eta^2 = .11$
Diminished sense of agency				T	$F(1.21, 18.09) = 0.14$, $p = .76$, $\eta^2 = .01$
Open Water	2.52 ± 1.08	2.87 ± 1.98	2.50 ± 1.49	G	$F(1, 15) = 0.26$, $p = .62$, $\eta^2 = .02$
Pool	2.94 ± 1.77	2.60 ± 1.77	3.31 ± 1.18	T x G	$F(1.21, 18.09) = 1.03$, $p = .34$, $\eta^2 = .06$
Difficulty with emotion regulation [a]				T	$F(1, 14) = 1.96$, $p = .18$, $\eta^2 = .12$
Open Water	2.80 ± 1.15	3.59 ± 2.09	2.54 ± 1.44	G	$F(1, 14) = 0.35$, $p = .57$, $\eta^2 = .02$
Pool	4.06 ± 1.32	3.21 ± 1.23	3.81 ± 1.27	T x G	$F(1, 14) = 6.05$, $p < .05$, $\eta^2 = .30$

Note. T = Time, G = Group. Self-esteem from modified version of the Rosenberg Self-Esteem Scale (Rosenberg, 1965); diminished sense of agency and difficulty with emotion regulation from modified Barlow et al. (2013) SEAS between participation inventory.
[a] = Mixed-Model ANCOVA

Need for competence. We conducted a mixed-model ANOVA to compare scores on satisfaction of the need for competence between open water swimmers and pool swimmers across three time periods (pre-intervention, post-intervention, three-month follow-up). Figure 3 illustrates the differences in satisfaction of the need for competence across time. The analysis indicated no significant main effects ($p > .10$). There was a significant group by time interaction ($p < .05$). Tukey's post hoc comparisons indicated that the open water-swimming group significantly decreased in satisfaction of the basic psychological need for competence from pre-intervention to post-intervention ($p < .05$). There was no significant change from post-intervention to three-month follow-up ($p > .05$). Conversely, the indoor pool-swimming group significantly increased in satisfaction of the need for competence from pre-intervention to post-intervention ($p < .05$), and significantly decreased in satisfaction of the need for competence from post-intervention to three-month follow-up ($p < .05$). Means, standard deviations, and analyses results are displayed in Table 15.

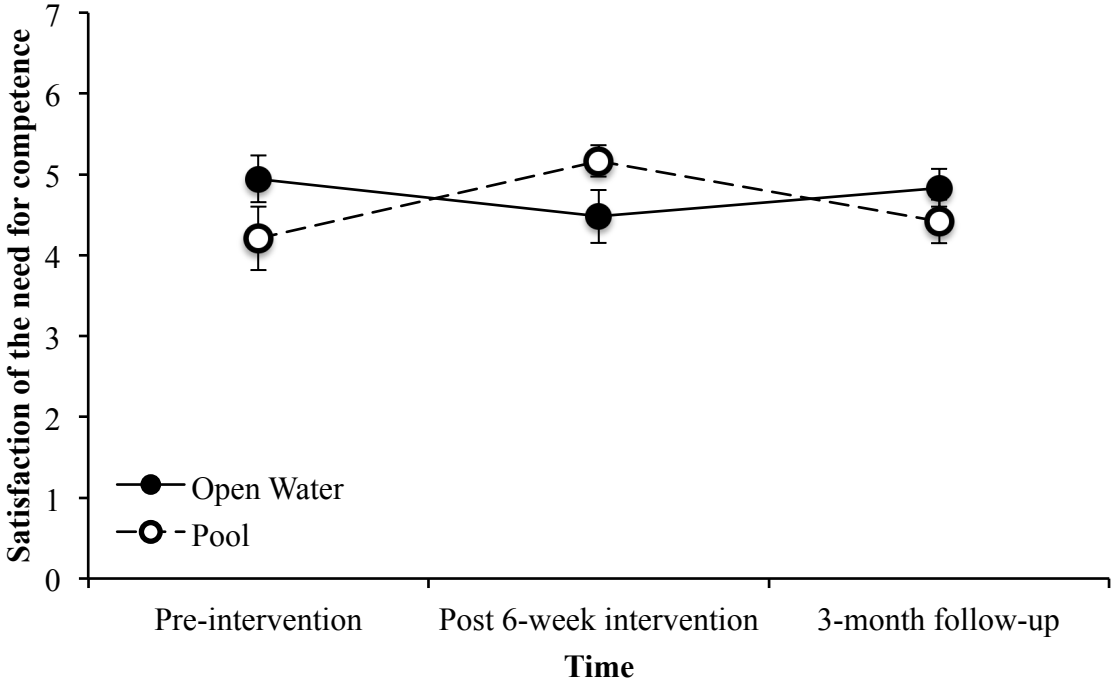

Figure 3. Means relating to satisfaction of the need for competence for each group across time. Error bars represent standard errors

Table 15

Summary of Means, Standard Deviations, and Time by Group Mixed Model Analysis of Variance for Satisfaction of the Need for Autonomy, Competence, and Relatedness Self-Report Outcomes (n = 17)

Variable	Pre-Intervention	Post-Intervention	3-Month Follow-Up	Omnibus	
Satisfaction of the need for autonomy				T	$F(2,30) = 0.82$, $p = .45$, $\eta^2 = .05$
Open Water	4.68 ± 0.78	4.67 ± 0.89	4.89 ± 1.22	G	$F(1, 15) = 0.05$, $p = .83$, $\eta^2 = .00$
Pool	4.43 ± 0.92	4.96 ± 1.01	4.59 ± 0.79	T x G	$F(2,30) = 1.26$, $p = .30$, $\eta^2 = .08$
Satisfaction of the need for competence				T	$F(2,30) = 0.71$, $p = .50$, $\eta^2 = .05$
Open Water	4.94 ± 0.87	4.48 ± 0.99	4.83 ± 0.70	G	$F(1, 15) = 0.23$, $p = .64$, $\eta^2 = .02$
Pool	4.21 ± 1.12	5.17 ± 0.55	4.42 ± 0.77	T x G	$F(2,30) = 5.75$, $p < .05$, $\eta^2 = .28$
Satisfaction of the need for relatedness				T	$F(2,30) = 0.12$, $p = .89$, $\eta^2 = .01$
Open Water	5.29 ± 0.72	5.07 ± 0.63	5.44 ± 0.88	G	$F(1, 15) = 0.50$, $p = .49$, $\eta^2 = .03$
Pool	4.81 ± 1.30	5.23 ± 1.78	4.70 ± 1.25	T x G	$F(2,30) = 2.35$, $p = .11$, $\eta^2 = .14$

Note. Satisfaction of the need for autonomy, competence, and relatedness from modified version of Gagné (2003) Basic Psychological Needs Satisfaction – General

Self-esteem, sense of agency, need for autonomy, and need for relatedness. We conducted separate mixed-model ANOVAs to compare the self-report outcomes between open water swimmers and indoor pool swimmers across three time periods (pre-intervention, post-intervention, three-month follow-up). The analyses revealed no significant main effects or interactions for self-esteem ($p > .10$), diminished agency ($p > .10$), satisfaction of the need for autonomy ($p > .10$), or satisfaction of the need for relatedness ($p > .10$). Means, standard deviations, and analyses results are displayed in Table 14 and Table 15.

Informant-rated coping effectiveness outcomes (performance, health). We conducted separate mixed-model ANOVAs to compare the informant-rated coping outcomes between open water swimmers and indoor pool swimmers across three time periods (pre-intervention, post-intervention, three-month follow-up). The analyses revealed no significant main effects or interactions for informant-rated coping effectiveness - performance ($p > .10$), and informant-rated coping effectiveness - health ($p > .10$). Means, standard deviations, and analyses results are displayed in Table 16.

Pattern of results. Despite these non-significant interactions it is worth noting the consistent pattern of results across dependent variables, particularly as the interaction patterns resemble the other (statistically significant) findings in the present study. The open water swimmers report greater diminished sense of agency than the pool swimmers post-intervention (see Figure 4), which is similar to the pattern of results for the significant difficulty with emotion regulation finding (see Figure 2). The open water swimmers also reported decreased self-esteem (see Figure 5) and less satisfaction of the need for autonomy (see Figure 6) and relatedness (see Figure 7) than the pool swimmers post-intervention, which is similar to the pattern of results for the significant the need for competence finding (Figure 3).

Discussion

The present study sought to examine the role that the environment plays on influencing psychological processes and outcomes by comparing the effects of participating in the same sport indoors and outdoors. The theoretical standpoint adopted in the present study is that the environmental factors and risks associated with outdoor environments (e.g., changing weather conditions) means that individuals are confronted with challenges during participation. The challenges associated with participation evoke intense unpleasant emotions (e.g., fear; Barlow et al., 2013) and experiences during

Table 16

Summary of Means, Standard Deviations, and Time by Group Mixed Model Analysis of Variance for Informant-Rated Coping Outcomes (n = 17)

Variable	Pre-Intervention	Post-Intervention	3-Month Follow-Up		Omnibus Test
Informant-rated coping effectiveness - performance				T	$F(1.33, 20.01) = 0.05$, $p = .89$, $\eta^2 = .00$
Open Water	4.96 ± 0.92	5.12 ± 0.96	5.04 ± 1.26	G	$F(1, 15) = 0.57$, $p = .46$, $\eta^2 = .04$
Pool	4.72 ± 1.12	4.67 ± 0.89	4.76 ± 0.78	T x G	$F(1.33, 20.01) = 0.16$, $p = .76$, $\eta^2 = .01$
Informant-rated coping effectiveness - health				T	$F(2,30) = 0.03$, $p = .97$, $\eta^2 = .00$
Open Water	5.26 ± 1.18	5.40 ± 0.82	5.38 ± 0.96	G	$F(1,15) = 1.16$, $p = .30$, $\eta^2 = .07$
Pool	4.97 ± 1.11	4.82 ± 0.77	4.93 ± 0.95	T x G	$F(2,30) = 0.26$, $p = .77$, $\eta^2 = .02$

Note. Informant-rated coping effectiveness - performance and coping effectiveness - health from new scales developed in Study 1.

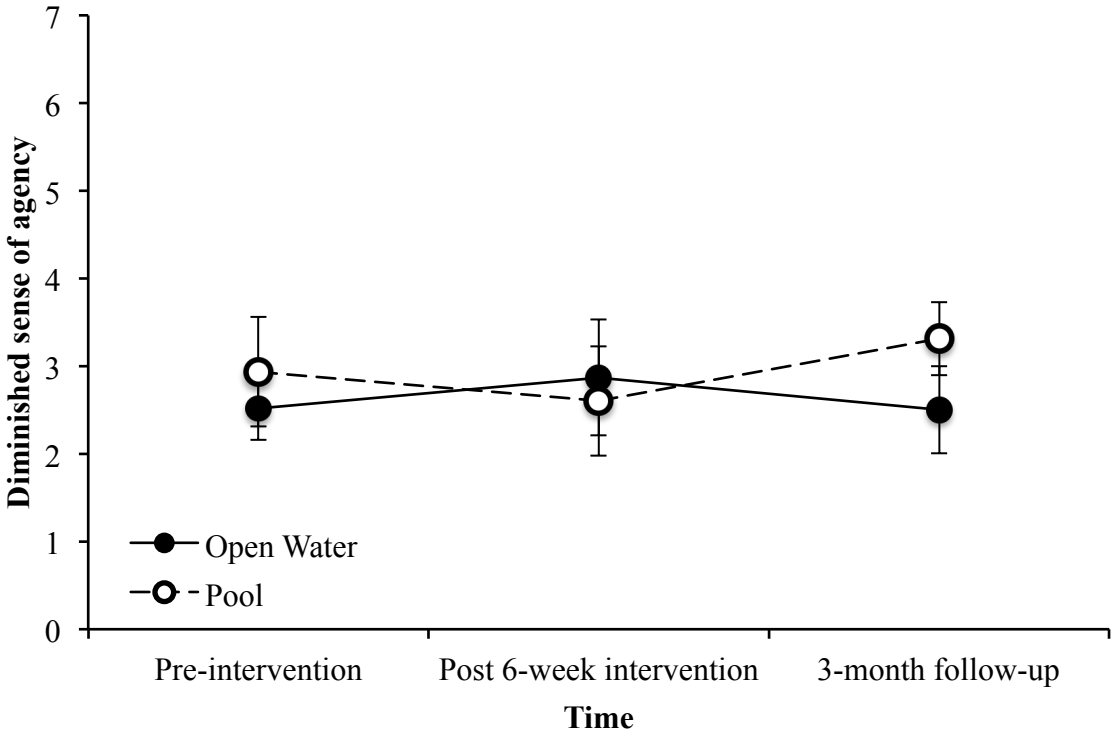

Figure 4. Means relating to diminished sense of agency for each group across time. Error bars represent standard errors.

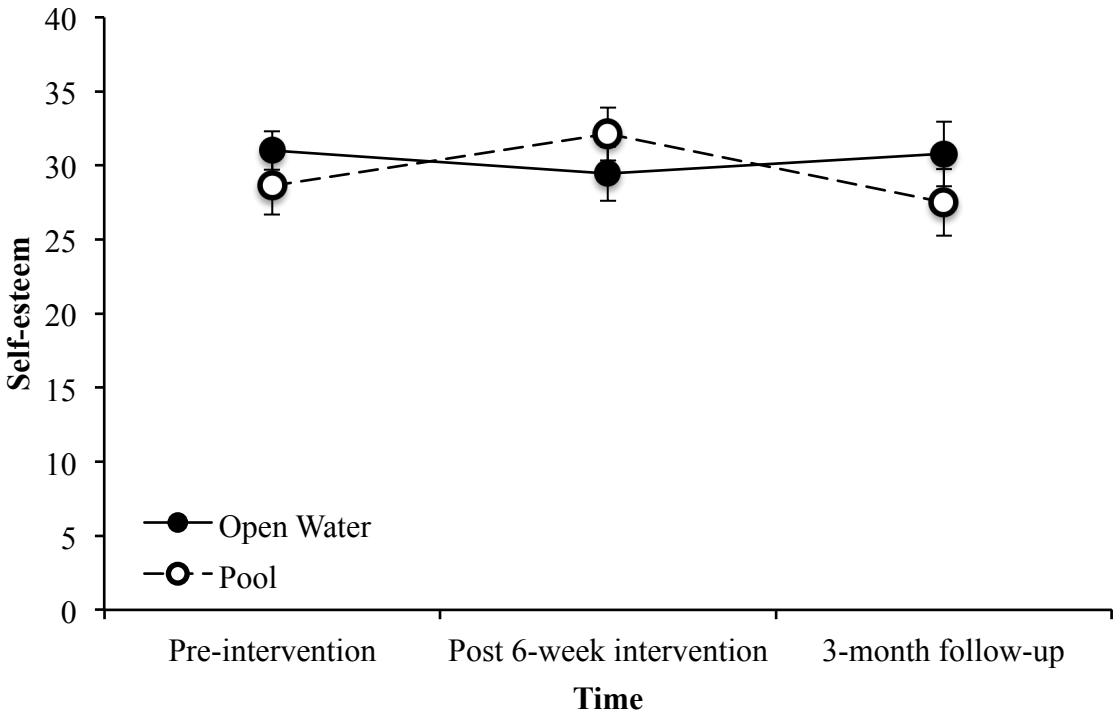

Figure 5. Means relating to self-esteem for each group across time. Error bars represent standard errors.

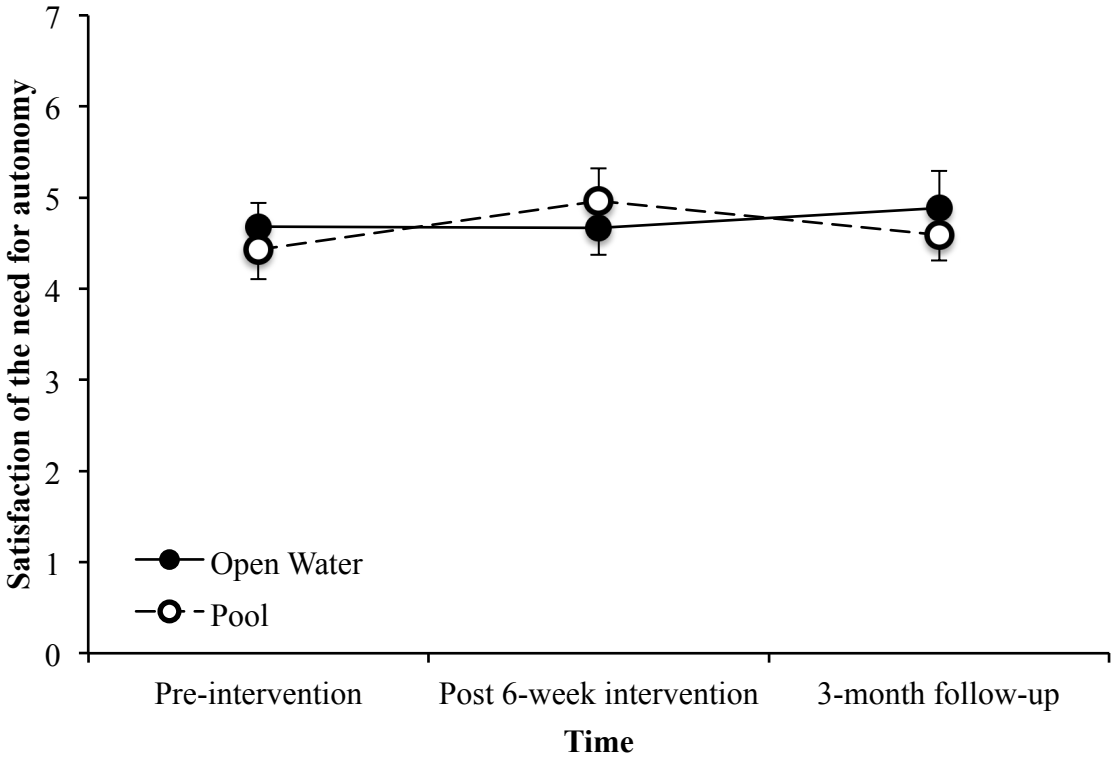

Figure 6. Means relating to satisfaction of the need for autonomy for each group across time. Error bars represent standard errors.

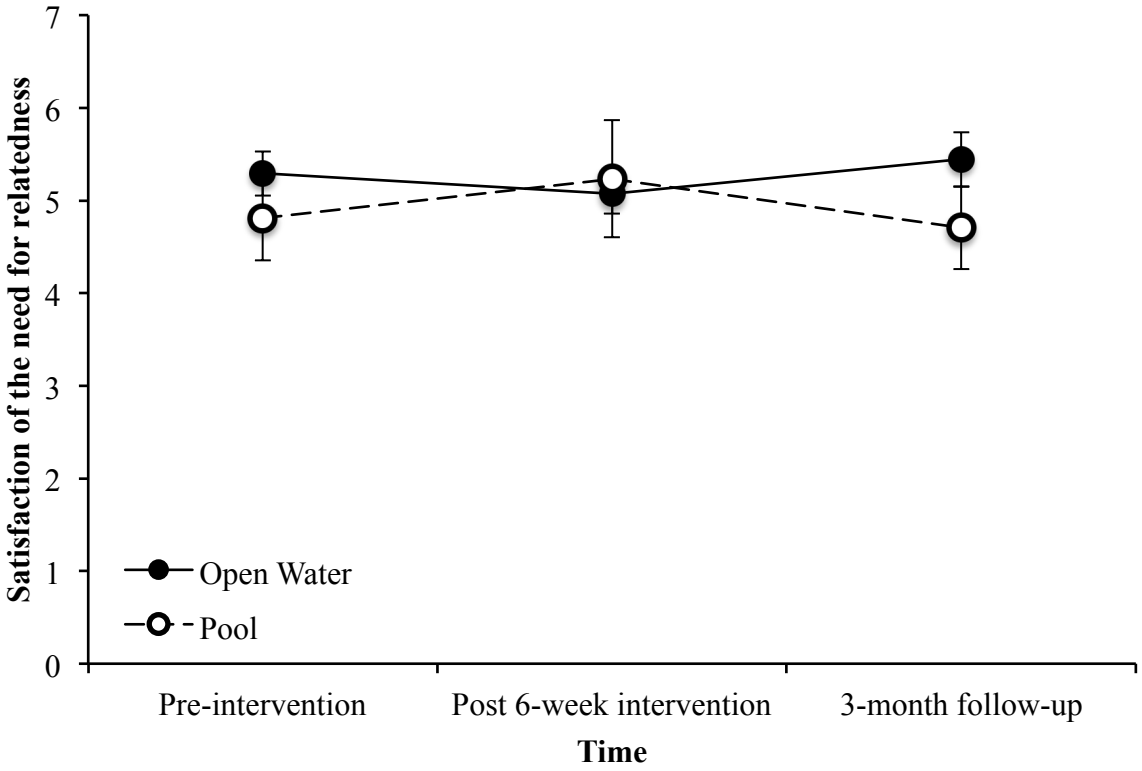

Figure 7. Means relating to satisfaction of the need for relatedness for each group across time. Error bars represent standard errors.

participation that individuals have to overcome in order to participate safely in the activity. Through regular involvement in outdoor sports, individuals develop strategies for dealing with challenges and uncertainty in outdoor environments that can transfer into everyday life, positively impacting well being outcomes such as self-esteem. Indoor environments in comparison are safe, sterile environments with stable environmental conditions, and challenge and uncertainty is not a feature (Breivik, 2010). Consequently, individuals participating in sports in indoor environments are unlikely to derive the same benefits, as individuals do not experience the same degree of challenge and intense emotions during participation.

We originally hypothesised that due to the challenges that are inherent in open water environments (e.g., waves, currents), the open water swimmers would report greater experience of emotion regulation and agency during the activity than the indoor pool swimmers. Furthermore, we hypothesised that following a six-week swimming intervention open water swimmers would report significant benefits (i.e., decrease in difficulty with emotion regulation and agency, greater self-esteem, and greater informant-rated coping effectiveness). Additionally, we hypothesised that the effects would be retained at three-month follow-up. We expected no differences to emerge regarding basic psychological need satisfaction. Counter to our original hypotheses the pattern of results revealed that the open water swimmers reported greater difficulty than the indoor pool swimming group. The open water swimmers reported greater difficulty with emotion regulation, diminished sense of agency, and reduced self-esteem following the six-week swimming intervention. The results also revealed differences in basic psychological needs satisfaction. The open water swimmers reported less satisfaction of the need for autonomy, competence, and relatedness following the six-week swimming intervention. It should be noted that only two of these interactions were statistically significant (i.e., difficulty with emotion regulation, satisfaction of the need for competence).

When the consistent pattern of results is considered together with the two significant findings, they reflect the reality of engaging in sports in outdoor environments. The pattern of results suggest that when we initially take part in outdoor sports we experience a period of psychological distress, an episode that challenges us psychologically. The results are consistent with the view that the dynamic nature of the outdoor environment challenges individuals (Willig, 2008). It may be that individuals have not yet had adequate time to learn to effectively deal with the experience of intense emotions (e.g., fear; Castanier et al., 2011) and successfully overcome the challenges

associated with outdoor environments. Previous research has focused on individuals regularly engaged in sports in outdoor environments with many years of experience dealing with and overcoming challenges (Barlow et al., 2013; Woodman et al., 2010). It may take a longer period of involvement for positive outcomes to be apparent, and for the transfer into everyday life to be evident.

However, it is possible that the study was not a true reflection of participation in outdoor sports, as we found no significant differences between the groups on experience of emotion regulation and agency during the swimming sessions. The constraints or limits of the research study may have meant that we did not tap into outdoor sport participation *per se* because of the contrived nature of the experience. Factors such as the weather influence when outdoor sport participants choose to participate and their choice of venue for the activity. For example, a white water kayaker can only participate in their sport when the rivers have sufficient water in to paddle. Unlike typical recreational outdoor sport participants, individuals in the present study attended a swimming session at a set time and set venue each week.

Open water swimming could be considered a lower-risk sport when compared to other sports previously examined using the emotion regulation and agency framework (e.g., rock climbing, mountaineering; Study 3; Barlow et al., 2013). Such sports are regarded as high-risk as they are "sports where you have to reckon with the possibility of serious injury or death as an inherent part of the activity" (Breivik, 1999, p. 10). One of the attractions of high-risk sports is that they allow individuals to experience the easily identifiable and intense externally derived emotion of fear (Barlow et al., 2013; Castanier et al., 2011; Fenichel, 1939) and successful emotion regulation can diminish fear (Barlow et al., 2013; Cisler et al., 2010).

Due to the lower-risk nature of open water swimming, the participants in the present study may not have experienced the emotion fear, or enough of the emotion fear, to warrant a noticeable need to regulate that emotion during the activity. This is reflected in the data, as we found no significant differences between groups on the experience of emotion regulation and agency during the activity. Furthermore, without the experience of emotions such as fear during the activity, individuals are unlikely to perceive that they are an acting agent of those emotions. When comparing the means attained in the present study for emotion regulation and agency during the activity to previous studies (Study 3; Barlow et al., 2013) the means are similar to those reported for low-risk sports. Thus, in

the present study emotion regulation and agency during the activity were similar to that of someone engaging in a low-risk sport.

Limitations and Future Research Directions

It is possible that there was not sufficient time for individuals to derive benefits of participating in outdoor environments, particularly as the data suggests that individuals experience an initial period of psychological distress when participating in a new outdoor sport. Studies that have measured similar constructs (e.g., Study 3; Barlow et al., 2013) included individuals who had participated in outdoor sports for many years. In the present study the swimming activity was relatively novel and short-lived (i.e., six swimming sessions, one week apart) in comparison to previous studies, and may explain why individuals did not derive benefits from participation. Future research should consider following individuals over a longer period (e.g., twelve months), as such studies would provide valuable insights as to the time point when individuals start to benefit psychologically from participation.

Second, the determinant of successful achievement is less clear in the open water sessions. In the pool sessions, the individuals are in the same environment as the previous week and through counting the number of lengths that they swim each week they are able to measure their achievement against previous weeks. Likewise, in other outdoor sports such as rock-climbing, there is a clear goal, which is to get to the top of a climb. The open water swimmers in the present study may have experienced challenge without subsequent achievement or reward. This was reflected in the data in the present study as counter to hypotheses the open water swimmers experienced greater difficulty with emotion regulation and less satisfaction of the need for competence than the indoor pool swimmers following the swimming intervention. For example, the group sessions meant that it was apparent when individuals were slower swimmers than other members of the group. If the route selected involved swimming to the other side of the lake and back, the faster swimmers would overtake the slower swimmers and would be swimming back towards the start before the slower swimmers had reached the other side, or be waiting for the other swimmers to catch up.

The incorporation of transformational leadership (Bass & Avolio, 1993) in the open water swimming sessions may have made clearer what determined successful achievement. For example, one of the components of transformational leadership is individual consideration, which refers to demonstrating concern for the needs and feelings of followers (Bass & Avolio, 1993). In a situation where one swimmer in the group is

notably slower than the rest of the group, a transformational leader may alter the task or route so that it best meets the need of the individual members and the group as a whole. Such as, suggesting stronger swimmers use an alternative swimming stroke, focusing on improving the swimming technique of the slower swimmers, or suggesting two alternative routes finishing at the same place. This is an aspect worthy of future research.

Finally, there was potentially a lack of statistical power in the present study to determine significant differences between groups. The stable nature of some of the traits assessed (e.g., coping) means that we found small effects for some of the outcome variables. The coping effectiveness – performance and coping effectiveness – health outcomes both had small effect sizes. A priori power analyses indicated that $N = 28$ was required to differentiate medium effect sizes, with this value increasing for smaller effect sizes. To address this we followed Stevens's (2009) recommendations of using a more liberal α level (.10 or .15) to improve power when group sizes are small ($n \leq 20$). However, even at the more liberal α level of .15 an $N = 110$ would be required to detect smaller effects. Although the statistical power was somewhat lacking, the data conforms to a consistent pattern of results in the opposite direction to the original hypotheses. One could argue that the consistent pattern of data in the opposite direction was meaningful as it reflects the difficulties that individuals face when initially participating in an outdoor sport. As stated previously, it may take a longer period of involvement for positive outcomes to be apparent, and for the transfer into everyday life to be evident. Future studies should consider larger samples to allow more confidently for statistical inferences regarding this pattern to be possible.

Conclusion

The findings of the current study contribute to the growing number of research studies exploring psychological aspects associated with participating in outdoor sports. Although the findings in the present study do not support our original hypotheses, a consistent pattern of results emerged from the data that suggests that initial involvement in outdoor sports may challenge us psychologically. When considered in the context of previous research it may be that it is through longer-term involvement in outdoor sports that individuals develop greater resilience and benefit from participating. Future research should consider the timeline of involvement in outdoor sports, following individuals from initial involvement through to longer-term engagement.

Chapter 4

General Discussion

The present chapter summarises the theoretical underpinnings and empirical findings of the research program. This is followed by a discussion of the key theoretical implications of the research, recommendations for future research, and strengths and limitations of the thesis.

Theoretical Underpinning

Outcomes. The opportunities for growth and development that participation in outdoor sports could provide has been of interest to researchers for a number of years (Crompton & Sellar, 1981; Hattie et al., 1997). Researchers have found that participation in outdoor sports positively influences a number of outcomes (e.g., self-esteem; Hattie et al., 1997). However, research findings are mixed due to considerable variability in the quality of the research conducted (Gibson, 1979; Hattie et al., 1997). Furthermore, the outcomes previously explored in the context of outdoor sports are not exhaustive. For example, scant research has examined whether participation in outdoor sports influences individuals' ability to regulate emotions (Barlow et al., 2013). Emotion regulation is a worthy outcome to examine, particularly as outdoor sport participants have to cope with anxiety and intense emotions during participation (Breivik, 2010; Castanier et al., 2011). Other outcomes that have received little research attention include the influence of participation in outdoor sports on individuals' sense of agency, satisfaction of basic psychological needs, and individuals' ability to cope effectively with stressors.

Underlying mechanisms. Few studies have examined how specific outcomes are achieved (Hattie et al., 1997; McKenzie, 2000). We know from the research literature that engaging in outdoor activities has a positive impact on outcomes such as self-concept, but we do not understand what specifically occurs during participation that influences these outcomes. The need for studies which examine the processes underlying specific outcomes was recognised over thirty years ago (Ewert, 1983). However, current understanding is largely based on theoretical explanations (e.g., facing challenges during participation) as opposed to empirical research (McKenzie, 2000). A clear gap in current knowledge exists that warrants research attention. If we are able to identify what factors lead to specific outcomes (e.g., experiences during participation, the outdoor environment), outdoor activities can be tailored to maximise their effectiveness (McKenzie, 2000).

Outdoor sports take place in dynamic environments that have unique characteristics and features (e.g., changing weather conditions) and outdoor sports inherently involve a

degree of challenge, risk, and uncertainty (Breivik, 1999). Consequently, individuals participating in outdoor sports experience intense emotions such as anxiety and fear during participation (Barlow et al., 2013; Castanier et al., 2011). In order to safely participate, individuals have to take control of their emotions (i.e., regulate their emotions) and dictate the course of action in the face of adversity (i.e., feel agentic) (Bandura, 2006; Barlow et al., 2013; Gross, 1998).

Experiencing emotion regulation and agency is essential during participation in outdoor sports, as failing to do so could have life-threatening consequences (Barlow et al., 2013; Breivik, 1999). Researchers have recently found that the experience of emotion regulation and agency during participation is unique to high-risk sports (Barlow et al., 2013). Furthermore, research suggests that emotion regulation and agency are important for mental health (Gross & Muñoz, 1995) and psychological well-being (Smith et al., 2000). They are important constructs to consider in relation to outcomes of participating in outdoor sports, as they may be a mechanism to which changes in outcomes such as self-esteem occur.

Purpose of the Thesis

The thesis set out to explore the underlying processes and outcomes associated with participation in outdoor sports. The research examined emotion regulation, agency, self-esteem, coping effectiveness, and basic psychological need satisfaction as outcomes of participation in outdoor sports. The research also sought to examine the experience of emotion regulation and agency during participation as underlying mechanisms of some of the aforementioned outcomes (e.g., self-esteem).

Empirical Findings

The main empirical findings were summarised within the respective empirical chapters. This section will synthesised the research findings in relation to the purpose of the research program.

Outcome measures. Due to a lack of suitable measure in the existing literature, one of the aims of Chapter 2 was to develop and validate two new informant-rated measures of coping effectiveness outcomes (Study 1 and Study 2). A nine-item measure of *coping effectiveness – performance* was developed and measures the behavioural outcome of coping (i.e., whether the individual is able to maintain a high level of performance effectiveness when faced with adversity). An 11-item measure of *coping effectiveness – health* was also developed, which measures the health effects of coping (i.e., whether the individual is able to maintain a high level of personal health when faced with adversity).

Fit indices confirmed that both measures fitted the data well following item removal in Study 1.

A second aim of Chapter 2 was to assess the psychometric properties of modified versions of existing self-report outcome measures (Study 1 and Study 2) with respect to the populations of interest in Study 3. Fit indices indicated adequate fit for all measures following removal of poorly fitting items.

Outcome variables. The final study of Chapter 2 utilised the modified self-report and newly developed informant-rated measures to test the hypothesised differential outcomes of rock-climbing, low-risk sport, and controls. The results revealed that rock-climbers reported significantly less *difficulty with emotion regulation* and greater *self-esteem* than both the low-risk sports and low-activity control group. Rock-climbers also reported less *diminished agency* than the low-activity control group. No significant differences existed in *basic psychological needs satisfaction* between the two physical activity groups (rock-climbing, low-risk sport). No significant differences existed in informant-rated *coping effectiveness – performance* and *coping effectiveness – health.* The findings in Chapter 2 provide useful insights into the potential mechanisms and outcomes associated with engaging in high-risk sports. The high-risk sport domain provides opportunities during participation (e.g., experience of emotion regulation) that are not prevalent in other activities (e.g., low-risk sports). Such opportunities have a positive impact on individuals' everyday functioning.

One of the aims of Chapter 3 was to examine the role that the exercise environment plays in relation to the outcomes of participation in outdoor sports. We conducted an experimental study whereby participants swam either outdoors in a natural lake or indoors in a swimming pool once a week for six consecutive weeks. The pattern of results indicated that the open water swimmers experienced greater difficulty (i.e., increased difficulty with emotion regulation) than the indoor pool swimmers as a consequence of participating in the intervention, which was counter to the original hypotheses. The pattern of results reflect the reality of engaging in sports in outdoor environments, that is that when individuals initially take part in outdoor sports they experience a period of psychological distress, an episode that challenges them psychologically. When the results of Study 4 are considered in relation to the results of Study 3 in Chapter 2 where participants had engaged in outdoor sports recreationally for a number of years. The positive outcomes of participation in outdoor sports become apparent through perseverance and longer-term exposure to challenges and difficulties in outdoor sports.

Process variables. A second aim of Chapter 2 (Study 3) and Chapter 3 was to explore the experience of emotion regulation and agency as underlying mechanisms associated with the outcomes of participation in outdoor sports. In Chapter 2 this was explored in relation to the high-risk sport traditional rock climbing, and in Chapter 3 this was explored in relation to the outdoor sport open water swimming. The results in Study 3 provide evidence that the *experience of emotion regulation and agency* during rock climbing is related to the positive outcomes of participating in outdoor sports (i.e., *increased self-esteem, greater sense of emotion regulation*). The results revealed that the *experience of emotion regulation and agency* during participation is unique to high-risk sports (i.e., rock climbing). There were no differences in the *experience of emotion regulation and agency* between open water swimming and indoor pool swimming, suggesting that the emotion regulatory and agentic mechanisms are only prevalent in some outdoor sports (i.e., high-risk outdoor sports).

Theoretical Implications

In line with recent theoretical and empirical developments regarding high-risk sport participation (see Barlow et al., 2013; Woodman et al., 2010), the present results suggest that the experience of emotion regulation and agency during participation is unique to high-risk sports. The results also provide evidence to suggest that in overcoming the challenges inherent to high-risk sports, individuals can derive positive psychological benefits (i.e., increased self-esteem, greater sense of emotion regulation). Thus, the experience of emotion regulation and agency during participation are likely mechanisms via which changes in some outcomes of outdoor sports occur (e.g., self-esteem). Few studies to date have explored the underlying mechanisms relating to specific outcomes of outdoor sports. The research program highlights that researchers should consider the mechanisms underlying specific outcomes, as opposed to focusing solely on outcomes.

The research also has potential theoretical implications regarding self-determination theory (Deci & Ryan, 1985, 2002). According to the theory satisfaction of the three innate psychological needs for competence, autonomy, and relatedness are essential for psychological growth and wellbeing (Deci & Ryan, 2000). In the present research rock-climbers reported significantly greater self-esteem than low-risk sportspeople, however no significant differences in basic psychological needs satisfaction between the two groups emerged. The present research challenges the view that basic psychological needs satisfaction is essential for psychological well being, as the

differences in self-esteem between the two physical activity groups could not be explained by basic psychological need satisfaction.

Finally, the results indicated that short-term participation in outdoor sports can have a negative impact on psychological outcomes, particularly when individuals have no prior experience of the outdoor sport. The findings have important theoretical implications, as the results are contrary to previous research that advocates the benefits of short-term participation in outdoor programs involving participation in outdoor sports (e.g., Outward Bound; Hattie et al., 1997). Furthermore, the results revealed that the short-term difficulty individuals' encounter during participation leads to beneficial outcomes through long-term participation.

Recommendations for Future Research

Consider underlying mechanisms. The present research program has highlighted the prevalence of some of the mechanisms and outcomes associated with participation in outdoor sports (e.g., rock-climbing). However, this research is very much in its infancy. Researchers should consider examining mechanisms along with the associated outcomes in future research, so that we can better understand what factors cause changes in outcomes. Examining only outcomes limits the expansion of research knowledge relating to outdoor sport participation. The present research identified the experience of emotion regulation and agency during participation as important mechanisms worthy of further research. More researchers should seek to explore the processes and outcomes of participation in high-risk sports using randomised control approaches.

Who benefits from participating in outdoor sports? Previous research has explored the outcomes of outdoor sports in relation to individuals recreationally engaged in an outdoor sport for a number of years, and positive outcomes are typically reported. The results in the present research indicate that when individuals initially engage in an outdoor sport (e.g., open water swimming) having not participated in the sport before, they experience a period of psychological distress (Study 4). It is through longer-term engagement in outdoor sports (Study 3) that individuals glean benefits from participation. It is not clear from the results in the present research or previous research at what point individuals start to derive positive benefits from participation. Future research would do well to conduct longer-term studies that examine at what point individuals start to derive the positive benefits (e.g., increased self-esteem).

Furthermore, given that individuals experience psychological challenges during early participation (and throughout involvement), it would be interesting to explore what

factors differentiate individuals who choose to pursue participation in spite of the challenge, and individuals who discontinue participation. Previous research has tended to examine individuals as a collective (Hattie et al., 1997). However, there may be individual variability, as some individuals may flourish in outdoor sports, whilst others do not. This could explain some of the mixed findings previously reported in the literature regarding the outcomes of outdoor sports (Crompton & Sellar, 1981). During participation in outdoor sports individuals are required to perform in stressful and potentially life-threatening situations. The ways in which people appraise and respond to stressful situations in the context of outdoor sports is worthy of future research, and could explain the variability in the benefits derived (e.g., biopsychosocial model of challenge and threat; Blascovich, 2008). Individuals who adopt a challenge state are likely to thrive in outdoor sports, while individuals who adopt a threat state are unlikely to thrive (Moore, Vine, Wilson, & Freeman, 2012).

Personality. The degree to which long-term engagement in outdoor sports shape personality over time would be an interesting avenue for future research. In Study 3 rock-climbers reported greater emotional stability than low-risk sport people did. The results are similar to the findings of Barlow et al. (2013) in which both mountaineers and skydivers reported significantly greater emotional stability than low-risk controls. In recent years researchers have explored the possibility that personality attributes can change across a lifetime (Boyce, Wood, & Powdthavee, 2012; Roberts & Mroczek, 2008), and in both studies participants had been involved in their respective sports for a number of years. It would be interesting to explore whether the differences in emotional stability between high-risk sport and low-risk sport groups emerged as a consequence of long-term participation in their respective sports.

Furthermore, specific life events (e.g., experiencing a successful and satisfying career) can contribute to changes in personality (Roberts, 1997; Roberts, Caspi, & Moffitt, 2003). Additionally, research pertaining to post-traumatic growth (O'Leary & Ickovics, 1995) has shown that individuals can experience positive change through adversity and trauma (e.g., bereavement) (Hefferon, Grealy, & Mutrie, 2009). The post-traumatic growth literature is worthwhile considering in the context of participation in outdoor sports, particularly if one considers the fear and distress of rock-climbing for example, as a proxy for trauma.

Coping effectiveness measurement. In the present research program we developed informant-rated measures of coping effectiveness (performance and health) and

used the measures to explore the degree to which participation in outdoor sports helps individuals to cope effectively with stressors in life. Although the results revealed no significant differences between individuals participating in outdoor sports (i.e., rock-climbing or open water swimming) and non-outdoor sports (i.e., low-risk sports or indoor pool swimming) this was likely due to the small informant samples. Future research would do well to explore the coping effectiveness outcomes (performance and health) in more detail using larger informant samples and across a wider range of outdoor sports.

Furthermore, with further validation (e.g., concurrent validity) the informant-rated *coping effectiveness – performance* and *coping effectiveness – health* measures could be valuable tools for examining coping in other research studies and are not limited to studying outdoor sports. The measures are informant-rated, therefore can help to provide a useful insight into coping behaviours, particularly as individuals may display behaviours of which they may not be aware (Vazire, 2006). Informants have the ability to provide an overall conception of the individual based on the behaviours they have observed (Vazire, 2006). Researchers could consider collecting data from multiple informants to more accurately and reliably measure coping effectiveness outcomes.

Outdoor sport participants relationship with nature. Interacting with the natural world is central to participating in outdoor sports (Brymer, Downey, & Gray, 2009). Researchers in the field of environmental psychology have explored individuals connectedness to nature in terms of conservation behaviour (Gosling & Williams, 2010). Place attachment refers to a positive connection or emotional bond between a person and a particular place (Williams & Vaske, 2003). Outdoor sports participants such as expeditionary mountaineers are documented to find romantic interpersonal relationships more stressful than the stressors they face in the mountains (Woodman et al., 2010), and the mountaineering literature portrays mountaineers relationship with the mountains as romantic (e.g., Lester, 2004). Surfers are also renowned for feeling a sense of connectedness to the ocean (Taylor, 2007). An area that has received little empirical research attention is the relationship that outdoor sport participants form with nature as opposed to other human beings. For example, why do some outdoor sport participants form stronger relationships with the natural environment than with significant individuals in their lives?

Strengths and Limitations of the Thesis

The specific strengths and limitations of the empirical research studies were summarised within the respective empirical chapters. The present research program used a

variety of research designs to explore the processes and outcomes of participating in outdoor sports. We initially explored a number of variables regarding participation in rock-climbers using a cross-sectional research design (Study 3). The research method allowed us to explore the prevalence of the mechanisms and the outcomes in the relevant populations, with relatively large sample sizes. However, as the research design does not provide definite information regarding cause-and-effect relationships, in Study 4 we explored the variables using an experimental research design.

The use of multi-source information (i.e., self-reports and informant-reports) is a strength of the research program. The outdoor sport literature is dominated by self-report data (Vazire, 2006), which can be subject to potential validity problems (e.g., participants providing deceptive data). An advantage of informant reports is that informants have typically observed participants' behaviours over a long period of time and in a variety of situations (McDonald, 2008). In the present research program, we found informant reports were notably more difficult to acquire via online data collection methods than in experimental data collection methods. A potential solution would be to request participants nominate more than one informant. If one informant was not willing to participate then the participants second (third, forth etc.) nominated informant could be contacted.

Finally, the population in the present research largely consisted of individuals aged between 25 and 35 years of age. This is notably older than much of the previous research, particularly research relating to the outcomes of outdoor adventure programs, where individuals typically are 21 or under. The population sampled in the present study is more representative of the real world.

Conclusion

The findings of the present research contribute to the growing research exploring psychological aspects associated with participating in outdoor sports. The experience of emotion regulation and agency during participation emerged as two aspects unique to participation in high-risk sports. In relation to rock-climbers the intense experiences during participation (of emotion regulation and agency) positively influenced their ability to regulate emotions and their feelings of worth (i.e., self-esteem). The experience of emotion regulation and agency during participation are plausible mechanisms to which changes in outcomes pertaining to outdoor sports occur, particularly as the differences in outcomes such as self-esteem could not be explained by basic psychological need satisfaction. The findings in the present study also highlight the hardship and challenges individuals face when initially participating in a sport in outdoor environments. Open water swimmers

experienced psychological difficulty (i.e., greater difficulty with emotion regulation) as a consequence of participating in the sessions. Overall, the findings in the present research program demonstrates that the high-risk sport domain provides opportunities for individuals to experience emotion regulation and agency during participation, which in time, can have a positive impact on individuals everyday functioning.

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Appendix A

Study 1 Demographic Questionnaire - Participant

Gender:

❍ Male

❍ Female

Age: _____ years

Please complete the following information regarding the outdoor activities you have been regularly involved in over the past 12 months (maximum of three sports):

	Outdoor Activity 1	**Outdoor Activity 2**	**Outdoor Activity 3**
Activity:			
How many years have you participated?	years	years	years
How frequently do you participate?	At least once ❍ A week ❍ A fortnight ❍ A month ❍ Every other month ❍ Every six months ❍ A year	At least once ❍ A week ❍ A fortnight ❍ A month ❍ Every other month ❍ Every six months ❍ A year	At least once ❍ A week ❍ A fortnight ❍ A month ❍ Every other month ❍ Every six months ❍ A year

Of the activities listed above, which would you consider your main activity?

❍ Outdoor activity 1

❍ Outdoor activity 2

❍ Outdoor activity 3

What would you consider your greatest achievement in your main activity?

Do you earn a living from your main activity?

- ❍ Yes
- ❍ No

Please specify how you earn a living:

- ❑ I am an instructor or guide
- ❑ I am sponsored
- ❑ Other _____

Appendix B

Modified SEAS Between Participating Inventory (Barlow et al., 2013)

Sense of Emotion Regulation and Agency

Below is a list of statements dealing with your experiences in everyday life. When the statements say "my life", please think about the elements of your life that are important to you (e.g. relationship with a partner, family, friends, work etc.). Please think about how you have generally felt in the past two months and rate the extent to which you agree or disagree with the statement.

We are interested only in your experiences, not how others feel about these things. Please think very carefully about each statement before answering. There are no right or wrong answers, so please be frank and give an honest appraisal of yourself.

In the past two months...		**Completely disagree**						**Completely agree**
1.	I have worried about other aspects of my life, not related to the task I was doing	1	2	3	4	5	6	7
2.	I have felt like people or circumstances have been trying to impose limits on me	1	2	3	4	5	6	7
3.	The emotional elements of my life have been difficult to deal with	1	2	3	4	5	6	7
4.	I have felt like my life 'belongs' to other people	1	2	3	4	5	6	7
5.	I have not been able to work out which emotions I have been experiencing	1	2	3	4	5	6	7
6.	I have felt trapped in my life	1	2	3	4	5	6	7
7.	I have been prevented from achieving my goals in life	1	2	3	4	5	6	7
8.	I have struggled to deal with the stressful situations in my life	1	2	3	4	5	6	7
9.	I have felt like a passive observer of my life rather than a major "actor"	1	2	3	4	5	6	7
10.	I have been emotional (e.g. anxious, angry) without understanding why	1	2	3	4	5	6	7
11.	I have had little belief in my ability to influence some important aspects of my life	1	2	3	4	5	6	7
12.	I have found that emotional situations in my life stress me out	1	2	3	4	5	6	7

Appendix C

Modified Basic Psychological Needs Satisfaction – General (Gagné, 2003)

Basic Psychological Needs Satisfaction

Please read each of the following statements carefully, thinking about how each statement relates to your life in the past two months, and then indicate how true it is for you.

In the past two months...		**Not at all true**						**Very true**
1.	I have felt free to decide for myself how to live my life	1	2	3	4	5	6	7
2.	I have really liked the people I have interacted with	1	2	3	4	5	6	7
3.	Often, I have not felt very competent	1	2	3	4	5	6	7
4.	I have felt pressured in my life	1	2	3	4	5	6	7
5.	People I know have told me I have been good at what I do	1	2	3	4	5	6	7
6.	I have got along with people I have come in contact with	1	2	3	4	5	6	7
7.	I have pretty much kept to myself and have not had a lot of social contacts	1	2	3	4	5	6	7
8.	I have generally felt free to express my ideas and opinions	1	2	3	4	5	6	7
9.	I have considered the people I have regularly interacted with to be my friends	1	2	3	4	5	6	7
10.	I have been able to learn interesting new skills	1	2	3	4	5	6	7
11.	In my daily life, I have frequently had to do what I was told	1	2	3	4	5	6	7
12.	People in my life have cared about me	1	2	3	4	5	6	7
13.	Most days I have felt as sense of accomplishment from what I have done	1	2	3	4	5	6	7
14.	People I have interacted with on a daily basis have tended to take my feelings into consideration	1	2	3	4	5	6	7
15.	In my life I have not had much of a chance to show how capable I am	1	2	3	4	5	6	7

16.	There have not been many people that I have been close to	1	2	3	4	5	6	7
17.	I have felt like I could pretty much be myself in my daily situations	1	2	3	4	5	6	7
18.	The people I have interacted with regularly have not seemed to like me much	1	2	3	4	5	6	7
19.	I have often not felt very capable	1	2	3	4	5	6	7
20.	There have not been many opportunities for me to decide for myself how to do things in my daily life	1	2	3	4	5	6	7
21.	People have generally been pretty friendly towards me	1	2	3	4	5	6	7

Appendix D

Modified Rosenberg Self-Esteem Scale (Rosenberg, 1965)

Self-Esteem

Below is a list of statements dealing with your general feelings about yourself in the past two months. Please rate the extent to which you agree or disagree with the statement.

In the past two months...	**Strongly Disagree**	**Disagree**	**Agree**	**Strongly Agree**
1. On the whole, I have felt satisfied with myself	1	2	3	4
2. At times, I have thought I am no good at all	1	2	3	4
3. I have felt that I have a number of good qualities	1	2	3	4
4. I have been able to do things as well as most other people	1	2	3	4
5. I have felt that I do not have much to be proud of	1	2	3	4
6. I have certainly felt useless at times	1	2	3	4
7. I have felt that I'm a person of worth, at least on an equal plane with others	1	2	3	4
8. I wished I could have more respect for myself	1	2	3	4
9. All in all, I have been inclined to feel that I am a failure	1	2	3	4
10. I have taken a positive attitude toward myself	1	2	3	4

Appendix E

Study 1 Demographic Questionnaire - Person X

Gender:

- ❍ Male
- ❍ Female

Which of the following best describes person X's age group?

- ❍ 16 – 17 years
- ❍ 18 – 24 years
- ❍ 25 – 34 years
- ❍ 35 – 44 years
- ❍ 45 – 54 years
- ❍ 55 – 64 years
- ❍ 65 – 74 years
- ❍ 75 years or older

What outdoor activity do you consider to be person X's main activity? _____

Approximately, how many years has person X participated in the activity? _____ years

On average, how frequently does person X participate in the activity?

At least once:
- ❍ A week
- ❍ A fortnight
- ❍ A month
- ❍ Every other month
- ❍ Every six months
- ❍ A year

Does person X earn a living from their main outdoor activity?

- ❍ Yes
- ❍ No

Please specify how person X earns a living:

- ❑ S/he is an instructor or guide
- ❑ S/he is sponsored
- ❑ Other _____

Appendix F

Study 1 Coping Effectiveness – Performance

The statements below reflect common stressors we are likely to experience at some point in our everyday lives. We want you to rate how often X is able to maintain a high level of effectiveness in everyday life when faced with stressors. Please read each statement carefully as X may respond to each stressor differently.

An individual who maintains a high level of effectiveness in everyday life typically:

- Maintains a good work/life balance
- Achieves deadlines
- Works to a high standard
- Uses their time effectively
- Completes tasks in a timely manner
- Is effective in their relationships (e.g., with friends, family, partner, colleagues)
- Doesn't generally make serious mistakes
- Carries out daily tasks efficiently

Please think about the examples above when responding to the statements. Where statements say "significant others" please think about important people in X's life or people s/he regularly interacts with. For example, friends, family, partner, colleagues.

Person X is able to maintain a high level of performance effectiveness in everyday life:		**Never**						**Always**
1.	When s/he has had important upcoming deadlines	1	2	3	4	5	6	7
2.	When s/he has had a setback	1	2	3	4	5	6	7
3.	When s/he has not been getting along with significant others	1	2	3	4	5	6	7
4.	When s/he has been working non-stop all week	1	2	3	4	5	6	7
5.	When s/he has been suffering from minor illness/sickness	1	2	3	4	5	6	7
6.	When significant others have been relying on him/her	1	2	3	4	5	6	7
7.	When s/he has been under pressure	1	2	3	4	5	6	7
8.	When s/he has not had much sleep	1	2	3	4	5	6	7
9.	When s/he has been faced with daunting challenges	1	2	3	4	5	6	7
10.	When his/her preparation has not going to plan	1	2	3	4	5	6	7
11.	When s/he has had limited control over a situation	1	2	3	4	5	6	7

12.	When s/he has had a change in personal circumstances (e.g. career, financial, family, residence etc.)	1	2	3	4	5	6	7
13.	When s/he has had a large number of demands placed on him/her	1	2	3	4	5	6	7
14.	When other activities have been interfering with what s/he has needed to get done	1	2	3	4	5	6	7
15.	When s/he has been faced with a situation that gets worse instead of better	1	2	3	4	5	6	7
16.	When s/he has been faced with unexpected problems	1	2	3	4	5	6	7

Appendix G

Study 1 Coping Effectiveness – Health

You will find a similar set of statements to the previous questionnaire below. They reflect common stressors we are likely to experience at some point in our everyday lives. We want you to rate how often X is able to maintain a high level of personal health when faced with stressors. Please read each statement carefully as X may respond to each stressor differently.

An individual who maintains a high level of personal health typically:

- Has a strong immune system (e.g. is rarely run down by colds/viruses)
- Has good sleeping patterns
- Has little worry or anxiety
- Has good personal hygiene
- Does not get unreasonably emotional
- Is rarely absent from work, university or school
- Eats healthily
- Does not engage in substance abuse or other unhealthy habits
- Is easy to engage and interact with (e.g. not unreasonably withdrawn, angry, defensive, avoidant)

Please think about the examples above when responding to the statements. Where statements say "significant others" we mean important people in X's life or people s/he regularly interacts with. For example, friends, family, partner, colleagues.

Person X is able to maintain a high level of personal health in everyday life:		**Never**						**Always**
1.	When s/he has had important upcoming deadlines	1	2	3	4	5	6	7
2.	When s/he has had a setback	1	2	3	4	5	6	7
3.	When s/he has had a number of personal issues	1	2	3	4	5	6	7
4.	When s/he has not been getting along with significant others	1	2	3	4	5	6	7
5.	When s/he has been working non-stop all week	1	2	3	4	5	6	7
6.	When his/her preparation has not gone to plan	1	2	3	4	5	6	7
7.	When s/he has been under pressure	1	2	3	4	5	6	7
8.	When significant others have been demanding	1	2	3	4	5	6	7
9.	When s/he has not had much sleep	1	2	3	4	5	6	7
10.	When s/he has been faced with daunting challenges	1	2	3	4	5	6	7

11.	When significant others have been relying on him/her	1	2	3	4	5	6	7
12.	When s/he has limited control over a situation	1	2	3	4	5	6	7
13.	When s/he has had a change in personal circumstances (e.g. career, financial, family, residence etc.)	1	2	3	4	5	6	7
14.	When other activities have been interfering with what s/he has needed to get done	1	2	3	4	5	6	7
15.	When s/he has been faced with a situation that gets worse instead of better	1	2	3	4	5	6	7
16.	When s/he has had a large number of demands placed on him/her	1	2	3	4	5	6	7
17.	When s/he has been faced with unexpected problems	1	2	3	4	5	6	7

Appendix H

Study 2 Coping Effectiveness - Performance

The statements below reflect common stressors we are likely to experience at some point in our everyday lives. We want you to rate how often X is able to maintain a high level of effectiveness in everyday life when faced with stressors. Please read each statement carefully as X may respond to each stressor differently.

An individual who maintains a high level of effectiveness in everyday life typically:

- Maintains a good work/life balance
- Achieves deadlines
- Works to a high standard
- Uses their time effectively
- Completes tasks in a timely manner
- Is effective in their relationships (e.g., with friends, family, partner, colleagues)
- Doesn't generally make serious mistakes
- Carries out daily tasks efficiently

Please think about the examples above when responding to the statements. Where statements say "significant others" please think about important people in X's life or people s/he regularly interacts with. For example, friends, family, partner, colleagues.

Person X is able to maintain a high level of performance effectiveness in everyday life:		**Never**						**Always**
1.	When s/he has had a setback	1	2	3	4	5	6	7
2.	When s/he has been working non-stop all week	1	2	3	4	5	6	7
3.	When significant others have been relying on him/her	1	2	3	4	5	6	7
4.	When s/he has not had much sleep	1	2	3	4	5	6	7
5.	When his/her preparation has not gone to plan	1	2	3	4	5	6	7
6.	When s/he has had a change in personal circumstances (e.g. career, financial, family, residence etc.)	1	2	3	4	5	6	7
7.	When s/he has had a large number of demands placed on him/her	1	2	3	4	5	6	7
8.	When other activities have been interfering with what s/he has needed to get done	1	2	3	4	5	6	7
9.	When s/he has been faced with unexpected problems	1	2	3	4	5	6	7

Appendix I

Study 2 Coping Effectiveness – Health

You will find a similar set of statements to the previous questionnaire below. They reflect common stressors we are likely to experience at some point in our everyday lives. We want you to rate how often X is able to maintain a high level of personal health when faced with stressors. Please read each statement carefully as X may respond to each stressor differently.

An individual who maintains a high level of personal health typically:

- Has a strong immune system (e.g. is rarely run down by colds/viruses)
- Has good sleeping patterns
- Has little worry or anxiety
- Has good personal hygiene
- Does not get unreasonably emotional
- Is rarely absent from work, university or school
- Eats healthily
- Does not engage in substance abuse or other unhealthy habits
- Is easy to engage and interact with (e.g. not unreasonably withdrawn, angry, defensive, avoidant)

Please think about the examples above when responding to the statements. Where statements say "significant others" we mean important people in X's life or people s/he regularly interacts with. For example, friends, family, partner, colleagues.

Person X is able to maintain a high level of personal health in everyday life:		**Never**						**Always**
1.	When s/he has had important upcoming deadlines	1	2	3	4	5	6	7
2.	When s/he has not been getting along with significant others	1	2	3	4	5	6	7
3.	When significant others have been demanding	1	2	3	4	5	6	7
4.	When s/he has not had much sleep	1	2	3	4	5	6	7
5.	When s/he has been faced with daunting challenges	1	2	3	4	5	6	7
6.	When significant others have been relying on him/her	1	2	3	4	5	6	7
7.	When s/he has had limited control over a situation	1	2	3	4	5	6	7
8.	When s/he has had a change in personal circumstances (e.g., career, financial, family, residence etc.)	1	2	3	4	5	6	7
9.	When other activities have been interfering with what s/he has needed to get done	1	2	3	4	5	6	7
10.	When s/he has had a large number of demands placed on him/her	1	2	3	4	5	6	7

11. When s/he has been faced with unexpected problems	1 2 3 4 5 6 7

Appendix J:

Study 2 Demographic Questionnaire - Participant

Gender:

- ❍ Male
- ❍ Female

Age: _____ years

What country do you currently live in? _____

Traditional Rock-Climbing Demographic Questions

What climbing activities do you do? (Please tick all that apply)

- ❑ Traditional climbing
- ❑ Indoor lead climbing
- ❑ Sport climbing
- ❑ Indoor bouldering
- ❑ Outdoor bouldering
- ❑ Ice/winter climbing
- ❑ Alpine climbing
- ❑ Mountaineering
- ❑ Mixed winter climbing
- ❑ Competition climbing
- ❑ Big wall climbing
- ❑ Urban climbing

How many years have you been involved in climbing activities? _____ years

How often do you participate in climbing activities?

- ❍ Never
- ❍ Less than once a month
- ❍ At least once a month
- ❍ At least once a fortnight
- ❍ At weekends
- ❍ At least once a week

How many years have you been traditional rock climbing? _____ years

How often do you participate in traditional rock climbing?

- ❍ Never
- ❍ Less than once a month
- ❍ At least once a month
- ❍ At least once a fortnight
- ❍ At weekends
- ❍ At least once a week

What is the hardest traditional rock-climbing grade you have lead? _____

What traditional rock-climbing grade do you currently lead at? _____

When did you last go traditional rock climbing?

_____

Please tick ALL that apply regarding your participation in traditional rock climbing

- ❑ Recreation
- ❑ Competitive
- ❑ Instructor
- ❑ Sponsored Athlete
- ❑ Professional Athlete

Please further describe your experience or any relevant information regarding your involvement in traditional rock climbing (typical venues, times of year, recent climbing holidays, any memorable experiences etc.):

Low-Risk / Outdoor Sport Demographic Questions

Have you participated in any of the following in the past 12 months?

	Never in my life	Not in the past 12 months	At least once	At least once every six months	At least once every three months	At least once a month	At least once a fortnight	At least once a week
Badminton	❍	❍	❍	❍	❍	❍	❍	❍
BASE Jumping	❍	❍	❍	❍	❍	❍	❍	❍
Basketball	❍	❍	❍	❍	❍	❍	❍	❍
Bouldering	❍	❍	❍	❍	❍	❍	❍	❍
Fitness/Gym	❍	❍	❍	❍	❍	❍	❍	❍
Football	❍	❍	❍	❍	❍	❍	❍	❍
Hockey	❍	❍	❍	❍	❍	❍	❍	❍
Horse riding	❍	❍	❍	❍	❍	❍	❍	❍
Kite boarding	❍	❍	❍	❍	❍	❍	❍	❍
Kayaking/Canoeing	❍	❍	❍	❍	❍	❍	❍	❍
Martial arts	❍	❍	❍	❍	❍	❍	❍	❍
Motor biking	❍	❍	❍	❍	❍	❍	❍	❍
Mountaineering	❍	❍	❍	❍	❍	❍	❍	❍
Mountain biking	❍	❍	❍	❍	❍	❍	❍	❍
Road biking	❍	❍	❍	❍	❍	❍	❍	❍
Rock climbing	❍	❍	❍	❍	❍	❍	❍	❍
Rugby	❍	❍	❍	❍	❍	❍	❍	❍
Running	❍	❍	❍	❍	❍	❍	❍	❍
Skiing/Snowboarding	❍	❍	❍	❍	❍	❍	❍	❍
Sky-diving	❍	❍	❍	❍	❍	❍	❍	❍
Squash	❍	❍	❍	❍	❍	❍	❍	❍
Surfing	❍	❍	❍	❍	❍	❍	❍	❍
Swimming	❍	❍	❍	❍	❍	❍	❍	❍
Tennis	❍	❍	❍	❍	❍	❍	❍	❍
Walking for exercise	❍	❍	❍	❍	❍	❍	❍	❍
White water rafting	❍	❍	❍	❍	❍	❍	❍	❍

Please complete this table if you have also participated in sports or physical activities during the past 12 months not listed above (maximum 6)

	Not in the past 12 months	At least once	At least once every six months	At least once every three months	At least once a month	At least once a fortnight	At least once a week
Other sport/activity:	❍	❍	❍	❍	❍	❍	❍
Other sport/activity:	❍	❍	❍	❍	❍	❍	❍
Other sport/activity:	❍	❍	❍	❍	❍	❍	❍
Other sport/activity:	❍	❍	❍	❍	❍	❍	❍
Other sport/activity:	❍	❍	❍	❍	❍	❍	❍
Other sport/activity:	❍	❍	❍	❍	❍	❍	❍

Please complete the following information regarding the main sports or physical activity you participate in (maximum of three):

	1	**2**	**3**
Activity:			
How many years have you participated?	years	years	years
How frequently do you participate?	❍ Currently, not at all ❍ Less than once a year ❍ At least once a year ❍ At least once every six month ❍ At least once every three months ❍ At least once a month ❍ At least once a fortnight ❍ At least once a week	❍ Currently, not at all ❍ Less than once a year ❍ At least once a year ❍ At least once every six month ❍ At least once every three months ❍ At least once a month ❍ At least once a fortnight ❍ At least once a week	❍ Currently, not at all ❍ Less than once a year ❍ At least once a year ❍ At least once every six month ❍ At least once every three months ❍ At least once a month ❍ At least once a fortnight ❍ At least once a week
How long since you last			

participated?			
Please tick ALL that apply regarding your participation	❑ Recreation ❑ Competitive ❑ Instructor ❑ Sponsored Athlete ❑ Professional Athlete	❑ Recreation ❑ Competitive ❑ Instructor ❑ Sponsored Athlete ❑ Professional Athlete	❑ Recreation ❑ Competitive ❑ Instructor ❑ Sponsored Athlete ❑ Professional Athlete
What is your ability level?	❍ Beginner ❍ Novice ❍ Intermediate ❍ Advanced ❍ Expert	❍ Beginner ❍ Novice ❍ Intermediate ❍ Advanced ❍ Expert	❍ Beginner ❍ Novice ❍ Intermediate ❍ Advanced ❍ Expert
Please further describe your experience or any relevant information regarding your involvement (e.g. typical venues, time of year if seasonal, typical level or grade at which you perform, any memorable experiences etc.)			

Of the activities listed above, which is your main sport or physical activity?

❍ 1

❍ 2

❍ 3

Interests / Hobbies Demographic Questions

Do you take part in any interests or hobbies from the following list? (Please tick all that apply)

- ❑ Reading
- ❑ Going to the cinema
- ❑ Fishing
- ❑ Creative writing
- ❑ Music
- ❑ Photography
- ❑ Knitting
- ❑ Playing video games
- ❑ Collecting (e.g. stamps, comics, antiques etc.)
- ❑ Playing an instrument
- ❑ Sport or physical activity
- ❑ Singing in a choir
- ❑ Watching TV
- ❑ Car restoration
- ❑ Painting
- ❑ Model building
- ❑ Playing chess
- ❑ Going to the theatre
- ❑ Bird watching
- ❑ Other: _____
- ❑ Other: _____
- ❑ Other: _____

What is your main interest or hobby?

_____

How many years have you participated in your main interest or hobby? _____ years

How frequently do you participate in your main interest or hobby?

- ❍ Currently, not at all
- ❍ Less than once a year
- ❍ At least once a year
- ❍ At least once every six months
- ❍ At least once every three months
- ❍ At least once a month
- ❍ At least once a fortnight
- ❍ At least once a week

Do you participate in any sports or physical activity?

- ❍ Yes
- ❍ No

If YES is selected or participant selected SPORT OR PHYSICAL ACTIVITY then participant directed to low-risk / other sport demographic questions

Appendix K

Study 2 Demographic Questionnaire - Informant

Your gender:

❍ Male

❍ Female

Your age: _____ years

What country do you currently live in? _____

About your relationship with X

How many years have you known X? _____ years

What is your relation to X?

❍ Friend
❍ Acquaintance
❍ Co-worker
❍ Partner
❍ Spouse
❍ Father
❍ Mother
❍ Brother
❍ Sister
❍ Son
❍ Daughter
❍ Other _____

On average, how many hours per week do you spend with X? _____ hours

How close are you to X?

Not close at all | □ □ □ □ □ □ □ | Extremely close

How well do you know X?

Not well at all | □ □ □ □ □ □ □ | Extremely well

How important is your relationship with X?

Not at all important | □ □ □ □ □ □ □ | Extremely important

How would you rate the quality of your relationship with X?

Not good | □ □ □ □ □ □ □ | Extremely good

How much do you like X?

Not at all | □ □ □ □ □ □ □ | Very much

Appendix L

Study 4 Medical Questionnaire

Medical Questionnaire

Name of Participant ……..……..

Age ……

Gender M / F

Are you in good health? ☐ YES ☐ NO

If no, please explain

How would you describe your present level of activity?
Tick intensity level and indicate approximate duration.

Vigorous		Moderate		Low intensity	

Duration (minutes)…….

How often?

< Once per month		2-3 times per week	
Once per month		4-5 times per week	
Once per week		> 5 times per week	

Have you suffered from a serious illness or accident? ☐ YES ☐ NO

If yes, please give particulars:

Do you suffer from allergies? ☐ YES ☐ NO

If yes, please give particulars:

Do you suffer, or have you ever suffered from:

	YES	NO		YES	NO
Asthma			Epilepsy		
Diabetes			High blood pressure		
Bronchitis					

Are you currently taking medication? ☐ YES ☐ NO

If yes, please give particulars:

Are you currently attending your GP for any condition or have you consulted your doctor in the last three months?

☐ YES ☐ NO

If yes, please give particulars:

Have you, or are you presently taking part in any other laboratory experiment?

☐ YES ☐ NO

PLEASE READ THE FOLLOWING CAREFULLY

Persons will be considered unfit to do the experimental exercise task if they:

- have a fever, cough or cold, or suffer from fainting spells or dizziness;
- have suspended training due to a joint or muscle injury;
- have a known history of medical disorders, i.e. high blood pressure, heart or lung disease;
- have had hyper/hypothermia, heat exhaustion, or any other heat or cold disorder;
- have chronic or acute symptoms of gastrointestinal bacterial infections (e.g. Dysentery, Salmonella);
- have a history of infectious diseases (e.g., HIV, Hepatitis B)

PLEASE COMPLETE AND SIGN THE DECLARATION ON THE NEXT PAGE

DECLARATION

I agree that I have none of the above conditions and I hereby volunteer to be a participant in the study.

My replies to the above questions are correct to the best of my belief and I understand that they will be treated with the strictest confidence. Alexandra MacGregor has explained to my satisfaction the purpose of the study and possible risks involved.

I understand that I may withdraw from the study at any time and that I am under no obligation to give reasons for withdrawal or to attend again for experimentation.

Furthermore, if I am a student, I am aware that taking part or not taking part in this experiment, will neither be detrimental to, or further, my position as a student.

I undertake to obey the study regulations and the instructions of the experimenter regarding safety, subject only to my right to withdraw declared above.

Signature *(participant)* _____ Date _____

Print name _____

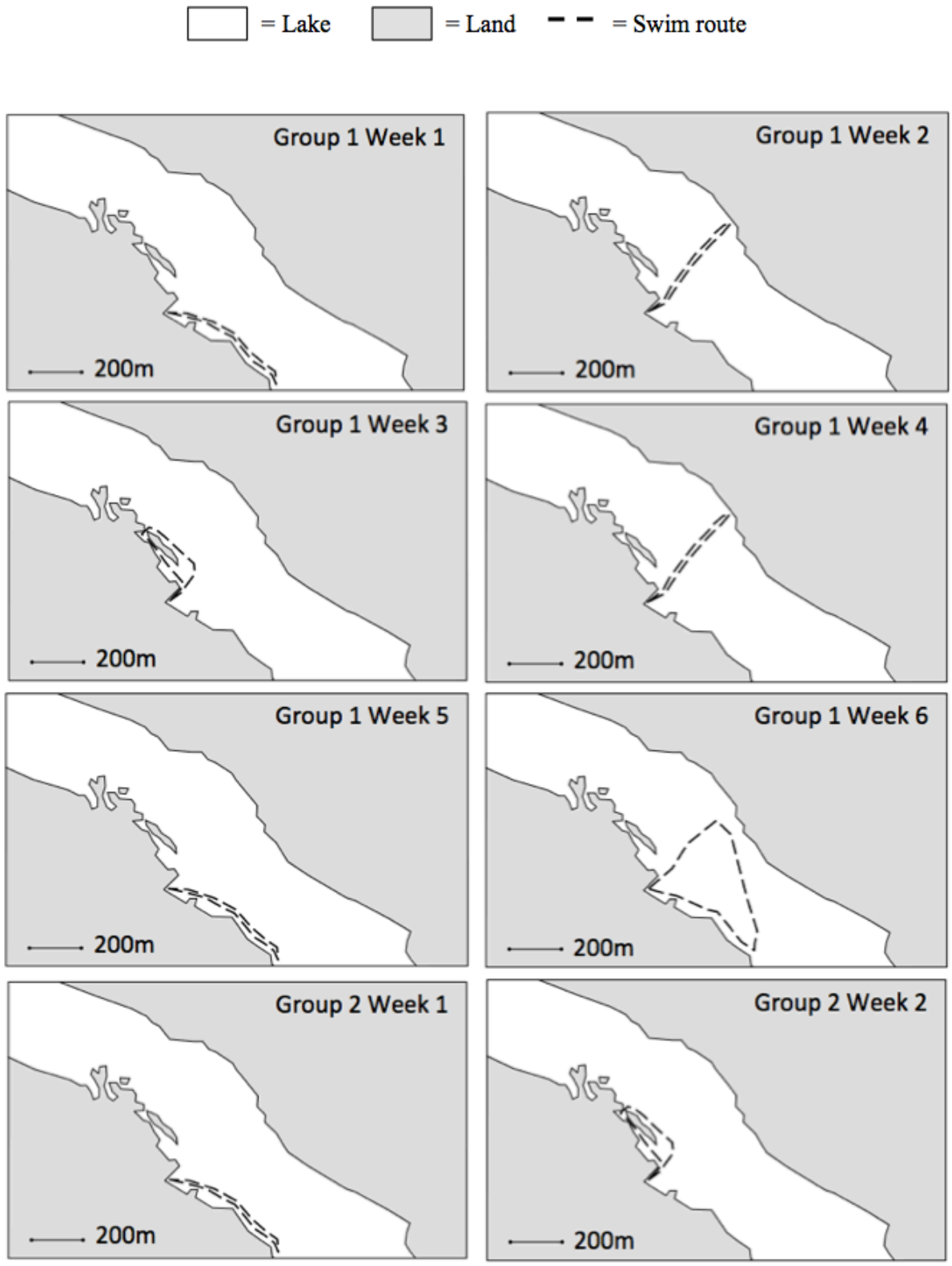
Signature *(researcher)* _____Date _____

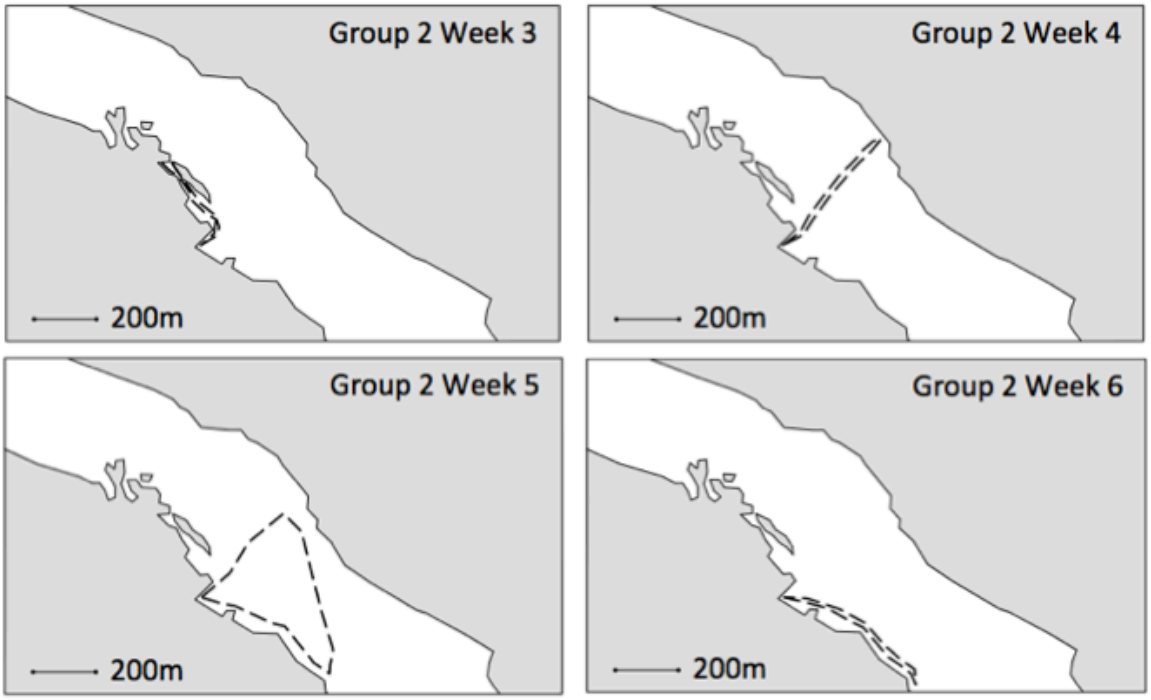
Print name _____

Appendix M

Study 4 Open Water Swimming Routes

There were slight variations in routes between groups due to weather conditions.




Group 2 Week 3
200m
Group 2 Week 4
200m
Group 2 Week 5
200m
Group 2 Week 6
200m