Social Identity, Mental Toughness, and Behavioural Intentions as Antecedents of Overuse Injury Pain in Physical Activity Contexts

Vista L. Beasley

University of Stirling
Faculty of Health Sciences and Sport

Thesis submitted for the degree of
Doctor of Philosophy in Sport Psychology
January 2018

ABSTRACT

Psychological factors specific to overuse injury pain in physical activity contexts were explored within a social identity theoretical framework. Study 1 involved development of a method for designating overuse injury pain occurrence of hikers (N = 751), along with exploration of relationships between psychological measures, overuse injury pain occurrence, and effort levels. The findings of this cross-sectional, mixed-methods investigation revealed that social identification, social identity content, and mental toughness differentiated hikers who incurred overuse injury pain or selected a higher-effort behaviour from those who did not. From qualitative analysis, several social identity constructs (i.e., group member's presence, in-group status, social creativity, additional social identity content) emerged as contributors to overuse injury occurrence. The focus of Study 2 was a prospective examination of the aforementioned psychological factors in relation to overuse injury severity of hikers (N = 283). Additionally, the Test of Intentions to Reduce Effort (TIRE) was developed to identify individuals with susceptibility to higher overuse injury severity. Results provided evidence of factorial, construct, and predictive validity of TIRE factor scores. TIRE factors and social identity content significantly predicted higher severity of hikers' overuse injury pain. Mental toughness scores moderated the relationship between social identification and overuse injury severity. Study 3 consisted of a qualitative examination of social identity mechanisms of overuse injury pain in a physical activity context, CrossFit®, involving the presence of group leaders, and in which group members view each other. Findings revealed mechanisms pertaining to social identity content, in-group status, and social threats. Overall, the findings support a new means for assessing overuse injury occurrence and susceptibility to higher overuse injury severity, whilst demonstrating the potential applicability of social identity theory to the study of overuse injury. Knowledge gained may ultimately aid development of interventions to reduce overuse injury occurrence and severity of physical activity participants.

ACKNOWLEDGEMENTS

Dr. Calum Arthur and Dr. Rosie Arthur: Thank you for your willingness to take this on and for helping me find my way back. The two of you were powerful confidence-builders when it was most needed. Your clear feedback helped me sharpen my ideas, and your encouragement made me believe in my ideas.

Dr. Robert Eklund and Dr. Pete Coffee: Thank you for every question you answered and for every question you asked. You helped me learn the process of growing ideas into research projects. Along the way you have converted me into a firm believer in the utility of theory.

The 1,000+ members of the Appalachian Trail and CrossFit® communities that must remain anonymous: Please accept my countless thanks for participating in these projects and for the innumerable nuggets of insight that shaped this thesis.

Jason Sorensen, Sumin Yi, Shane Callahan: Thank you for being my core through the Ph.d years and through all the years before and beyond.

Dr. Jeffrey Martin, Goldie, Roy Benson, Jarrett Liles, Brian McGuire, Jeff Castillo, Serenity and Jason Gardner, Red Moose, Brad Scott, Glob, Brad Taylor, Donn Simmons, Jonathan Beal, Michael Cohen, and Dr. Tommie du Preez: Thank you for the correspondence, visits, and support that uplifted me during the blustery times.

Dr. Kevin Tipton, Suhardi Alias, Dr. Tim Howle, Nikki Barczak, Ed McCosh, Mel McInnes, Christine Habeeb, Dan Jefferson, Jason Adair, and Ross Murray: Much appreciation for the exchange of ideas, the office antics that lightened the heavy days, cookies, and the shared adventures.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER 1

Introduction

1.1 Background

Research of psychological factors related to injury in sport and exercise contexts has typically addressed two aspects, prevention of injury and injury rehabilitation (Williams & Andersen, 2007). The injury-prevention aspect has typically been examined using the stress-injury model developed by Andersen and Williams in 1988 (Junge, 2000). However, several researchers pointed out that the stress-injury model did not account for overuse injury (Petrie & Hamson-Utley, 2011; Petrie & Perna, 2004). In 2007, the model's creators appraised research of psychological factors pertaining to injury prevention that had occurred since the model's creation. The creators conceded that the model, and research employing it, addressed acute injury but was insufficient for addressing overuse injury (Williams & Andersen, 2007). In 2014, researchers in the sport/exercise psychology field reviewed literature of psychological factors pertaining specifically to prevention and prediction of injury in sport (Johnson, Tranaeus, & Ivarsson, 2014). They concluded that research and knowledge of psychological factors specific to overuse injury is scarce. Researchers in the epidemiology field also concluded that research specific to overuse injury is needed, as most injury researchers focused on acute injury or did not discriminate between acute and overuse injury (Roos & Marshall, 2014).

Given the paucity of literature specific to overuse injury, the purpose of this thesis was to carve out a path so that psychological factors specific to overuse injury could be studied. Two critical considerations impacted the direction of this thesis: theory and methodology. Regarding theoretical considerations, McGlashan and Finch (2010) conducted an analysis of injury-prevention interventions. They found that most interventions were based on manipulation of miscellaneous factors, yielding negligible or no effects in terms of reducing injury occurrence or severity. In contrast, interventions with a theoretical basis, and manipulation of theory-based factors, appeared to be more effective at preventing injury.

Regarding methodological considerations, all of the above-mentioned researchers asserted a need to study overuse injury separate from acute injury because the two have different causal mechanisms. Further, inclusion criteria typically employed in injury research did not take these differences into account (Rossler et al., 2014). According to the typical inclusion criteria, participants were not designated as

'injured' unless the pain they experienced was severe enough to force them to cease physical activity engagement. Those in the early stages of overuse injury typically experience low-level pain which is not severe enough to force them to cease physical activity engagement. In this way, those in the early stages of overuse injury did not meet the inclusion criteria of injury research. Therefore, factors contributing to the increase of severity from the early stages to later stages of overuse injury have not been examined. Recognizing this limitation, researchers have asserted a need for a methodology that takes into account the causal mechanisms and nature of overuse injury that differ from acute injury (Roos et al., 2015; Williams & Andersen, 2007).

Given these two considerations, one focus of this thesis was to determine a theoretical framework suited for study of overuse injury. The second focus was to initiate creation of methodology and measures appropriate to overuse injury with inclusion of those in the early stages of overuse injury. With these two considerations being paramount, the third focus was to identify psychological factors specific to overuse injury.

Of note, a fresh crop of overuse injury research was published during the time that the studies in this thesis were being conducted. Like the studies in this thesis, those studies involved initial attempts to identify psychological factors specific to overuse injury (e.g., Cavallerio, Wadey, & Wagstaff, 2016; Russell & Wiese-Bjornstal, 2015; Tranaeus, Johnson, Engstrom, Skillgate, & Werner, 2014) and to develop methodology specific to overuse injury (e.g., Clarsen, Myklebus, & Bahr, 2013). Thus the analyses and design of subsequent projects in this thesis were informed by emerging research. However, the studies in this thesis differ in the theoretical framework employed, and in the type of methods and measures developed.

1.2 Significance of Research

The current thesis contributes to the extant literature in the area of psychological basis for overuse injury in several ways. Study 1 involved two advancements. One, a method was developed to identify participants who suffer overuse injury pain. The focus of this method was to ensure participants in the early stages of overuse injury were included in the study. Two, the study represented an initial attempt to apply the theoretical framework of social identity to the study of overuse injury. To do so, quantitative analysis of retrospective, cross-sectional data was conducted to determine

whether those who incurred overuse injury pain differed from those who did not in measures of social identity. Qualitative analysis was used to identify other social identity constructs and mechanisms relevant to overuse injury. Qualitative analysis was also used to identify the behavioural responses of participants when they first experienced overuse injury pain. Participants in this study were long-distance hikers who had attempted to hike the 2,000+ miles of the mountainous Appalachian Trail (AT) in less than a year. The data they provided was of a retrospective nature.

Study 2 built upon Study 1. In this study, the participants were hikers who provided data before and after their attempts to hike the AT. This study involved refinement of the method developed in Study 1 to identify participants with overuse injury pain without excluding those in the early stages. Further, Study 2 employed multiple measures of overuse injury severity, rather than solely assessing occurrence as done in Study 1. This methodology enabled study of psychological factors specific to the various manifestations of overuse injury severity. Extending the findings from the cross-sectional data in Study 1, a quantitative analysis of prospective data was conducted to determine if there was a predictive relationship between social identity constructs and overuse injury severity. An additional contribution was made within this study with the development and initial testing of a measure designed to identify individuals with susceptibility to higher overuse injury severity. The measure, Test of Intentions to Reduce Effort (TIRE), incorporated the behavioural responses to overuse injury pain identified by hikers in Study 1. The measure was based on the premise that those who intend to reduce effort when they feel low-level overuse injury pain are more apt to incur less severe overuse injury than those who intend to maintain effort.

Study 3 expanded the study of social identity in relation to overuse injury pain to a different context. Recognizing that contextual factors of a solitary endeavor such as hiking differ from contexts in which groups have defined leaders, and members are able to view each other's behaviours, Study 3 was conducted within the CrossFit® context. Whilst the previous studies focused primarily on two social identity constructs (i.e., social identification and social identity content), the qualitative analysis in Study 3 was used to assess potential involvement of other social identity constructs (e.g., positive distinctiveness, prototypicality) in relation to overuse injury. Behavioural responses to

overuse injury pain specific to this context were also identified as a step to aid further development of the TIRE so that it can be generalized to contexts beyond hiking.

Overall, the studies in this thesis contributed to extant literature via development of a new method and measure as well as identification of theory-based psychological factors specific to overuse injury. As these are initial steps taken in an area in which there is a void of research, additional research is needed. Ultimately, it is expected this line of research may assist in the development of interventions to reduce overuse injury occurrence and severity.

1.3 Definitions of Terms

Behavioural intentions: The perceived likelihood of engaging in behaviours (Ajzen, 2002)

Hierarchical self-categorization: Processes in which members of a social identity group form different classifications of members within the group (e.g., runners, recreational runners, competitive runners; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987)

In-group centrality: Processes whereby an in-group member perceives membership in the group to be a central aspect of the individual's self-concept (Leach et al., 2008)

In-group homogeneity: Processes whereby an in-group member perceives in-group members to be similar to each other, such that the group appears homogenous (Leach et al., 2008)

In-group satisfaction: Processes whereby an in-group member has positive feelings about group membership (Leach et al., 2008)

In-group self-stereotyping: Processes whereby an in-group member perceives himself to be similar to other in-group members and takes on the group's norms, values, and standards (Leach et al., 2008)

In-group solidarity: Processes whereby an in-group member perceives himself to have a psychological bond with, and commitment to, other in-group members (Leach et al., 2008)

Minimal group condition: Experimental strategy in which groups are formed with no prior psychological meaningfulness (e.g., formed by toss of a coin; Tajfel, 1974)

Negative emotional evaluation: Assessment of a distinct attribute of a group such that the attribute is perceived as undesirable (Tajfel, 1974)

Polarization: Processes in which group members' endorsement of a group norm becomes more extreme, more so than initially endorsed, usually in a direction away from out-group norms (Hogg & Reid, 2006)

Positive distinctiveness: A condition in which an in-group is perceived more positively than an out-group based on attributes valued by the perceiver (Haslam, Reicher, & Platow, 2011)

Positive emotional evaluation: Assessment of a distinct attribute of a group such that the attribute is perceived as desirable (Tajfel, 1974)

Prototypical group members: In-group members perceived as exemplifying the group's social identity content, being dissimilar from out-group members, and having high in-group status (Turner et al., 1987)

Prototypicality: The extent to which a group member is perceived to represent stereotypical attributes of the social group as a whole (Turner et al., 1987)

Publicity: A situation in which one is being viewed and/or evaluated by others (Leary & Kowalski, 1990)

Self-categorization: The act of defining one's self with membership in a social identity group (Turner et al., 1987)

Social creativity: A strategy that involves redefinition of the meaning of group membership by comparing the group on dimensions that render positive perceptions of group membership rather than on dimensions that render negative perceptions (Haslam & Reicher, 2006)

Social identification: The degree to which one considers membership in a social identity group to have emotional significance and importance (Turner et al., 1987)

Social identity: An individual's perception of belonging to a social group such that the group membership has emotional significance and value to the individual (Tajfel, 1974)

Social identity content: Attributes (i.e., norms, values, beliefs) of a group which are perceived to be specific, meaningful reasons for identifying with the in-group,

defining the group, and guiding the thoughts, feelings, and behaviours of members (Haslam et al., 2011)

Social stereotyping: The process in which a group member is assessed in terms of similarity with other group members rather than individual attributes (Hogg & Reid, 2006)

Social threat: A barrier to an in-group's attempt to achieve or preserve positive distinctiveness including out-group members' failure to recognize the in-group's claim of positive distinctiveness (Brown & Ross, 1982)

Status (relative to an out-group): Perception that one group is superior to another group based on comparison of attributes of the groups (Tajfel, 1974)

Status (relative to in-group members): Perception that an in-group member is superior to another in-group member based on comparison of attributes of the members (Tajfel, 1974)

1.4 Structure of the Thesis

Following this introductory chapter, Chapter 2 provides a more detailed review of literature regarding overuse injury. It addresses overuse injury causal mechanisms and stages because the psychological factors are linked to injury via the mechanisms and stages. The harms of overuse injury are then presented in terms of prevalence and severity, followed by a summary of what little is known about the psychological antecedents of overuse injury. Given the paucity of overuse injury research, and research specific to psychological factors of overuse injury, a deductive rationale for employing the social identity approach as a theoretical framework for the study of overuse injury is given. Finally the notion that mental toughness plays a role with overuse injury within the social identity framework is examined.

Chapter 3 contains Study 1. The purposes of Study 1 include 1) test a new procedure for designating overuse injury occurrence; 2) determine whether social identity and mental toughness constructs differentiate those who incurred overuse injury pain symptoms from those who did not; 3) identify additional social identity constructs related to overuse injury pain; and 4) identify behavioural responses specific to overuse injury pain.

In Chapter 4, Study 2 is presented. Purposes include 1) refine the method developed in Study 1 of designating overuse injury occurrence; 2) examine relationship

of social identity and mental toughness constructs with overuse injury severity, as opposed to occurrence, by employing multiple measures of severity outcomes; 3) conduct initial validation of a new measure developed to identify individuals with potential susceptibility to higher overuse injury severity.

Chapter 5 encapsulates Study 3. Purposes include 1) access group members' perceptions of overuse injury; 2) examine social identity constructs in a physical activity context in which there are defined group leaders, and in which group members' behaviours are visible to other group members.

In Chapter 6, a synthesis of the entire thesis is given, including suggestions for future research directions.

CHAPTER 2

Review of Literature

2.1 Causal Mechanism and Stages

Researchers who identified the need for study of overuse injury also identified the need to study it separately from acute injury because the two have different causal mechanisms (Roos et al., 2015; Williams & Andersen, 2007). Acute injury (e.g., broken leg, sprained ankle) results from a sudden, single, identifiable event (e.g., fall, collision) whereas overuse injury (e.g., stress fractures, plantar fasciitis) stems from repetitive stress with no single, identifiable, responsible event (Roos & Marshall, 2014; Yang et al., 2012). Intrinsic factors (e.g., biomechanical abnormalities, mal-alignments, muscle imbalance, inflexibility, weakness, instability) and external factors (e.g., improper technique, equipment, and surfaces) may contribute to overuse injury (Renstrom & Johnson, 1985; Stephan, Deroche, Brewer, Caudroit, & Le Scanff, 2009; Wilder & Sethi, 2004). However, these factors can be benign until changes in mode of physical activity, as well as improper changes in effort (i.e., frequency, duration, and/or intensity) occur. For example, a bunion (i.e., a bony deformity of the joint at the base of the big toe) may not be problematic in a sedentary life, but pain, swelling, and ultimately functional impairment may ensue after initiation of backpacking on a daily basis. The combination of general physical inactivity with high engagement in physical activity can also contribute to overuse injury (Launay, 2015). Altogether, excessive or improper applications of effort appear to underlie overuse injury occurrence. This is exemplified by male high school distance runners, of which 59% reported overuse injury (Tenforde et al., 2011). The males who incurred overuse injury reported significantly higher weekly mileages and workouts per week than those who did not incur overuse injury. Thus, the study of psychological factors contributing to overuse injury occurrence might focus on contributors to excessive effort.

Just as the causal mechanisms of overuse and acute injuries differ, so does the pain symptomology and pattern associated with each injury type. The onset of acute injury typically involves a high amount of pain and/or functional impairment, necessitating immediate cessation of participation in physical activity (i.e., time-loss) and/or medical attention (Rossler et al., 2014; Schroeder et al., 2015; Timpka et al., 2015). In contrast, the onset of overuse injury is often characterized by low-level pain (Clarsen, Myklebust, & Bahr, 2013; Ekenman, Hassmen, Koivula, Rolf, & Fellander-Tsai, 2001; Russell & Wiese-Bjornstal, 2015; Shuer & Dietrich, 1997; Tranaeus,

Johnson, Engstrom, Skillgate, & Werner, 2014). Those who experience this low-level pain may initially misinterpret it as the normal consequence of exertion, perhaps enabling them to become stronger (i.e., functional overreaching), and/or of a temporary nature that will ebb in time. These sorts of pain may be intermittent, as the severity may fluctuate between days, and even within a day, for no clear reason. The pain may also be persistent, remaining low-level, not improving nor worsening. Indeed, these very features of overuse injury highlight the difficulty in diagnosing overuse injury in the early stages as there is no visible deformity (Turner, Barlow, & Ilbery, 2002).

Launay (2015, p. S140) delineated the experience of overuse injury pain into four stages:

> "stage 1: pain after physical activity;
> stage 2: pain during physical activity with no impact on function (can continue participating in activities);
> stage 3: pain during physical activity that lasts all day and has an impact on function (need to decrease or even stop the activities);
> stage 4: pain during all physical activities, even basic musculoskeletal functions"

This stage progression has two implications. First, the early stages are critical because actions taken in the early stages typically determine whether the overuse injury worsens (Wilder & Sethi, 2004). The low-level pain in the early stages may reflect minor physical damage (e.g., tiny lesions in a knee tendon). The injury of those who rest or reduce effort may be resolved in the early stages because the body's repair response is sufficient for healing the damaged component. Those who continue to engage in physical activity may exacerbate the damage (e.g., the lesions become larger, the repair response becomes insufficient), and the injury's severity increases to the later stages. This progression suggests that behaviours in the early stages, particularly the maintenance or reduction of effort, are a critical determinant in the severity of overuse injury.

Second, the delineation also reveals the methodological limitation in previous injury research. In stages 1 or 2 of overuse injury, physical activity participants may continue participation in physical activity with no time loss, and they may not deem the pain severe enough to warrant medical attention. Most injury studies, both in epidemiology (Rossler et al., 2014; Timpka et al., 2015) and sport/exercise psychology (e.g., Maddison & Prapavessis, 2005; Smith, Smoll, & Ptacek, 1990; Wiese-Bjornstal,

Smith, Shaffer, & Morrey, 1998) had inclusion criteria of time loss and medical attention. Some studies used emergency room visits to calculate physical activity injury rates, or required contact with health care providers (Conn, Annest, & Gilchrist, 2009). One tool for collecting data about high school athletic injuries did not initially include an option of overuse injury as a mechanism (Schroeder et al., 2015), and some reporting systems do not classify people as injured if they are able to continue physical activity participation (Pike, 2004). Those in the early stages of overuse injury would not have met the above inclusion criteria and thus would have been excluded from study of injury.

A typical recommendation in injury research is for injury data to be objective, in that it is collected and/or confirmed by medical professionals rather than relying on self-reports (Williams & Andersen, 2007). This method may also preclude inclusion of those in the early stages of overuse injury. One reason is that physical activity participants may be reluctant to report low-level pain as injury, given pain reports about low-level pain can be met with censure in physical activity contexts (Crocket, 2014; Martin Ginis & Leary, 2004; Tranaeus et al., 2014). Those with low-level overuse injury pain may also be reluctant to report it if they fear they will be directed to cease participation in the physical activity (Almeida et al., 2012; Ekenman et al., 2001; Turner et al., 2002). Another reason is that overuse injury in the early stages may not be detectable for diagnosis (e.g., a scintigram used to detect stress fractures may not detect stress fractures in the earliest stages though a person feels pain; Ekenman et al., 2001). Thus, some injury researchers endorse self-reported measures for assessing pain severity (Salamon, Davies, Fuentes, Weisman, & Hainsworth, 2014).

In these ways, methods employed in previous injury research (i.e., inclusion criteria, reliance on objective data collection) would appear to exclude people in the early stages of overuse injury. Evidence of this assertion is provided by a study of athletes' injuries in which the number of overuse injuries captured with time-loss/medical attention criteria was 90% less than the number captured when the criteria were not used (Clarsen et al., 2013). Because those in the early stages of overuse injury have been excluded from previous injury research, it can be inferred that prior calculations of the prevalence of overuse injury excluded them as well.

2.2 Prevalence and Severity

Given the scarcity of research specific to overuse injury, the prevalence of overuse injury in physical activity contexts was relatively unknown, though overuse injuries were estimated to account for 50% of sports injuries (Herring & Nilson, 1987; Roos et al., 2015; Schroeder et al., 2015; Wilder & Sethi, 2004; Yang et al., 2012). Recent epidemiological attempts to quantify overuse injury in physical activity contexts without time-loss criteria hint at substantial prevalence. Without time-loss criteria, and with medical professionals collecting data, 29.3% of the injuries of American collegiate athletes (Yang et al., 2012), and 7.7% of all injures of high school athletes (Schroeder et al., 2015) were designated as overuse injuries. Rates incurred by women were significantly higher than men. Of the collegiate athletes' overuse injuries, 50.8% resulted in no time loss from sport. Half of the high-school athletes' overuse injuries resulted in time loss of less than one week. Time loss for 20.4% of collegiate athletes' overuse injuries was more than 21 days, compared to 7.7% of high school athletes (Roos et al., 2015). The above injury rates were tallied involving pain reports from athletes to medical professionals and coaches. When the injury data were reported by athletes themselves, overuse injuries were reported by 68% of female, high-school distance runners, and 59% of the male runners (Tenforde et al., 2011).

In addition to prevalence, researchers must consider severity of harms when determining whether a phenomenon merits attention. The severity of overuse injury in the early stages may appear negligible at first glance, relative to that of acute. Certainly, a broken leg appears more severe than low-level, nagging knee pain. Floorball players who suffered from overuse injury echoed this sentiment: "Overuse injuries are less important than traumatic injuries", and medical staff was "busy with important injuries" (Tranaeus et al., 2014, p. 165), implying their own overuse injuries were of less importance. The negative impacts of injury are often calculated based on inability to work or attend school, and/or financial costs of medical treatment, but those in the early stages of overuse injury do not typically experience these impacts (Korkmaz, Bülent, Çatıkkaş, & Yücel, 2014; Rossler et al., 2014). Assessments of severity based on these two indicators do not take into account the psychological harms of pain in the early stages. The tolerance of low-level, chronic pain as experienced by those in the early stages of overuse injury has been associated with depressive symptoms (von Korff &

Dunn, 2008). Indeed, collegiate athletes who continued training despite overuse injury pain scored as high on a measure of traumatic stress as individuals whose lives were devastated by natural disasters (e.g., earthquakes, fire; Shuer & Dietrich, 1997).

In the later stages, it is likely that time loss will occur such that sufferers may experience psychological distress from not being able to engage in an activity of personal importance (Evans & Hardy, 1995). In these stages, medical costs may also be incurred. Continuing engagement in physical activity despite overuse injury pain can produce damaging and permanent physical consequences (e.g., surgery, arthritis, restricted mobility; Maffulli, Longo, Gougoulias, Caine, & Denaro, 2010; Roos et al., 2015; Turner, et al., 2002), with inestimable lifetime harm. In the long term, those who suffer injuries, particularly at a young age, are less prone to participate in sport, recreation, or physical activity, later in life (Rossler et al., 2014; Schroeder et al., 2015). Injury was also cited by adults as the most common reason for exercise relapse (Sallis et al., 1990). In this way, overuse injury can contribute to the well-known harms of physical inactivity in adults.

In the above sections, the different causal mechanisms of acute injury and overuse injury were reviewed. The mechanisms underlying onset of overuse injury (i.e., high effort) were also shown to differ from those underlying increasing severity of overuse injury (i.e., effort despite pain). These differences can impact how overuse injury is studied, in that psychological factors specific to acute may differ from those of overuse, and the psychological factors specific to onset of overuse injury may differ from those specific to severity.

2.3 Psychological Antecedents

Given the differences between acute and overuse injuries, researchers in the sport/exercise psychology have acknowledged that the psychological antecedents of overuse injury will also likely differ from those implicated in acute injury (Petrie & Hamson-Utley, 2011; Williams & Andersen, 2007). However, this difference is little more than a hypothesis as very little research has addressed the specific psychological antecedents of overuse injury (Johnson, Tranaeus, & Ivarsson, 2014; Petrie & Hamson-Utley, 2011). In one study that focused on psychological factors specific to overuse injury, adult athletes with overuse injuries were more likely to have adaptive, post-injury emotional adjustment if they attributed the cause of injury to internal factors (e.g.,

their own choices) rather than an external (e.g., a coach) or unstable (e.g., bad luck) factors (Brewer, 1999). The study did not identify actual antecedents of overuse injury, and it was based on athletes who sought medical assistance, likely excluding athletes in the early stages of overuse injury. Another study revealed that runners with one type of overuse injury, stress fractures, were more apt to have Type-A personality traits, which involves high levels of competitiveness, than runners who did not have stress fractures (Ekenman et al., 2011). Researchers emphasized the need to identify other psychological factors that are indicative of susceptibility to overuse injury so that injury-prevention interventions can include identification of individuals with higher susceptibility.

During the time this thesis was conducted, several qualitative studies were published regarding psychological factors specific to overuse injury. In one, researchers created a chronology of factors for the pre-injury, injury onset, and post-injury phases from interviews of 10 long-distance runners who experienced overuse injury (Russell & Wiese-Bjornstal, 2015). Runners primarily attributed onset of overuse injuries to overtraining and changes in training (e.g., mileage increases), but the psychosocial factors in the pre-injury phase were not identified. The psychosocial factors presented revolved around post-injury emotional responses (e.g., frustration, fear of re-injury). The runners highlighted that, in the initial stages of overuse injury, the runners tended to continue training after injury onset because of a desire to obtain a goal such as run a marathon they had planned to do. The underlying reason for considering the goal to be of such importance as to risk more severe overuse injury was not addressed within the paper. That is, why might some runners with goals be willing to push through the pain of early-onset overuse injury, whilst some runners with goals may not do so? Though runners identified not taking time off after injury onset as a contributor to injury severity, the underlying reasons—the psychological basis—for not taking time off were not presented, a gap to be addressed in the current thesis.

In another qualitative study which focused on overuse injury, participants involved in elite rhythmic gymnastics training in Italy were observed for over a year and interviewed in focus groups (Cavallerio, Wadey, & Wagstaff, 2016). The researchers used ethnographic, creative non-fiction to portray the different perspectives of athletes and coaches of overuse injury in the early stages. Echoing findings of previous injury

research, the researchers illustrated that athletes in a competitive sport culture who attempt to report overuse injury pain to a coach may encounter censure from coaches or believe that they will encounter censure (Crocket, 2014; Martin Ginis & Leary, 2004). Other findings in this study included the notion that coaches who feel pressure to ensure teams perform well may believe that pain must be endured for the sake of success in competition, particularly as the time of a critical competition nears. Coaches may mis-attribute performance decrements in the early stages of overuse injury to lack of dedication rather than to the experience of low-level pain. Also, the gymnasts appeared to believe that the endurance of overuse injury pain demonstrated mental toughness. Questions that arise from this study include: Are similar beliefs relevant to overuse injury in physical activity contexts which do not involve competition and/or coaches? In what conditions might physical activity participants be willing to demonstrate mental toughness by enduring low-level overuse injury pain? Therefore, the current thesis extends this study by examining these questions further.

The perspective of both athletes and coaches regarding overuse injury was also presented by van Wilgen & Verhagen (2012). In this study, a list of variables related to overuse injury were derived from interviews of 18 Dutch athletes and coaches who dealt with overuse injuries in a variety of sports, predominantly basketball. Some of the variables were labelled psychological (e.g., having too much of a drive, laying too much pressure on myself). In some cases, participants described overuse injuries as an outcome of pressure from coach (e.g., "the coach demands too much of me", p. 120). The underlying reasons for athletes applying drive despite pain, pressuring themselves, and succumbing to the demands of coaches despite injury risk were not explicated, yielding future directions to pursue in the current thesis.

Another study also resulted in a compilation of variables related to overuse injury, but these variables were derived from 11 Swedish floorball players (Tranaeus et al., 2014). Researchers focused on the identification of psychological factors preceding overuse injury, which were categorized with five core themes. The researchers organized the themes into a working model of psychological risk factors for overuse injury. Four of the themes (i.e., history of stressor, person factors, physiological factors, psychosocial factors) were portrayed as factors affecting an athlete's risk for overuse injury. According to the model, overuse injury occurrence was ultimately contingent on

coping ability. That is, those who cope well with the risk factors do not incur overuse injury whereas those who cope ineffectively incur overuse injury. The new model was created to be specific to overuse injury but was based on this one study of 11 floorball players. The variables in this newly-created overuse injury model matched the variables of the stress-injury model, created by Andersen and Williams (1988). The stress-injury model, rather than the newly-created overuse injury model, was used as a foundation in the current thesis because it existed at the time the studies in the current thesis were designed and implemented; because it has been used extensively in research with more contexts and evidence to support the same variables identified by Tranaeus et al. (2014); and because it has more variables to consider.

In the field of sport and exercise psychology, psychological antecedents of injury have primarily been studied using the stress-injury model developed by Andersen and Williams in 1988 (Johnson et al., 2014). The model was based on Lazarus and Folkman's theory of stress and coping. According to the model, as shown in Figure 2.1, injury occurrence in physical activity begins when a stressor arises. Various moderators (i.e., personality, history of stressors, social support) and mediators (e.g., physiological responses, cognitive appraisal, behavioural responses) then affect the likelihood of injury occurrence (Williams & Andersen, 1998). For example, a football player who perceives a recruiter's presence at a game to be stressful may experience the physiological response of peripheral vision narrowing, and thus be more apt to collide with another player, thereby incurring acute injury.

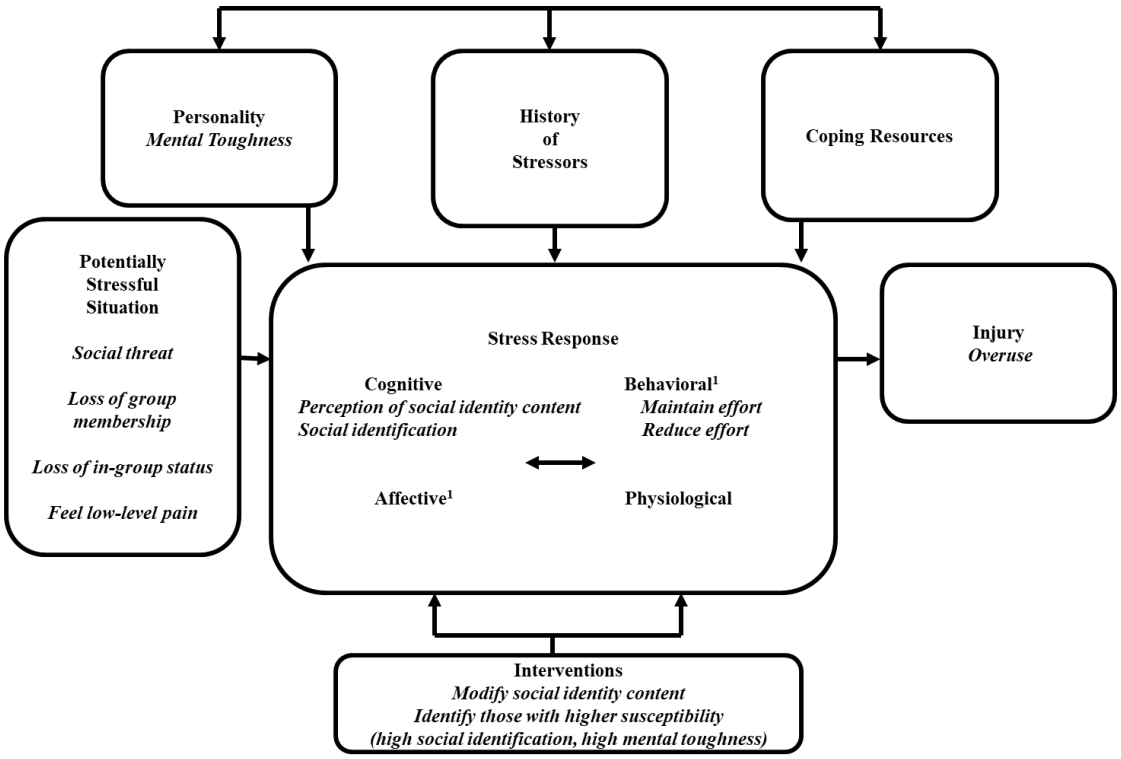


Figure 2.1. Integration of stress-injury model with social identity approach. Proposed elements related to social identity, mental toughness and overuse injury are italicized. [1]Recommendations of Petrie and Perna (2004).

In appraising research that occurred after their introduction of the model, Williams and Anderson (2007) and others (e.g., Johnson et al., 2014; Petrie & Hamson-Utley, 2011) concluded that the model, or research incorporating the model, was appropriate for addressing the likelihood of acute injury occurrence. It was not constructed to account for injury severity, nor for overuse injury occurrence, nor for overuse injury severity. In attempting to modify the model to account for overuse injury occurrence, it has been suggested that the antecedent, stressful situation, include training stressors such as high-volume training, as excessive effort is the root of overuse injury (Petrie & Perna, 2004). However, this modification did not account for why physical activity participants engage in high-effort behaviours in the first place (Williams & Andersen, 2007). The current thesis involves a proposal to account for the engagement in high effort during physical activity, though the high effort induces overuse injury.

Altogether, the studies described above served as critical first steps in identifying psychological factors relevant to overuse injury and revealed numerous

directions for future research, some of which are addressed in the current thesis. A key recommendation going forward is for researchers to use theory as a basis to pursue the identification and understanding of the psychological factors related to overuse injury (McGlashan & Finch, 2010). An advantage of a theoretical rationale is that it can provide the unifying, underlying reasons for the inter-relationships of variables presented in the models and studies above. The recommendation for identification of theory-based variables is also based on evidence that theory-based, injury-prevention interventions are more effective than interventions involving manipulation of miscellaneous injury-related variables. With this in mind, the intent of the current thesis was to focus on theoretical-based constructs which may provide the underlying reasons for relationships between injury-related psychological factors. Therefore, rather than extending the research of overuse injury psychological factors by examining the variables identified in the above-described models and studies, a primary focus of the current thesis was to extend the study of overuse injury by incorporating the theoretical framework of the social identity approach. Next, an overview of the social identity approach is given, followed by a rationale for how social identity constructs are hypothesized to be related to overuse injury.

2.4 The Social Identity Approach

Without knowing contextual factors, the phenomenon in which people exert such excessive effort that they become injured, then continue exerting effort despite feeling injury pain, appears counter to human sensibility. In examining the phenomenon of continued effort despite pain in a sport context, Hughes and Coakley (1991) provided insight. They discussed the reasons some athletes make physical sacrifices during sport participation, stating "it is simply to play, to be an athlete, and *maintain their membership* in the special and elite athletic fraternity" (Hughes & Coakley, 1991, p. 314). They labelled this tendency 'overconformity to sport ethic'. They described one of the characteristics that make athletes more likely to overconform to the sport ethic in this way: "Those athletes who have low *self-esteem* or who, for other reasons, are vulnerable to *group demands* and less able to withstand pressures to sacrifice themselves for the group" (p.312). The observation was formed in a theoretical vacuum, but the words italicized above suggested pursuit of self-esteem, group membership and group demands were relevant to this phenomenon.

The social identity approach provides a well-developed theoretical framework for understanding the group membership and group demands because it describes how membership in social group is related to behaviours (Tafjel, 1974; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). The social identity approach was developed in the area of social psychology stemming from attempts to explain the behaviours of people who identify with a social group (e.g., we are Catholics; we are fans of the Manchester United football club; we are hikers) without the members necessarily knowing each other, liking each other, or interacting with each other. According to the social identity approach, the only necessary and sufficient condition for group formation, and for behaviours in accordance with group norms to occur, is a member's own perception of belonging to the group (Turner, 1982).

This conceptualization of groups differed from other theories regarding groups for which interpersonal attraction was an important antecedent of group formation and cohesion (Turner, 1982). Numerous studies demonstrated support for the social identity group conceptualization (Tajfel, 1970). The lack of prior attraction or interaction was evidenced by people who were grouped together on the basis of a minor commonality (e.g., flip of a coin), with no other prior meaning for group membership. Group members then demonstrated favoritism towards their own group members and discrimination against members of other groups. The importance of social identity theory is illustrated by a study in which participants were fans of the Manchester football team (Levine, Prosser, Evans, & Reicher, 2005). Participants were more apt to offer help to a person appearing to be in pain if the person wore a Manchester football shirt, and less likely to offer help if the person wore an unbranded shirt or the shirt of an opposing team, Liverpool football club. The essence of social identity is shown in that membership in social groups can influence members' behaviours.

Researchers in the area of sport/exercise psychology have proposed that the social identity approach has applicability to sport/exercise contexts (Bruner, Dunlop, & Beauchamp, 2014; Rees, Haslam, Coffee, & Lavallee, 2015). Team sports inherently have connotations of group membership, but given the minimal group conditions of social groups, group membership applies to people engaged in solitary sport and recreational activity as well. For example, runners who do not run with others need only perceive themselves to be members of the social group 'runners', such that they

think in terms of "we" and "us" and behave accordingly. The application of social identity to physical activity contexts is in its infancy, such that it has only just recently been employed as a theoretical basis for studies in sport and exercise psychology (e.g., Barker, Evans, Coffee, Slater, & McCarthy, 2014; Bruner, Bailey, & Benson, 2016; Bruner & Spink, 2012; Fransen et al., 2015; Slater, Barker, Coffee, & Jones, 2014). Thus, a brief overview is provided.

The social identity approach consists of two theories, social identity theory and self-categorization theory. The two theories overlap in some regards (for overview, see Haslam, 2004), but a general, introductory distinction is that the emphasis of social identity theory is inter-group processes, whereas the emphasis of self-categorization theory is intra-group processes. Social identity theory involves how members views their own group (i.e., in-group) in relation to other groups (i.e., out-groups; for review, see Hogg & Abrams, 1988; Tajfel, 1978; Tajfel, 1982). In contrast, self-categorization theory elaborates primarily on how a group member views herself in relation to other members of the same in-group (Turner et al., 1987). Self-categorization theory addresses how members come to understand the meaning and values of their own group, and their own fit with such.

The idea that social identity may be related to injury has yet to be directly assessed in the literature. However, possible links between the constructs have been alluded to in two studies (Jones & Jetten, 2010; Levine & Reicher, 1996). Jones and Jetten (2010) examined the number of social groups that individuals were part of (i.e., age, gender, nationality, college major, occupation) and the duration of time they could withstand their arm being submerged in ice water. A greater duration of time was indicative of higher pain endurance. The number of social groups was found to be related to the length of time that participants endured pain by keeping their arms submerged. In relation to the current research program, it is plausible to suggest that membership in social groups may also be related to overuse injury severity. This is because higher overuse injury severity is typically induced by enduring initial, low levels of pain for longer. Individuals who persevere longer may exacerbate the injury.

Levine and Reicher (1996) proposed that social identity affects how one construes injury symptoms, stating that "even amongst those with identical organic conditions, what is ill for one individual or group need not be ill for another" (p.245).

In their study, knee pain was described as "a damaged knee which was weak and unable to take excessive strain" (p. 250). This description was presented to male and female physical education students. It was expected that the knee pain would be perceived more seriously, more stressful, when the students' social identity as a physical education student was made salient than when the students'gender identity was emphasized. However, no significant difference was found between identities in outcomes (e.g., how upset, frustrated, anxious they would be; how much their lives would be affected). It could be argued that social identity does affect symptom interpretation, but this study did not test a relevant factor: the degree to which a social identity was threatened by the knee pain. Students could continue being male or female, and being a physical education student, with a damaged knee. In contrast, a member of a physical activity social group who wishes to continue participation in the physical activity may be threatened by a damaged knee. Only when a valued group membership itself is threatened would the damaged knee be considered a stressor.

Aside from these studies, there is no other empirical support for the proposition that social identity and overuse injury are related. However, these studies point to the possibility that the application of social identity theory to injury is an exciting avenue of future research. Next, deductive reasoning is employed to demonstrate how social identity constructs—status, social identification, and social identity content, along with their relation to behavioural intentions—may account for overuse injury.

2.4.1 In-group Status

A basic motivation for membership in a social group is the self-esteem enhancement that can be derived from it (Tajfel, 1978). One means of obtaining self-esteem from group membership is based on positive distinctiveness. That is, members may perceive their group's attributes to be different from and better than another group's attributes. Being a member of a group perceived as being superior in some attribute can be a source of self-esteem. As explained by Cairns (1982), a member who is "worthless", not being personally successful nor contributing to a group's success in any fashion, may find it pleasing to think upon being a member of a group that is dominant, "even if he had nothing else to boast of" (p. 291).

Another means of obtaining self-esteem is by obtaining higher status within a group, such that a member is perceived to be better than another member in some way

(Turner et al., 1987). In physical activity contexts, performance is often the basis for assigning higher status between groups (e.g., our team scored more points than yours) and within a group (e.g., one team member runs faster than another; Rees et al., 2015). For those who are unable to achieve the best performances in physical activity contexts, another means for being perceived favorably by others, thereby gaining higher status within a group, is via exhibitions of effort and/or tolerance of pain (Callow, Hardy, Roberts, Rogers, & Woodman, 2011; Hardy, Hall, & Prestholdt, 1986; Leary, 1992; Leary, 1996; Leary & Kowalski, 1990; Rejeski & Lowe, 1980; Tenenbaum et al., 2005; Wann et al., 2002; Worringham & Messick, 1983). Thus, it may be that attempts to gain higher status within a group membership involve exerting high effort, which underlies overuse injury occurrence. Likewise, attempts to gain higher status may be made by exerting effort despite pain, which underlies increasing severity of overuse injury.

2.4.2 Social Identification

Social identification involves the degree to which one considers membership in a group to have emotional significance and importance (Tajfel, 1972). Members with high social identification (i.e., highly-identified members) are those who deem membership to have high emotional significance and importance. In the context of a theatre production, highly-identified group members tended to exert more effort than members with lower social identification (Haslam, Jetten, & Waghorn, 2009). In physical activity contexts, the tendency of highly-identified group members to exert more effort may imply they are more apt to induce overuse injury occurrence than group members with lower social identification. In a situation involving onset of injury pain, pain could be perceived as a stressor to a highly-identified group member, because the pain could cause loss of group membership or status. To prevent this loss of a highly-valued membership or status, a highly-identified group member in the early stages of overuse injury may be more apt to continue effort despite the pain, thereby increasing the severity of the injury. In this thesis, high social identification is envisioned to be a risk factor for overuse injury, such that those with higher social identification are expected to have higher susceptibility to overuse injury occurrence and severity than those with lower social identification.

2.4.3 Social Identity Content

Social identity content consists of the particular norms, beliefs, and values that group members deem important to the group's identity (Turner et al., 1987). This is illustrated when inferring that the social identity content of women in a social group of ballerinas differs from the social identity content of women in a social group of rugby players. Social identity content are considered to be predictive of group members' behaviours (Livingstone & Haslam, 2008). For example, Catholics in northern Ireland who endorsed an antagonistic social identity content (i.e., the norm is to have a negative relationship with Protestants) were more apt to object to a child marrying a Protestant.

The relationship between social identity content and behaviour has not been examined in physical activity but can be hypothesized. For example, members of a physical activity group who perceive social identity content related to socializing or enjoyment aspects to be of high importance may be inclined to invest effort in socializing at a nearby pub after physical activity. Members of a physical activity group who rate goal-related social identity content (e.g., goal accomplishment, performance) of high importance may be more prone to persist in high volumes/intensities of effort even when injury-onset pain is experienced than to socialize at the pub with group members. Whilst social identity content can be different between groups, they can also be perceived differently by members of the same group (Turner et al., 1987). As an example, some cliques within a team may emphasize relational norms whilst others may tend to emphasize task-focused norms, yet they are technically members of the same group. Therefore, an individual's perception of the social identity content of the group is what determines how the individual behaves.

An aspect of social identity content is that members' status in the group can be contingent on whether the members' behaviours appear aligned with the group's social identity content. For example, prototypical group members are those who are perceived by other group members to epitomize the group's social identity content (Haslam, Reicher, & Platow, 2011). If a group's social identity content is perceived to emphasize performance or winning, then the group member who performs best may be perceived to be most impressive to other members, indicative of high status within the group. In contrast, if the social identity content emphasized is relational values, but a member does not socialize with other members, the member may not be regarded highly by other

members. Highly-identified group members may attempt to align their behaviours with social identity content in order to gain higher in-group status. When attempts to be aligned with social identity content induce high-effort behaviours, overuse injury may also be induced. When attempts to be aligned with social identity content induce effort-despite-pain behaviours, higher severity of overuse injury may also be induced.

Like status, provision of social support can be contingent on behaviours being aligned with the social identity content (Levine et al., 2005). For example, if the social identity content of goal accomplishment is perceived as important, in-group members may be more apt to offer social support to a member if the member continues exerting effort towards goals rather than ceasing effort. In this way, social support may incentivize group members to continue effort towards a goal despite low-grade, injury-onset pain.

A feature of social identity content that makes it of particular interest in the study of overuse injury is that it is considered modifiable (Haslam et al., 2011). That is, the leaders of a group, or the prototypical group members, are able to modify the group's social identity content. This has implications for injury-prevention interventions. For example, if social identity content emphasizing goal achievement induces high-effort behaviours, or effort-despite-pain behaviours, and/or is associated with overuse injury occurrence/severity, but social identity content emphasizing relational aspects are not, then interventions may involve group leaders changing the group's social identity content to relational aspects. In this thesis, an intent is to identify social identity content that are both positively and negatively associated with injury-inducing behaviours, with overuse injury occurrence, and with overuse injury severity. In doing so, future studies beyond this thesis will be able to employ this knowledge in interventions.

2.4.4 Behavioural Intentions

Another reason the social identity approach was selected to serve as the theoretical basis for the study of overuse injury is due to its integration with the theory of planned behaviour (for a review, see Terry, Hogg, & White, 1999). Within the theory of planned behaviour, subjective norms consist of normative beliefs or social pressures to enact behaviours or not enact behaviours. These subjective norms in turn influence the formation of behavioural intentions, which are the perceived likelihood of

engaging in behaviours (Ajzen, 2002). Behavioural intentions in turn influence, to some degree, actual behaviours. Researchers employing the theory of planned behaviour often study the effect of various constructs on behavioural intentions, rather than measuring the effects on actual behaviours. Researchers have found that social identity constructs influence behavioural intentions (Fielding, McDonald, & Louis, 2008; Hagger & Chatzisarantis, 2006; Karjaluoto & Leppaniemi, 2013; Livingstone & Haslam, 2008). This link is based upon the understanding that social identity constructs are formulated in relations to norms of a social identity group, which is a type of subjective norm.

As shown above, the various social identity constructs, to some degree, dictate behaviours of group members. Members who desire high in-group status, members with higher social identification, and members who endorse various social identity content, such as try hard, are predicted to engage in high-effort behaviours, and effort-despite-overuse-injury-pain behaviours. However, these behaviours are the ones linked to overuse injury occurrence, whereas behaviours to reduce effort (e.g., rest, take a day off) are ones that, particularly in the early stages of overuse injury, could decrease severity of overuse injury (Wilder & Sethi, 2004). The proposal in this thesis is that behavioural intentions regarding maintaining effort, or reducing effort, are associated with overuse injury. As such, measuring these intentions would be a means for identifying individuals with higher susceptibility to overuse injury in physical activity contexts.

2.5 Mental Toughness

The viability of the social identity approach to account for overuse injury occurrence and severity is contingent on one's ability to engage in high effort, and one's ability to maintain effort despite pain. Group members high in social identification who perceive behaviours of physical exertion despite pain to be aligned with the group's social identity content may desire to exert themselves despite overuse injury pain, but what if they do not have the capability to do so? Mental toughness is a psychological factor that renders one capable of pushing through pain (Arthur, Fitzwater, Hardy, Beattie, & Bell, 2015), so it may be a psychological factor related to overuse injury within the social identity approach. The following analysis supports this proposal.

The definition and conceptualization of mental toughness has been heavily disputed, but mental toughness generally encompasses maintenance of goal-driven behaviours despite stressors (Arthur et al., 2015). Mental toughness has been associated with the tendencies to maintain physical effort despite pain and to increase effort when facing stressors (Arthur et al., 2015; Kaiseler, Polman, & Nicholls, 2009; Nicholls, Polman, Levy, & Backhouse, 2008). These two properties may enable one to perform well in physical activity contexts, yet they also imply that individuals with high mental toughness may be more susceptible to higher overuse injury severity.

Throughout research of mental toughness, an assumption is that individuals perform well, in part, because of possession of mental toughness (Jones, Hanton, & Connaughton, 2007). As measures of mental toughness have been developed, researchers attempting to account for performance via mental toughness explanations have revealed inconsistent and unexpectedly low amounts of performance variance explained. The following analysis supports the proposal of the current thesis that those high in mental toughness are also more apt to incur overuse injury, which may in turn impair performance, which may account for the inconsistent findings in the mental toughness-performance relationship.

When researchers used the 8-item Mental Toughness Inventory (MTI), mental toughness was associated with a subjective measure of performance in the form of ratings based on cricket statistics (Bell, Hardy, & Beattie, 2013). However, mental toughness did not significantly correlate with lab performances of adult cricketers on measures of threat detection, processing time, and decision-making errors of adult cricketers (Hardy, Bell, & Beattie, 2013). Perhaps it is telling that, in developing the MTI, this item was removed: "able to maintain a high level of personal performance in competitive matches when he is struggling with an injury" (p.71). Perhaps the mental toughness-performance relationship may not be guaranteed when nursing overuse injuries is taken into account.

Using another 8-item MTI (Mental Toughness Index), researchers found that mental toughness was associated with performance of workplace, academic, social, and military tasks, some tasks being primarily physical (e.g., carrying heavy loads for extended period with little sleep), some not (e.g., navigating, planning missions; Gucciardi, Hanton, Gordon, Mallett, & Temby, 2015). With this MTI, there was also a

significant but weak correlation with high-school cross country runners mental toughness and race times (Mahoney, Gucciardi, Ntoumanis, & Mallet, 2014). Noticeably, performance times for this study were derived from a race at the end of the season. Given the high rate of overuse injuries with high-school, long-distance runners (68% females, 59% males; Tenforde et al., 2011), perhaps some runners with high mental toughness did not make it to the end-of-the-season race if injuries incurred earlier in the season prevented them from participating.

With another measure of mental toughness, the Mental Toughness Questionnaire 48 (MTQ48), mental toughness was related to student performance (Crust et al., 2014) and related to performance on a single, endurance task (i.e., how long relative weight could be held suspended; Crust & Clough, 2005). However, scores on the MTQ48 did not differentiate between athletes' achievement levels (i.e., international, national, county, club/university, and beginner; Nicholls, Polman, Levy, & Backhouse, 2009).

With another measure, Sport Mental Toughness Questionnaire, mental toughness scores did not significantly differentiate between elite (i.e., international, national) and sub-elite (i.e., county, provincial, club, regional) athletes (Sheard, Golby, & van Wersch, 2009). An explanation for why some athletes with high mental toughness did not make it to the highest echelons of sport may be that their careers were hobbled by overuse injuries (Turner et al., 2002).

With another measure of mental toughness, the Military Training Mental Toughness Inventory mental toughness was related to subjective (e.g., instructor evaluations) and objective (e.g., assault course, requiring some physical ability as well as skill) performance measures of military recruits (Arthur et al., 2015). With use of another mental toughness measure, the Mental Toughness Scale, a significant relationship between mental toughness and performance on a free-throw basketball shooting task was not detected (Madrigal, Hamill, & Gill, 2013). Using the Video Game Mental Toughness Questionnaire, a significant relationship between mental toughness and video game performance was detected (Hardy, Imose, & Day, 2014), but the participants likely were not affected by overuse injury. Overall, mental toughness does not seem to result in successful performance uniformly across tasks of differing natures (e.g., physical endurance, physical skill, and non-physical).

Recently, a new definition of mental toughness was proposed: "a personal capacity to produce consistently high levels of subjective (e.g., personal goals or strivings) or objective performance (e.g., sales, race time, GPA) despite everyday challenges and stressors as well as significant adversities" (Gucciardi et al., 2015, p. 28). The researchers then selected seven indicators of mental toughness based on "their link with performance and goal attainment or progress" (p. 28). However, these researchers emphasized that mental toughness provides "a foundation for performance consistency" but "is imperfectly translated into behaviours" (p.28), and suggested that behaviours chosen in reaction to stress then affect performance. As such, they conceptualized mental toughness as a buffer of perceived stress, suggesting individuals with high mental toughness may believe they have the personal resources needed to cope with perceived stress.

Similarly, Petrie, Deiters, and Harmison (2013) proposed that mental toughness serves as a protective factor when stress arises in physical activity, reducing the likelihood of injury outcomes. Thus they incorporated mental toughness as a moderating personality variable in the stress-injury model. They found that when experiencing high positive life stress (e.g., selection to position of higher responsibility, receipt of athletic scholarship), American football players with higher mental toughness missed less days owing to injury than those with lower mental toughness. However, the findings relied on the methodology involving both time-loss and medical attention inclusion criteria (i.e., the football players had to perceive the pain severe enough to seek medical assistance and take days off from physical training). This methodology excluded players who might have been in the early stages of overuse injury. Of note, mental toughness did not significantly moderate negative life stress (e.g., demotion to lower-status position, losing athletic scholarship) and injury outcomes. Negative life stress is perceived as the type that most predicts the likelihood of sport injury occurrence (Junge, 2000; Petrie, 1992; Rogers & Landers, 2005). The onset of overuse injury (e.g., a nagging knee pain) would be considered negative stress, threatening social identity as one may be forced to discontinue sport engagement. Of interest is to consider what behavioural responses an individual with high mental toughness enacts in order to cope with the negative stress of threatened social identity.

There is some evidence suggesting that those high in mental toughness might respond to the negative stress of low-level overuse injury pain by maintaining effort. In one study, 482 athletes in the United Kingdom reported using the coping strategy of increasing effort most out of 12 coping strategies (Kaiseler et al., 2009). The athletes appeared to perceive increasing effort as the most effective of the 12 strategies. They reported using the coping strategy of behavioural disengagement least, perceiving it as the least effective strategy. This pattern was shown even when the self-reported stressor was injury. Of the 12 coping strategies, increasing effort had the largest, positive correlation with, and prediction of, self-reported mental toughness scores. Behavioural disengagement had the highest, negative correlation with, and prediction of, mental toughness. In another study, 677 athletes similarly rated effort expenditure as the most-used coping strategy, and there was a significant, positive relationship between endorsement of this strategy and mental toughness (Nicholls et al., 2008). Notably, seeking support was rated as one of the least-used coping strategies and had no significant relationship with mental toughness scores. Altogether, this indicates that those with higher levels of mental toughness are more apt to use effort to deal with stressors, yet they are less apt to quit a task and less apt to seek help from others.

In essence, a person with high mental toughness may be the human equivalent of Boxer, the cart horse in George Wells' *Animal Farm*, who lived by the mantra that any problem could be solved by working harder. This tendency may produce successful performances in non-physical achievement contexts (e.g., academic, business). However, this profile has clear ramifications for the onset of overuse injury, as well as increased severity, in physical activity, which in turn impairs performance.

Some researchers (e.g., Arthur et al., 2015; Hardy et al., 2013) have proposed that behavioural evidence of mental toughness, not solely performance, should be examined. Researchers have compiled descriptions of behaviours enacted by those with mental toughness which included high-effort behaviours. Examples include "Pushing back the boundaries of physical and emotional pain, whilst still maintaining technique and effort under distress" (Jones, Hanton, & Connaughton, 2002, p. 211), "Pushing yourself to the limit" (Jones et al., 2007, p. 250), "Go the extra mile mindset" (Bull, Shambrook, James, & Brooks, 2005, p. 217), and "Work ethic" (Gucciardi & Gordon, 2008, p. 125). Whilst extreme effort may contribute to successful performance in

academic/workplace settings and physical activity, extreme effort is also the very core of overuse injury. Explicit links between mental toughness and injury are shown in the description of the characteristic, Physical Toughness: "Pushing through the pain barrier…while carrying an injury, fatigued or hurting" (Coulter, Mallett, & Gucciardi, 2010, p. 705).

At the time of proposal of this thesis, the idea that high mental toughness was related to overuse injury, as opposed to injury in general, was novel. During the conduct of this thesis, a qualitative study was published in which participants in gym and fitness classes indicated that those with high mental toughness appeared to be more apt to train excessively, thereby incurring injury, and to continue physical training with injuries, thereby incurring more severe injury (Crust, Swann, Allen-Collinson, Breckon, & Weinberg, 2014). Likewise, a qualitative study of rhythmic gymnasts revealed their beliefs that those high in mental toughness were more able to endure the initial pain associated with overuse injury, implying those high in mental toughness would be more susceptible to more severe injury (Cavallerio, Wadey, & Wagstaff, 2016). These findings lend support to the current proposal. However, the underlying reason for exercisers with high mental toughness, or for individuals high in mental toughness who are not members of team sports, to train excessively and train despite injury pain was not identified. The potential interaction of mental toughness with social identity may account for this, as discussed next.

Regardless of how mental toughness is conceptualized, it is inarguable that it is considered a desirable characteristic in physical activity, such that there is a demand for researchers to design interventions to develop and maintain mental toughness (Connaughton, Thelwell, & Hanton, 2011). From its popularity, it could be inferred that mental toughness is a social identity content—a highly-valued group norm—for many physical activity groups. Thus, if a group member can behave in such a way that others will perceive the group member as possessing the magical substance called mental toughness, the group member may reap all the rewards that come from being perceived positively by group members, earning in-group status. The need to be perceived as possessing mental toughness seems apparent in that four measures are informant-rated (Arthur et al., 2015; Gucciardi, Jackson, Hanton, & Reid, 2015; Hardy et al., 2013; Madrigal et al., 2013). That is, a person's level of mental toughness is determined by

the perceptions of others, which may be based on their observations of the person's behaviours. In a physical activity group in which effort-despite-pain behaviours are considered admirable, a group member who has high social identification has the incentive (i.e., desire to obtain high in-group status and self-esteem) to push through low-level pain. A group member who has high mental toughness has the ability to push through low-level pain. Therefore, a group member with high social identification and high mental toughness may have higher susceptibility to overuse injury severity. In contrast, a member who is highly identified, but does not possess much mental toughness, may not have the quality that enables them to push through pain, even though they wish to do so. This member may be less apt to incur overuse injury and be less susceptible to higher severity of overuse injury.

2.6 Summary and Aims of the Thesis

Research specific to overuse injury psychological factors has just begun. As a pioneer in this unexplored area, there are many routes that could be taken. For this thesis, the need for theoretical framework, sound methodologies, and measures were prioritized. Here, the gaps identified in the literature review, which will be addressed in this thesis, are summarized.

Regarding methodology, it was determined that overuse injury should be examined separate from acute injury, given their different causal mechanisms and pain patterns. A method needed to be developed for identifying occurrence of overuse injury pain, particularly in the early stages. However, given the afore-mentioned limitations, the method should not rely on time-loss and medical assistance inclusion criteria, nor on objective reports. Given the unique progression of overuse injury, the severity of overuse injury should be examined in addition to occurrence. Therefore, measures for assessing severity should also be employed.

There is a need for identification of theory-based psychological factors specific to overuse injury. The psychological factors associated with the onset of overuse injury (i.e., high effort) may differ from the psychological factors associated with severity (i.e., the choice to maintain effort rather than reduce effort in the early stages). Therefore, psychological factors specific to occurrence and severity need to be separately identified. The proposition that the social identity approach could serve as a theoretical framework for the study of overuse injury was primarily based on deductive reasoning.

Therefore, there is a need to assess empirical support for the proposition that in-group status, social identification, social identity content, and behavioural intentions are related to overuse injury. It is of particular value to identify social identity content specific to physical activity contexts, and, once known, determine which ones are related to injury-inducing behaviours, and which ones are related to injury-prevention behaviours. Though these four social identity constructs were selected for initial testing of social identity's relation to overuse injury, it is of worth to identify other social identity constructs that may be applicable to physical activity contexts and overuse injury.

There is a need to identify individuals with higher susceptibility to overuse injury via validated measures. It was hypothesized that individuals with high social identification, moderated by high mental toughness, may have high susceptibility. Measures of these constructs could be employed to determine susceptibility. However, there are various measures of social identity constructs so exploration is needed to determine the most parsimonious measure (i.e., multi-dimensional, uni-dimensional) suited for study of overuse injury. Measures of social identity constructs will also need to be modified for applicability to physical activity contexts given they were derived in the area of social psychology. Given the proliferation of mental toughness measures, there is a need to explore the most parsimonious versions of these as well that can be used for identifying susceptibility. Aside from these measures, a measure of behavioural intentions to reduce effort in the early stages of overuse injury pain could be a means for identifying individuals who are most susceptible to increased overuse injury severity.

The projects in this thesis were designed to start the process of addressing these gaps. The purpose is to extend knowledge of overuse injury psychological factors, and application of social identity approach to physical activity contexts by 1) developing a method to identify individuals with overuse injury, including those in the early stages; 2) developing a measure to identify individuals who are susceptible to higher overuse injury severity; 3) identifying theory-based psychological factors specific to the causal mechanism of overuse injury occurrence (i.e., high effort); and 4) identifying theory-based psychological factors specific to the causal mechanism of overuse injury severity (i.e., effort-despite-pain behaviours).

2.7 Methodology Employed

Various research methods were employed to meet the above-described aims, with a high reliance on exploratory methods given the scarcity of research in this area. Study 1 consisted of a mixed-method analysis of cross-sectional, retrospective data which was obtained via online surveys. Study 2 was primarily quantitative in nature, involving analysis of prospective data, along with initial validation of a measure. The data was obtained via online surveys administered at two time points. Study 3 consisted of a qualitative examination based on observations and interviews of participants.

The first purpose (i.e., develop a method to identify participants with occurrence of overuse injury pain) was addressed in Studies 1 and 2. In Study 1, the newly-developed method consisted of a series of questions which elicited participants' pain reports. A protocol was constructed such that researchers could analyse the pain reports to yield designations of those reporting overuse injury pain symptoms and those not. Inter-rater reliability was assessed. The term "overuse injury pain" was used in the designations because the method did not meet technical criteria for medical diagnosis of injury, but this method and terminology enabled inclusion of participants in the early stages of overuse injury. This method was refined and employed again in Study 2.

The second purpose (i.e., develop measure to identify individuals who are susceptible to higher overuse injury severity) was also implemented via Studies 1 and 2. In Study 1, qualitative analysis of the pain reports yielded a list of behavioural responses that participants reported invoking when they felt low-level injury pain. In Study 2, these behavioural responses were incorporated as items in a newly-constructed measure of behavioural intentions to reduce effort despite overuse injury pain. The measure was titled Test of Intentions to Reduce Effort (TIRE). Higher TIRE scores were indicative of higher susceptibility to more severe overuse injury pain. Factorial validity was assessed via exploratory factor analysis. Construct and predictive validity were assessed in relation to severity outcomes via appropriate statistical analyses (e.g., correlations, MANOVAs).

All three studies addressed the third and fourth purposes (i.e., identify theory-based psychological factors related to overuse injury occurrence and to severity). In Study 1, psychological factors examined included participants' social identification, social identity content, and mental toughness. The quantitative portion of Study 1

focused on assessing support for the contribution of these psychological factors to the occurrence of overuse injury. Various statistical analyses (e.g., factorial MANOVAs with follow-up discriminant analyses; loglinear analysis) were used. In the qualitative portion, new social identity content, as well as other social identity constructs (e.g., in-group status, desire for proximity to in-group members), were identified with links to both injury-inducing and injury-prevention behaviours.

In Study 2, participants' social identification, social identity content, mental toughness, and behavioural intentions were measured. The measures of social identity content and mental toughness differed in Study 2. Social identity content measures assessed new social identity content which were identified in Study 1. A multi-dimensional measure of mental toughness was used in Study 1, whereas a uni-dimensional measure of mental toughness was used in Study 2. In contrast to Study 1, Study 2 focused on assessing support for the contribution of these psychological factors to the severity, rather than occurrence, of overuse injury. Statistical analyses included a moderation regression analysis with follow-up simple slope analyses.

Study 3 met the third and fourth purposes by identifying social identity constructs related to overuse injury pain. Social identity constructs proposed originally within this thesis (e.g., in-group status, social identity content) were examined. Further evidence confirming those identified in Study 1 (e.g., social creativity) was obtained. The methods yielded additional psychological factors based on social identity theory (e.g., social threat, polarization) related to overuse injury, aside from the ones already proposed.

Software used to conduct the analyses within this thesis included SPSS, the PROCESS macro for SPSS which facilitates moderation regression analysis, and NVIVO which enhances coding for qualitative data.

CHAPTER 3

"The Easy Way Is for the Weak": A Mixed-Methods Examination of Social Identity, Mental Toughness, and Overuse Injury Pain Occurrence of Long-distance Hikers

3.1 Introduction

Overuse injury in sport and recreational activities (SRA) can be caused, or made more severe, when one continues engaging in the SRA despite pain. However, cessation due to pain may cause pain in a different form—derision and censure from other members of one's SRA group. This study is focused upon the choice between exertion that could result in overuse injury or dealing with the derision of valued others.

Overuse injuries account for an estimated 50% of sports injuries overall (Wilder & Sethi, 2004), and approximately 13% of SRA injuries requiring medical attention (Conn, Annest, & Gilchrist, 2003). Overuse injuries occurring in SRA can have wide-ranging consequences, including restricted mobility, arthritis, traumatic stress, medical costs, and lifetime physical inactivity (Maffulli, Longo, Gougoulias, Caine, & Denaro, 2010; Shuer & Dietrich, 1997). Research on psychological factors specific to SRA overuse injury is scarce, as most injury research focuses on acute injury, or the research does not discriminate between acute and overuse injury (Johnson, Tranaeus, & Ivarsson, 2014). Researchers have urged future examinations to focus separately on psychological factors specific to injury type because the causal mechanism and nature of overuse injury pain differ from those of acute injuries (Roos & Marshall, 2014). Specifically, acute injuries result from sudden, single, identifiable events (e.g., falls, collisions) whereas overuse injuries stem from repetitive movement. In the early stages of overuse injury, the pain does not meaningfully impact upon function (Launay, 2015). Thus, one may choose to continue exerting effort. The choice to continue engaging in repetitive movement despite low-level overuse injury pain contributes to escalation of injury severity. Identification of psychological factors related to this choice could ultimately aid efforts to reduce overuse injury rates and severity. However, a theoretical basis for the factors is vital for providing explanations and improving effectiveness of injury-prevention interventions (McGlashan & Finch, 2010).

When describing athletes' reasons for continuing SRA despite pain, Hughes and Coakley (1991) pointed out that these athletes may strongly desire to maintain membership in their SRA group. These athletes may be "less able to withstand pressures to sacrifice themselves for the group" (p. 312). The social identity approach, consisting of social identity and self-categorization theories, provides a well-developed theoretical framework for understanding people who sacrifice themselves for the sake

of group membership because these theories describe how group membership is related to behaviours (Tafjel, 1974; Turner, Hogg, Oakes, Reicher, & Wetherell, 1987). Group membership, within the social identity approach, minimally involves one's own perception that one belongs to a group. A basic motivation for group membership is the self-esteem enhancement that could be derived from it. For example, people who are perceived, or perceive themselves, to be hikers may be associated with positive connotations of the group "hikers" such as healthy, fit, and knowledgeable about outdoor practices. Additionally, status within the group (i.e., in-group status) is a source of self-esteem (Tajfel, 1974; Turner et al.1987). Hikers who hike a mountainous, 2,000-mile trek, such as the Appalachian Trail, may perceive themselves to have higher in-group status than hikers who quit the trek after 400 miles. The proposition for how overuse injury is explained by the social identity approach is based primarily on these two aspects: group membership and in-group status.

Social identification has to do with the degree to which individuals regard their group membership as having importance and emotional significance (Tajfel, 1974). Highly-identified group members tend to exert more effort than members with lower identification (Haslam, Jetten, & Waghorn, 2009); they may do so in order to retain group membership, or to increase in-group status. When the effort involves physical exertion, extra effort—to hike faster, or more miles, for example—may result in overuse injury pain. If the pain is low-level, as it is in the early stages of overuse injury (Launay, 2015), the highly-identified person may continue hiking, risking increased pain and injury severity. If the pain is severe enough, the person may have to seek medical attention and/or discontinue SRA participation—matters that can be perceived as threats to one's social identity as a hiker if one can no longer hike. In both examples, having a high level of social identification could be interpreted as being related to higher levels of effort, and effort despite pain, thereby potentially inducing overuse injury occurrence and severity.

Another construct of relevance is social identity content. Social identity content provides meaningful reasons for individuals to identify with a group whilst also being prescriptive of members' behaviours (Barker, Evans, Coffee, Slater, & McCarthy, 2014; Livingstone & Haslam, 2008). For example, if one perceives goal acquisition as important to in-group status assessments, one may enact behaviours directed towards

acquiring a goal valued by group members. Social identity content of groups in SRA contexts is expected to be related to overuse injury in SRA if the prescribed behaviours involve higher effort or effort despite pain. For example, group members who identify with the importance and emotional significance of goal acquisition (e.g., completing the AT) may continue hiking despite pain; group members who identify with the socioemotional bonds (i.e., friendships) that a group provides may be inclined to hike for social benefits. To date, social identity content has not been studied in relation to gender in SRA contexts, but the behaviours enacted by women to reflect the social identity content have been hypothesized to differ from the behaviours of men (Carter, 2014). If this is the case in SRA contexts, behavioural differences may explain the higher overuse injury rate of women (Roos et al., 2015), though the perception of the SRA group's social identity content may not differ by gender.

Group members whose behaviours are aligned with social identity content (e.g., hiking despite pain aligned with goal acquisition) tend to be perceived more positively by other group members than group members whose behaviours are not aligned with social identity content (Levine, Prosser, Evans, & Reicher, 2005). That is, in-group status is contingent on whether a group member is perceived by other group members to be behaving in conformity to the group's norms, values, and beliefs. To increase in-group status in SRA contexts, participants may be apt to engage in high-effort behaviours and continue effort despite pain. Group members who violate this norm by not engaging in high-effort behaviours and who wish to retain in-group status or prevent censure may engage in tactics used to restore a tarnished social identity (Benoit, 1997; Lee, Quigley, Nesler, Corbett, & Tedeschi, 1999; Scott & Lyman, 1968; Tedeschi & Riess, 1981). One way to do so is to provide an account to explain one's behaviours (Scott & Lyman, 1968). The account of a group member whose behaviours is not aligned with social identity content is expected to differ from the explanation of a group member whose behaviours is aligned with social identity content. The former is expected to contain excuses for the behaviours, and to use more embellishment—more words—than the latter in order to defend the non-aligned behavioural choice.

So far, it has been proposed that highly-identified members of a group who identify with social identity content prescriptive of high-effort behaviours may wish to engage in high effort and maintain effort despite pain in order to retain or increase in-

group status. Thus, they may be susceptible to overuse injury. However, the viability of the social identity approach to account for overuse injury severity is contingent on a member's ability to engage in high effort and maintain effort despite pain. One conceptualization of mental toughness is the ability to maintain goal-driven behaviours despite difficulties (Arthur, Fitzwater, Hardy, Beattie, & Bell, 2015). Possession of this capacity implies one is able to engage in high-effort behaviours and maintain effort despite pain (Crust & Clough, 2005) which has clear ramifications for overuse injury. As mental toughness is considered a desirable characteristic in SRA, one could infer that being mentally tough might contribute towards the social identity content in SRA groups. Behaving in such a way (e.g., hiking despite pain) that leads others to perceive possession of the desirable attribute of mental toughness should allow one to reap the rewards (e.g., higher in-group status) that come from being positively perceived. Whilst an individual's possession of the mental toughness personal capacity differs from a group's emphasis of mental toughness as a source of in-group status, both would be expected to contribute to overuse injury.

The purpose of the current study was to advance understanding of psychological factors which influence overuse injury pain by adopting a social identity approach in examination of a group of people who attempted to hike the Appalachian Trail (AT). This group is hereafter referred to as thru-hikers, and members are referred to as AT hikers. The goal for AT hikers was to finish the 2,000+ miles trek between Georgia and Maine in the United States in less than a year. It was hypothesized that AT hikers who experienced overuse injury pain, and persisted despite overuse injury pain, during their attempts to hike the AT would differ from those who did not by reporting (a) stronger social identification with AT hikers; (b) higher importance of social identity content related to goals, being mentally tough, and effort; (c) lower importance of relational and enjoyment social identity content; and (d) higher mental toughness. Because the choice to engage in high effort underlies overuse injury, further study of this phenomenon was incorporated into the current study via analysis of a situation where participants chose a higher- or lower-effort behaviour. It was hypothesized that hikers who chose the lower-effort behaviour would differ from hikers who chose the higher-effort behaviour in that they would report lower social identification with AT hikers; lower importance of social identity content related to goals, effort, and being mentally tough; lower mental

toughness; use more words to defend the choice; and use excuses in their accounts. Given the aforementioned behavioural differences in relation to social identity, gender was considered in testing the hypotheses.

3.2 Method

3.2.1 Participants

Participants (N = 751) in this study were hikers who attempted to hike the AT, of whom 73% successfully completed the 2,000+ mile trek. These participants (women = 28.7%; age M = 35.74, SD = 14.40) attempted to hike the AT within a 12-month period between 2004 and 2014. Almost all (i.e., 94.7%) were nationals of the United States. Group membership is a construct relevant to hikers attempting to hike the entire AT because they contrast themselves from other groups of hikers on the AT (e.g., hikers who are out for a day, hiking a trail section, or completing the AT in *more* than one year; Appalachian Trail Conservancy, retrieved 8/3/15). AT hikers were also recruited because long-distance hikes involve risk of overuse injury from the repetitive movement, and high rates of injury and musculoskeletal complaints (Bouleware, 2004). In this study, 683 participants provided pain descriptions sufficient for classification, of which 63.5% reported overuse injury pain symptoms.

3.2.2 Retrospective Design

Due to the novel nature of the two areas being studied, retrospective methods were used to gather initial information from participants who had experienced overuse injury in the past. This practice is similar to that employed by other researchers in the study of psychological factors related to injury (e.g., Brewer, 1999; Podlog & Eklund, 2005). There is concern for the accuracy of participants' responses in using retrospective methods given the potential for error in recall. Researchers have found that accuracy of recall about past events is improved when the recall period is short; when the event is salient to participants; when emotion is generated from the recall of intense, peak moments; when participants identify landmark events that aid recall; and when the behaviour being recalled is repetitive and structured (Barrett, 1997; Bridge & Toms, 2013; Larsen, 1992). The current study incorporated these conditions as described below.

The maximum recall period in the current study (i.e., less than one year for all participants) was less than other studies of a retrospective nature of physical activity

participation. Larsen (1992) cited the following recall periods used in research of sport participation: 10 years (Butcher, Lindner, & Johns, 2002); 18 years (Bridge & Toms, 2013); 19 years (Schmidt, Slanger, Chang-Claude, Wahrendorf & Steindorf, 2006); 26-29 years (Baker, Cote, & Deakin, 2006); across lifetime (De Vera, Ratzlaff, Doerfling, & Kopec, 2010). Inclusion criteria for the current study restricted the time between the salient event (i.e., attempt to hike the AT) and time of recall (i.e., participation in this study) to no more than 10 years. The attempts to hike the AT were salient in that hiking a 2,000-mile mountain trail is outside of normal daily activities of living. To enact the guidance regarding recall of peak, intense moments (Barrett, 1997), hikers were directed to describe the most challenging times they encountered during their attempts to hike the AT. Descriptions of encounters with bears and extreme pain appeared to involve intense moments. The act of hiking 2,000 miles is repetitive by nature yet is also structured in that participants hiked a set path from north to south, or vice versa, with excursions to town to obtain food and supplies along the way.

Recall accuracy is also fostered by use of temporal anchors (Larsen, 1992). Temporal anchors prompt participants to think about landmark events (e.g., "Within my first season since returning to sport from injury"; Podlog & Eklund, 2005, p. 26). A season for most sports would span three months to a year. Similarly, attempts to hike the AT lasts from one day to a year, taking 5.5 months on to complete a thru-hike (Appalachian Trail Conservancy, retrieved 8/3/15). In the current study, participants indicated the start and end dates of their first attempt to hike the AT to aid recall because the recall of dates of personal significance aids accuracy (Sobell, Toneatto, Sobell, Schuller, & Maxwell, 1990). The temporal anchor "in relation to the most challenging aspects of my first thru-hike attempt" also preceded questions within the study.

Using the method employed by Bridge and Toms (2013), the retrospective questionnaire was tested with former AT hikers (n = 3) and athletes (n = 4). They answered the questionnaire regarding injury during participation in their respective physical activities. They had not participated in the activities for 3 to 20 years prior to assisting with the development of the questionnaire. All indicated they had no difficulty with recall in the questionnaires.

3.2.3 Measures

Data were obtained via an online survey (Appendix A). Participants first provided demographic information (e.g., age, sex), and were then asked to provide an open-ended description of the most challenging aspects experienced in their first attempt to hike the AT. This item served as a temporal anchor (Barrett, 1997; Larsen, 1992). Before completing each subsequent measure, participants were directed to think of the challenging aspects they detailed. After completing measures of psychological factors, participants provided information about pain/injury, and their AT hike completion status (i.e., finishers, who completed the 2,000-mile hike in less than a year; non-finishers).

3.2.3.1 Social Identity Measures. Two measures of social identification, one being a unidimensional global assessment and the other being a multi-dimensional assessment of specific subcomponents, were employed in this investigation, along with measures of social identity content. Before completing the social identity measures, participants read guidance specifying members of the group "AT thru-hikers" as those attempting to complete the AT in one year and excluding section hikers or day hikers.

The *Social Identification Scale* (SIS; Spears, Doosje, & Ellemers, 1997) is a unidimensional measure of the degree to which members identify with a group, modified for use with AT thru-hikers. Participants rated their level of agreement with each of four items that corresponded with general identification (i.e., "I identified with AT thru-hikers") as well as the cognitive, affective, and evaluative aspects of social identification (i.e., "I saw myself as an AT thru-hiker"; "I was pleased to be an AT thru-hiker"; "I feel strong ties with AT thru-hikers"). Level of agreement was rated on a Likert-type scale ranging from 1 *disagree completely* to 7 *agree completely*. Spears et al. (1997) reported α coefficients of .79 to .81 in scores obtained with this measure across 4 samples of undergraduate students, sizes ranging from 137 to 187 participants, relative to their social identity as psychology students. Evidence of factorial validity (e.g., confirmatory factor analysis) was not provided. Predictive validity of the measure was exhibited in that, across all four samples, students categorized as low identifiers according to low scores on this measure tended to rate themselves as less typical in-group members than students categorized as high identifiers. *In-group identification* items adapted for AT thru-hikers from Leach et al. (2008) also measured social

identification, but relative to five differentiated components. Components include centrality (3 items; e.g. “Being an AT thru-hiker was an important part of how I saw myself”); solidarity (3 items; e.g., “I felt committed to AT thru-hikers”); satisfaction (4 items; e.g., “I was glad to be an AT thru-hiker”); individual self-stereotyping (2 items; e.g., “I was similar to the average AT thru-hiker”); and in-group homogeneity (2 items; e.g., “AT thru-hikers were very similar to each other”). Participants responded to these items on a Likert-type scale ranging from 1 strongly disagree to 7 strongly agree. Leach et al. (2008) reported α coefficients > .80 in scores obtained with this measure across two studies of university students. Leach et al. (2008) also detailed seven studies which provided evidence of the factorial validity via confirmatory factor analyses, construct, predictive, and discriminant validity of this measure in regard to identification with nationality.

Social identity content (SIC) items were employed to measure the perceived importance of various meaningful reasons for identifying with AT thru-hikers as a group. The 12 exploratory items (i.e., Completing the trail; Not quitting; Not giving up; Making friends; Building relationships; Trying hard; Exert as much effort as physically possible; Enjoying the experience; Having fun; Being mentally tough; Keep hiking despite pain; Keep hiking despite adversity) were constructed in alignment with the development of SIC items by Livingstone and Haslam (2008; Antagonistic Identity Content) and Evans, Slater, Turner, and Barker (2013; Results, Friendship). The items were elicited from the researcher’s experience of living with this group, AT thru-hikers, for 4.5 months; from discussions with two AT thru-hikers; and from discussions with a sport/exercise psychology researcher who specializes in the study of social identity. Participants were asked to think of themselves as AT thru-hikers, and then rate the level of importance for each item (e.g., completing the trail; building relationships) on a Likert-type scale ranging from 1 *not at all important* to 7 *extremely important*.

Social identity content alignment was assessed using a situational device involving effort choice. It was employed to garner open-ended responses which can be analyzed to identify alignment/nonalignment between behaviours (e.g., lower- or higher-effort behaviours) and social identity content (Scott & Lyman, 1968). Participants read this brief description of a real-world situation that AT hikers would have encountered on the trek in New York: “In New York, there is a sign on the AT

near some steep rocks. The words "Easy Way" are on the sign, with an arrow pointing at an alternate route around the rocks." Participants then indicated whether they did or did not see the sign. Participants who reported seeing the sign during their attempts to hike the AT indicated the route choice (i.e., hard, easy) they made during their trek and then responded to this open-ended question: "Please describe your reasons for taking the route you chose, whether it was the easy or hard way". Based on Scott and Lyman (1968), the behaviour chosen by the majority of group members was designated as being aligned with social identity content. Word counts of open-ended responses were analyzed; larger word counts imply engagement in defensive tactics due to nonalignment between behavioural choice and social identity content (Scott & Lyman, 1968). Responses were analyzed to detect the usage of defensive tactics such as excuses, which are indicative of nonalignment between social identity content and behavioural choice, and the presence of assertive tactics, which are indicative of alignment (Lee et al., 1999).

3.2.3.2 Mental Toughness Measures. Two measures, one multi-dimensional and one single-item, were used to assess the individuals' perceptions of the degree to which they possess mental toughness. The *Sports Mental Toughness Questionnaire* (SMTQ; Sheard, Golby, and van Wersch, 2009) was modified for hikers attempting to hike the AT. Participants responded to items of the three subscales: confidence (6 items; e.g., "I had qualities that set me apart from other hikers"), constancy (4 items; e.g., "I gave up in difficult situations"), and control (4 items; e.g., "I got angry and frustrated when things did not go my way"). Participants responded to each item on a Likert-type scale ranging from 1 *not at all true* to 4 *very true*. In three studies with athletes, researchers reported α coefficients > .72 in scores obtained with this measure (Crust & Swann, 2011; Sheard et al., 2009). In two studies with athletes (n = 633, n = 509), Sheard et al. (2009) presented evidence of factorial validity via an exploratory factor analysis in the first, yielding three factors that accounted for 40.7% of the variance, and a confirmatory factor analysis in the second, $\chi^2(509) = 182.56$, RMSEA = .05, CFI = .92, TLI = .01, and RMR = .05. Evidence of discriminant validity in relation to measures of hardiness and optimism was also provided.

A *single-item mental toughness* (SIMT) measure was created as an exploratory measure. A criterion for the development of single-item measures is that the underlying

psychological construct is considered to be unidimensional (Postmes, Haslam, & Jans, 2013). Given recent evidence that mental toughness may be a unidimensional concept (e.g., Gucciardi, Hanton, Gordon, Mallett, & Temby, 2015), this item was constructed for exploratory purposes. Participants responded to the item (i.e., "I was mentally tough") on a Likert-type scale ranging from 1 *not at all true* to 7 *very true.*

3.2.3.3 Overuse Injury Pain Symptoms. Participants were categorized as having experienced (or not) overuse injury pain based on their descriptions of pain symptoms during their attempts to hike the AT. The method of assigning categories inferred from qualitative responses is previously used in the extant literature (e.g., Livingstone & Haslam, 2008; Rogers & Landers, 2005). Participants first read definitions of pain/injury types (e.g., acute, overuse) then responded to a yes/no question as to whether or not they had experienced injury-related pain during their attempts to hike the AT. If they responded "yes", they were asked to describe the pain experiences as well as their beliefs about the implicated cause(s). As recommended for the study of overuse injury (e.g., Roos & Marshall, 2014), a protocol (Appendix B) was developed to assess whether the descriptions implicated causal mechanisms suggesting that the pain resulted from overuse injury or not. This categorization process differed from previous injury research which relied upon criteria such as seeking medical attention and/or participation time-loss. These criteria have limited relevance to overuse injury, particularly in the early stages where low-level pain not impacting on function is often tolerated or ignored in continuing SRA (Launay, 2015). To assess reliability of coding, the researcher and a research supervisor used the protocol to independently code a random sample of 50 participants' descriptions. The two agreed on categories for 47 of the 50 (kappa = .89; $p < .001$). Following discussion to resolve disagreement in the three cases coded differently, the researcher categorized the remainder using the protocol.

3.2.4 Procedures

The content of recruitment materials and the recruitment strategy detailed below was approved by the university's ethics committee. The materials contained a brief description of the research, inclusion criteria, contact information for the researchers and the ethics committee, and a link for the online survey. Internet searches and social media (e.g., Facebook® groups specific to the AT) were used to identify individuals

who, via posts in online forums open to the public, indicated that they had attempted to hike the AT. Initial contact involved emails/online messages to these potential participants. Two follow-up contacts, sent approximately two weeks and one month after initial contact, contained requests for individuals to participate if they had not done so already, and for individuals to forward the survey's link to other eligible individuals. No further recruitment effort was made after the third attempt. In the final page of the online survey, participants were asked to forward the link to other eligible individuals. Additionally, businesses (e.g., hostel owners) and organizations (e.g., Appalachian Trail Conservancy) associated with the AT were identified via internet searches. Emails containing requests for assistance in publicizing the study were sent to these entities. Included in the emails were electronic copies of flyers to post at establishments and recruiting materials to post on their websites. Similarly, administrators of online forums (e.g., Facebook® groups) related to the AT were contacted and asked to assist in publicizing the study. Administrators were provided with recruiting materials to post if they were willing to do so.

Upon accessing the link, participants provided informed consent. Participants were randomly assigned via survey software such that the order of psychological questionnaires was counterbalanced.

3.2.5 Data Analyses

For quantitative analyses, normality, internal consistency, and order effects were assessed. Data excluded from subsequent analyses included: (a) the scores from the homogeneity subscale of the in-group identification measure, and the SMTQ control and constancy subscales, because of less-than-satisfactory internal consistency (Cronbach's alpha < .70), (b) responses to social identity content item "keep hiking despite adversity" because they were found to be susceptible to order effects, $F(2,490.71) = 3.56$, $p = .03$, and (c) responses from 68 participants who did not provide sufficient details about causal mechanism in their pain descriptions. Analyses included loglinear analyses and factorial ANOVAs/MANOVAs. The factors were overuse injury pain (overuse injury, no overuse injury), completion status (finished, did not finish), gender (male, female), and, when applicable, route choice (easy, hard).

Regarding the factorial MANOVA, the five sub-scales of the in-group identification scale were the dependent variables. When the omnibus interactions were

significant (e.g., overuse injury x gender), discriminant function analysis was selected as the most appropriate follow-up test to examine the differences in the in-group identification sub-scales between categories of overuse injury occurrence, gender, and completion status. This use of a discriminant function analysis was based on the recommendations of Tabachnick and Fidell (2013) as it takes into account both the inter-correlations between the in-group identification sub-scales and the composite variable created from the linear combination of the five sub-scales. Conversely, the alternative approach of using univariate ANOVAs as follow-up tests was not employed. Use of univariate ANOVAs would ignore the correlations among in-group identification sub-scales and the optimally weighted linear combination that were obtained with the MANOVA (Huberty & Morris, 1989). In the cases of significant multivariate interactions resulting from factorial MANOVAs, only the highest-order, significant, multivariate interactions are analyzed when using discriminant function analysis as a follow-up. For example, if the higher-order three-way interaction (i.e., overuse injury x completion status x gender) is revealed to be significant, then it would be explored using the discriminant function analysis. In this instance, the lower-order, two-way interactions (e.g., overuse injury x gender; overuse injury x completion status) nor the simple main effects of individual categories (e.g., overuse injury) would be analyzed further. Analysis of the lower-order effects and simple main effects is incorporated into the discriminant function analysis of the interaction and is not considered to provide useful information separate from examination of the interaction.

In addition to the analyses detailed in the measures section, qualitative data from the open-ended items were analyzed via the variable-oriented approach recommended by Miles, Huberman, and Saldana (2014). Multiple iterations of inductive, descriptive coding were used to identify emergent themes, and the themes were interpreted deductively using social identity and self-categorization theories.

3.3 Results

3.3.1 Quantitative Findings

Descriptive statistics in relation to overuse injury pain and completion status categories are presented in Table 3.1. A loglinear analysis revealed that the highest-order interaction (overuse injury pain x completion status x gender) was not significant, $\chi 2\ (1) = 1.69$, $p = .19$. There was no significant association between overuse injury

pain and completion status, $\chi 2$ (1) = .59, p = .44, *Phi* = .03, nor between overuse injury pain and gender, $\chi 2$ (1) = 1.32, p = .25, *Phi* = .04.

Results of the 2 (overuse injury pain) x 2 (completion status) x 2 (gender) factorial ANOVAs of uni-dimensional measures are displayed in Table 3.2. The significant three-way interactions are depicted in Figure 3.1 to illustrate the relationships. Descriptive statistics for these groups are provided in Appendix C.

As depicted in Figure 3.1, significant three-way interactions revealed that goal SIC (i.e., "Completing the trail", "Not giving up") and the single-item measure of mental toughness differentiated men and women who finished despite overuse injury pain from those with overuse injury pain who did not finish, with large effect sizes (d from .76 to 1.27). Per significant two-way interactions, the goal SIC item "Not quitting" differentiated those who finished despite overuse pain from those with overuse pain who did not finish (d = .72). The higher rating of the SIC item "Being mentally tough" by those who finished despite overuse pain compared to those with overuse pain who did not finish neared significance (p = .05; d = .38). Men with overuse pain rated relational SIC (i.e., "Building relationships", "Making friends") of more importance than men without overuse pain, with small effect sizes (d = .28, d = .23, respectively).

Table 3.1

Means (Standard Deviations) and Cronbach Alphas of Psychological Measures of Hikers Who Attempted to Hike the Appalachian Trail (N = 683)

				Finishers		Non-finishers	
Psychological Measures	α	With Overuse *n* = 434	Without *n* = 249	With Overuse *n* = 322	Without *n* = 179	With Overuse *n* = 112	Without *n* = 70
SIC Being mentally tough	-	6.45 (0.86)	6.30 (0.98)	6.53 (0.79)	6.30 (0.99)	6.21 (1.01)	6.30 (0.94)
SIC Building relationships	-	4.99 (1.44)	4.69 (1.52)	5.01 (1.41)	4.73 (1.53)	4.93 (1.55)	4.59 (1.48)
SIC Completing the trail	-	6.18 (1.32)	6.16 (1.34)	6.51 (1.01)	6.43 (1.06)	5.21 (1.59)	5.46 (1.69)
SIC Enjoying the experience	-	6.26 (1.05)	6.47 (0.87)	6.24 (1.08)	6.39 (0.95)	6.33 (0.97)	6.69 (0.58)
SIC Exert as much effort…	-	4.39 (1.74)	4.20 (1.82)	4.39 (1.67)	4.25 (1.78)	4.41 (1.92)	4.09 (1.92)
SIC Having fun	-	6.02 (1.23)	6.21 (1.08)	6.06 (1.12)	6.17 (1.11)	5.90 (1.50)	6.31 (1.02)
SIC Keep hiking…pain	-	5.37 (1.41)	5.05 (1.48)	5.44 (1.37)	5.11 (1.48)	5.19 (1.53)	4.91 (1.50)
SIC Making friends	-	5.09 (1.35)	4.87 (1.51)	5.09 (1.32)	4.88 (1.47)	5.07 (1.45)	4.86 (1.61)
SIC Not giving up	-	6.45 (0.99)	6.40 (1.00)	6.66 (0.72)	6.55 (0.86)	5.86 (1.35)	6.01 (1.20)
SIC Not quitting	-	6.51 (0.92)	6.48 (0.92)	6.67 (0.74)	6.51 (0.90)	6.05 (1.21)	6.40 (0.97)
SIC Trying hard	-	5.88 (1.07)	5.94 (1.19)	5.89 (1.05)	5.89 (1.26)	5.86 (1.11)	6.09 (0.99)
Social Id Scale	.81	6.10 (0.91)	6.05 (0.95)	6.25 (0.75)	6.16 (0.86)	5.65 (1.15)	5.78 (1.10)
In-group Solidarity	.80	5.80 (1.17)	5.74 (1.24)	5.95 (0.99)	5.83 (1.14)	5.37 (1.51)	5.50 (1.44)
In-group Satisfaction	.73	6.24 (0.81)	6.29 (0.82)	6.36 (0.63)	6.33 (0.74)	5.87 (1.11)	6.18 (0.99)
In-group Centrality	.85	5.72 (1.32)	5.54 (1.47)	5.88 (1.15)	5.68 (1.35)	5.26 (1.64)	5.16 (1.71)
In-group Self-stereotype	.85	4.41 (1.40)	4.47 (1.47)	4.54 (1.35)	4.54 (1.42)	4.02 (1.47)	4.30 (1.58)
SMTQ Confidence	.72	3.07 (0.52)	3.07 (0.50)	3.14 (0.48)	3.12 (0.49)	2.87 (0.57)	2.94 (0.53)
SIMT	-	5.89 (1.27)	5.85 (1.21)	6.18 (0.92)	6.11 (0.93)	5.07 (1.72)	5.20 (1.57)

Table 3.1 (Continued)

	Women		Men	
Psychological Measures	With Overuse *n* = 130	Without *n* = 65	With Overuse *n* = 304	Without *n* = 184
SIC Being mentally tough	6.31 (0.99)	6.20 (0.96)	6.51 (0.79)	6.33 (0.98)
SIC Building relationships	5.18 (1.52)	5.26 (1.38)	4.90 (1.40)	4.49 (1.51)
SIC Completing the trail	6.22 (1.24)	5.91 (1.58)	6.16 (1.35)	6.24 (1.24)
SIC Enjoying the experience	6.33 (1.01)	6.51 (0.89)	6.23 (1.07)	6.46 (0.87)
SIC Exert as much effort…	4.50 (1.90)	4.31 (1.75)	4.35 (1.66)	4.17 (1.85)
SIC Having fun	6.08 (1.21)	6.38 (0.98)	5.99 (1.24)	6.15 (1.11)
SIC Keep hiking…pain	5.38 (1.52)	4.89 (1.58)	5.37 (1.37)	5.11 (1.45)
SIC Making friends	5.22 (1.37)	5.35 (1.36)	5.03 (1.35)	4.70 (1.52)
SIC Not giving up	6.55 (0.85)	6.22 (1.14)	6.41 (1.05)	6.46 (0.93)
SIC Not quitting	6.49 (0.91)	6.42 (0.88)	6.52 (0.93)	6.51 (0.94)
SIC Trying hard	6.17 (1.11)	6.11 (1.12)	5.76 (1.03)	5.89 (1.21)
Social Id Scale	6.10 (0.89)	6.05 (0.86)	6.10 (0.92)	6.05 (0.98)
In-group Solidarity	5.79 (1.24)	5.93 (1.09)	5.80 (1.14)	5.67 (1.28)
In-group Satisfaction	6.24 (0.80)	6.32 (0.97)	6.24 (0.82)	6.28 (0.76)
In-group Centrality	5.77 (1.53)	5.54 (1.56)	5.70 (1.22)	5.53 (1.45)
In-group Self-stereotype	4.15 (1.41)	4.56 (1.42)	4.52 (1.38)	4.44 (1.49)
SMTQ Confidence	2.91 (0.54)	2.84 (0.55)	3.14 (0.49)	3.15 (0.46)
SIMT	5.62 (1.39)	5.51 (1.34)	6.01 (1.20)	5.97 (1.14)

Note. SIC = Social Identity Content; SMTQ = Sport Mental Toughness Questionnaire; SIMT = Single-item Mental Toughness.

Ranges: SMTQ Confidence = 1-4; All others = 1-7.

Table 3.2

Results of 2 (Overuse Injury Pain Occurrence) x 2 (Completion Status) x 2 (Gender) ANOVAs Regarding Social Identity and Mental Toughness of Hikers (N = 683)

Effect	*F*	*p*	η^2	*d*
SIC Being mentally tough[1]				
Overuse x Completion x Gender	0.20	.66	.000	-
Overuse x Completion**	3.79	.05	.006	-
Overuse x Gender	0.14	.71	.000	-
Completion x Gender	0.40	.53	.001	-
Overuse	0.68	.41	.001	.17
Completion	1.88	.17	.003	.22
Gender	2.08	.15	.003	.19
SIC Building relationships				
Overuse x Completion x Gender	0.48	.49	.001	-
Overuse x Completion	0.00	.96	.000	-
Overuse x Gender**	3.81	.05	.006	-
Completion x Gender	1.78	.18	.003	-
Overuse	1.75	.19	.003	.20
Completion	2.12	.15	.003	.08
Gender*	10.69	<.01	.016	.32
SIC Completing the trail[1]				
Overuse x Completion x Gender*	6.77	.01	.010	-
Overuse x Completion	0.27	.60	.000	-
Overuse x Gender*	11.10	<.01	.016	-
Completion x Gender	1.24	.27	.002	-
Overuse	0.25	.62	.000	.01
Completion*	106.55	<.01	.136	.98
Gender	0.53	.47	.001	.06
SIC Enjoying the experience[1]				
Overuse x Completion x Gender	0.51	.48	.001	-
Overuse x Completion	1.65	.20	.002	-
Overuse x Gender	0.00	1.00	.000	-
Completion x Gender	0.68	.41	.001	-
Overuse*	6.50	.01	.010	.22
Completion	2.91	.09	.004	.18
Gender	0.10	.75	.000	.07

Table 3.2 (Continued)

Effect	*F*	*p*	η^2	*d*
SIC Exert as much effort as possible				
Overuse by Completion by Gender	0.04	.85	.000	-
Overuse by Completion	0.20	.66	.000	-
Overuse by Gender	0.00	.96	.000	-
Completion by Gender	0.02	.90	.000	-
Overuse	1.62	.20	.002	.11
Completion	0.27	.61	.000	.03
Gender	0.66	.42	.001	.09
SIC Having fun				
Overuse by Completion by Gender	0.86	.35	.001	
Overuse by Completion	3.04	.08	.004	-
Overuse by Gender	0.76	.38	.001	-
Completion by Gender	0.29	.59	.000	-
Overuse*	7.14	.01	.010	.16
Completion	0.01	.91	.000	.03
Gender	3.05	.08	.004	.11
SIC Keep hiking despite pain				
Overuse by Completion by Gender	0.31	.58	.000	-
Overuse by Completion	0.02	.90	.000	-
Overuse by Gender	1.23	.27	.002	-
Completion by Gender	0.66	.42	.001	-
Overuse*	6.29	.01	.009	.22
Completion	1.76	.19	.003	.16
Gender	0.08	.78	.000	.04
SIC Making friends				
Overuse by Completion by Gender	1.76	.19	.003	-
Overuse by Completion	0.17	.68	.000	-
Overuse by Gender*	4.75	.03	.007	-
Completion by Gender	1.30	.26	.002	-
Overuse	0.52	.47	.001	.15
Completion	0.40	.53	.001	.02
Gender	7.18	.01	.011	.26

Table 3.2 (Continued)

Effect	*F*	*p*	η^2	*d*
SIC Not giving up				
Overuse by Completion by Gender*	7.74	.01	.011	-
Overuse by Completion	0.45	.50	.001	-
Overuse by Gender	13.90	<.01	.020	-
Completion by Gender	0.27	.61	.000	-
Overuse	1.00	.32	.001	.05
Completion	62.59	<.01	.085	.77
Gender	0.01	.92	.000	.01
SIC Not quitting				
Overuse by Completion by Gender	2.27	.13	.003	-
Overuse by Completion*	5.39	.02	.008	-
Overuse by Gender	2.08	.15	.003	-
Completion by Gender	0.41	.53	.001	-
Overuse	0.36	.55	.001	.03
Completion	20.70	<.01	.030	.48
Gender	0.16	.69	.000	.05
SIC Trying hard				
Overuse by Completion by Gender	0.33	.57	.000	-
Overuse by Completion	1.34	.25	.002	-
Overuse by Gender	1.38	.24	.002	-
Completion by Gender	0.04	.83	.000	-
Overuse	0.69	.41	.001	.05
Completion	0.19	.66	.000	.05
Gender*	9.12	<.01	.013	.31
Social Id Scale				
Overuse by Completion by Gender	0.02	.89	.000	-
Overuse by Completion	1.90	.17	.003	-
Overuse by Gender	0.14	.70	.000	-
Completion by Gender	0.08	.78	.000	-
Overuse	0.00	.98	.000	.05
Completion*	33.30	<.01	.047	.59
Gender	0.22	.64	.000	.01

Effect	*F*	*p*	η^2	*d*
Sport Mental Toughness Questionnaire (SMTQ)				
Overuse by Completion by Gender	0.21	.64	.000	-
Overuse by Completion	0.54	.46	.001	-
Overuse by Gender	0.91	.34	.001	-
Completion by Gender	1.71	.19	.003	-
Overuse	0.20	.66	.000	.01
Completion*	22.45	<.01	.032	.47
Gender*	33.83	<.01	.048	.52
Single-item Mental Toughness				
Overuse by Completion by Gender*	5.53	.02	.008	-
Overuse by Completion	0.01	.92	.000	-
Overuse by Gender	3.22	.07	.005	-
Completion by Gender	0.43	.51	.001	-
Overuse	0.26	.61	.000	.03
Completion	83.62	<.01	.110	.92
Gender	10.61	<.01	.015	.33

Note. SIC = Social Identity Content.

Degrees of freedom = 1, 675

[1]Levene's values for these items were nonsignificant; as advised by Tabachnick and Fidell (2007), results were derived from unweighted means analysis to account for unequal group *n*.

* $p < .05$; ** $p = .05$

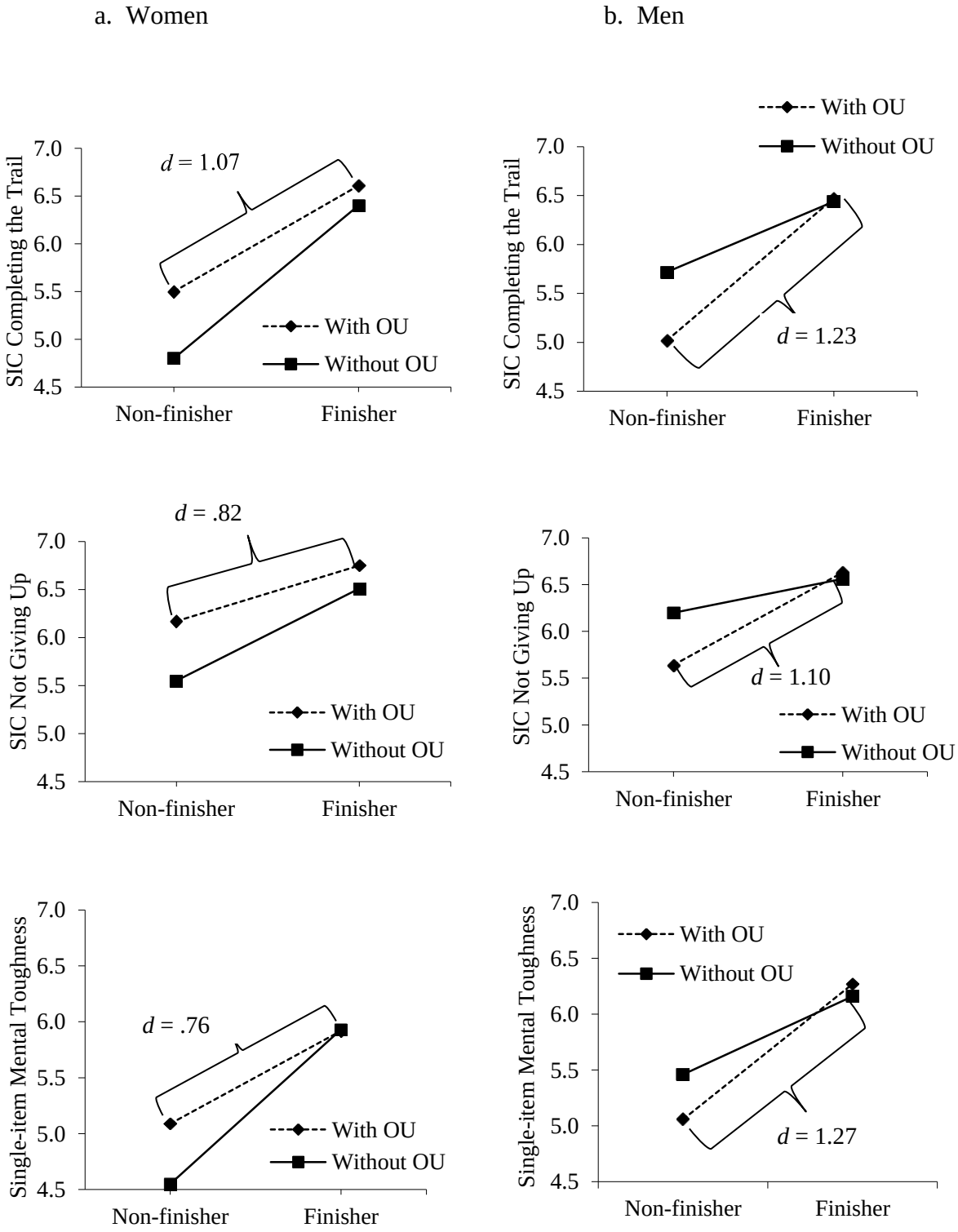


Figure 3.1. Significant three-way interactions (overuse injury pain x finisher status x gender) for two social identity content (completing the trail, not giving up) and the single-item measure of mental toughness. Cohen's *d* values reflect differences between hikers with overuse injury pain who finished the trail and hikers with overuse injury pain who did not finish the trail. OU = Overuse injury pain. SIC = Social Identity Content.

Regarding the multi-dimensional measure of in-group identification, results of the 2 x 2 x 2 MANOVA are presented in Table 3.3. The higher-order, three-way interaction was not significant, $\lambda = .990$, $F\ (4,672) = 1.74$, $\eta^2 = .01$, $p = .14$. Therefore, the next highest-order interactions were examined (Huberty & Morris, 1989). The overuse injury pain x gender interaction was significant, $\lambda = .986$, $F\ (4,672) = 2.45$, $\eta^2 = .01$, $p < .05$. Therefore, lower-order interactions and main effects of sub-scales were not analyzed (Huberty & Morris, 1989).

The follow-up discriminant analysis of the significant interaction revealed three functions significantly differentiated the groups, $\lambda = .965$, $\chi^2\ (12) = 24.08$, $p = .02$. Removing the first function indicated that the second and third functions did not significantly differentiate the groups, $\lambda = .988$, $\chi^2\ (6)$, $p = .24$. The first function accounted for 67.0% of the variance, canonical $R^2 = .02$. Group centroids indicated that the group, women with overuse pain (-.289), was different from the other three groups, women without overuse pain (.129), men with overuse pain (.003), and men without overuse pain (.154). Canonical variate correlation coefficients indicate self-stereotype (.52) and centrality (-.38) subscales significantly contributed to the differences between the groups. Inspection of means indicates that women with overuse pain had lower self-stereotype scores relative to members of the other three groups; men and women with overuse injury had higher centrality scores, relative to men and women without overuse pain.

Table 3.3

Results of Factorial MANOVA of In-group Identification Scale of Hikers (N = 683)

Effect	Wilk's λ	*F*	*p*	η^2
Overuse by Completion by Gender	.990	1.74	.14	.01
Overuse by Completion	.989	1.91	.11	.01
Overuse by Gender	.986	2.45	<.05	.01
Completion by Gender	.994	1.05	.38	.01
Overuse	.977	4.03	<.01	.02
Completion	.959	7.26	<.01	.04
Gender	.993	1.11	.35	.01

Note. The value of Box M for in-group identification was < .001. As advised by Tabachnick and Fidell (2007), results from Pillai's Trace were examined and found to correspond with the above Wilk's values. Degrees of freedom = 4, 672.

Regarding the effort choice situation, 332 participants (women = 25.6%; finishers = 88.3%; age *M* = 34.5, *SD* = 13.96) reported seeing the sign on the AT giving the choice between an easy and hard route; characteristics of these participants are presented in Table 3.4. Descriptive statistics and ANOVA results pertaining to effort choice are presented in Table 3.5.

Table 3.4

Characteristics of Participants who Chose Higher-effort (n = 274) and Lower-effort (n = 58) Routes

	Route Taken			
	Hard		Easy	
Groups	%	*n*	%	*n*
Women	23.4	64	36.2	21
Men	76.6	210	63.8	37
Finishers	89.1	244	84.5	49
Non-finishers	10.9	30	15.5	9
Overuse injury pain	63.9	159	63.6	35
No overuse injury pain	36.1	90	36.4	20

Table 3.5

Descriptive Statistics and Results of ANOVAs for Psychological Measures by Effort Choice

	Hard (n = 274)		Easy (n = 58)				
Psychological Factors	M	SD	M	SD	F	*d*	*p*
SIC Being mentally tough	6.48	0.80	6.43	0.90	0.16	.06	.69
SIC Keep hiking despite pain	5.27	1.45	5.45	1.23	0.76	.13	.38
SIC Trying hard	5.80	1.19	5.95	1.07	0.82	.13	.37
SIC Exert as much effort…	4.24	1.75	4.16	1.78	0.10	.05	.75
SIC Not quitting	6.65	0.74	6.31	1.19	7.77	.41*[a]	.04
SIC Completing the trail	6.42	1.08	5.97	1.36	7.71	.40*[a]	.02
SIC Not giving up	6.63	0.67	6.38	1.15	5.03	.33[a]	.11
SIC Making friends	5.08	1.43	5.21	1.32	0.41	.09	.52
SIC Building relationships	4.89	1.47	5.00	1.49	0.25	.07	.62
SIC Enjoying the experience	6.30	1.07	6.29	1.03	0.00	.01	.97
SIC Having fun	6.11	1.21	6.10	1.17	0.00	.00	.99
Social Id Scale	6.22	0.80	6.30	0.67	0.54	.11	.47
In-group Solidarity	5.92	1.01	6.19	0.84	-	-	-
In-group Satisfaction	6.29	0.75	6.49	0.52	-	-	-
In-group Centrality	5.70	1.32	5.94	1.18	-	-	-
In-group Self-stereotype	4.47	1.34	4.65	1.38	-	-	-
SMTQ Confidence	3.17	0.48	3.01	0.59	4.96	.32*	.03
SIMT	6.18	0.93	5.72	1.44	9.15	.45*[a]	.02

Note. SIC = Social Identity Content; SMTQ = Sport Mental Toughness Questionnaire; SIMT = Single-item Mental Toughness

* $p < 05$ = significant

Of these participants, 17.5% took the easy route. As the minority of the group took the easy route, this finding was indicative that taking the lower-effort route was not aligned with the group's social identity content. As hypothesized, the mean number of words written by the majority who took the hard route to explain their reasons for taking the hard route (M = 15.61, SD = 13.64) was significantly fewer (F = 13.05, $p < .001$, d = .53) than the mean number of words written by the minority who took the easy route (M = 23.28, SD = 18.87). The loglinear analysis revealed that the highest-order interaction (route choice x gender x completion status x overuse injury) was not significant, $\chi 2$ (1) = .72, p = .40, nor were the three-way, $\chi 2$ (5) = 2.12, p = .83, or two-way, $\chi 2$ (11) = 7.95, p = .72, interactions. As shown in Table 3.5, mean scores of those who took the hard route were significantly higher than mean scores of those who took the easy route, with medium effect sizes, on these measures:

Goal SIC "Not quitting"; goal SIC "Completing the trail"; single-item mental toughness; and SMTQ confidence.

3.3.2 Qualitative Findings

Analysis of pain descriptions yielded insight into members' perceptions of causal attributions for overuse injury, as well as behavioural responses when they felt pain. Categorizations are presented in Table 3.6.

Table 3.6

Causal Attributions and Behavioural Responses of Hikers Who Experienced Overuse Injury Pain (n = 434) During Attempts to Hike the Appalachian Trail

a. Causal Attributions of Overuse Injury Pain (*n* = 262, 60.4%)

Category	*n*	%	Sample Descriptors
Excessive effort	131	30.2	increased mileage too fast/hike too fast to keep up with others
Pre-existing	92	21.2	previous injury/surgery/SRA, poor fitness, body weight, age
Environment	78	18.0	terrain, weather (inclement, storm)
Gear	26	6.0	size/fit/type of footwear/pack, wrong insoles/arch support
Normal	22	5.1	hiking all day, par for the course, everyone suffers, part of it
Miscellaneous	15	3.5	inadequate stretching, sleeping positions, gait

b. Behavioural Responses to Overuse Injury Pain (*n* = 224, 51.6%)

Category	*n*	%	Sample Descriptors
Sought medical help	111	25.6	chiro, doctor, surgery, medication, diagnosis
Modified effort	81	18.7	days off, rested, quit, decreased pace/mileage/pack weight
Passive pain management	54	12.4	over-the-counter, Biofreeze, steroids, cortisone injections
Modified gear	43	9.9	size/type of footwear, pack weight distribution
Used physical appliances	40	9.2	brace, strap, band, wrapped, taped, kinesiology tape
Active pain management	33	7.6	ice, massage, stretch, exercise, elevate
Stoicism	14	3.2	dealt with it, lived with it, ignored it
Miscellaneous	8	1.8	changed sleep position/gait, favored hurt part

Note. Percentages do not total to 100%. Some participants named more than one causal attribution and/or behavioural response.

Analysis of open-ended items focused on theory-based explanations of effort and overuse injury pain, yielding results related to three social identity constructs: Group members—presence and proximity; In-group status; and Social creativity. Visual summaries of qualitative results can be viewed in Appendix D, whereas the analysis of underlying reasons is presented below. Participants' original texts, including errors, are italicized within quotation marks.

3.3.2.1 Group members: Presence and proximity. Notably, 35.8% of participants indicated other people as a challenge. In regards to social identity theory, "others" was designated in terms of group membership: in-group (i.e., other hikers attempting to hike the AT) or out-group (e.g., family back home). Some hikers expressed concern about the perception of others: *"if I don't complete my goal how will others perceive me"*; "*I decided to complete the trail because I told people I was going all the way and several friends and family wanted to see me finish."; "I often felt like I was not doing as well, hiking as fast, or going as far as other thru-hikers."* These statements could be interpreted as expressions of concern about appearing competent, with competence being conveyed by finishing, or by going as fast or far as others, to in-group members, and to out-group members who were not present.

The actual presence of in-group members appeared to affect effort choices. Some hikers who took the hard route, and some who took the easy route, cited mere presence of others (e.g., *"I was with others"*) as a reason for route choice. Some who took the hard route cited a collective desire (e.g., *"The group I Was Hiking With Wanted The Challenge"*), or facilitation (e.g., *"My hiking friends and I decided to go up the hard way but we helped each other up."*). Via collective desire and facilitation, in-group members' presence might induce one to engage in higher effort. One participant who took the easy route stated: *"I was alone and did not want to take an unnecessary injury risk as such. I would have attempted the hard way had I been with other hikers."* This implies the possibility that when in-group members are present, one may be more willing to take unnecessary injury risks.

Likewise, the presence, or desired presence, of in-group members appeared to influence pace, mileage, and rest choices (e.g., *"Keeping a hiking partner with me that would match my hiking pace"; "finding other thru-hikers to hike with and planning milage in order to stick together as a group."*). Pace can determine whether one hikes with other group members (e.g., *"because I was slow, I couldn't keep up with a group. I hiked 8 months, all of it solo. The isolation was difficult."; "Being slower than everyone else and they passed me by. I was not able to find/form a trail family."*). Decisions of how much to rest when injury pain is felt affects one's ability to be near group members (e.g., *"In Virginia, I got injured. We were off the Trail for a week. When we got back on, our "hiker crowd/hiker family" was miles*

ahead of us. We were very depressed and wanted to leave the Trail simply because out community was gone".) Potentially, the reward for hiking faster or farther, or not resting as long when pain is felt, would be proximity with in-group members. Yet excessive pace/mileage and insufficient rest are contributors to overuse injury. The desire to maintain proximity with in-group members may at times affect effort choices. Of note, social identification was exemplified by calling group members "family"; thus, strength of social identification may be an impetus in behaviours related to injury.

3.3.2.2 In-group status. One way of increasing in-group status may have been to take the hard route, as evidenced by this hiker's words: "*I thought it would be a little accomplishment outside of the standard hiking."* The desire for additional "accomplishment", beyond finishing a hike of the entire trail, suggests one may be able to obtain higher in-group status by making extra effort, beyond that necessary to acquire the goal of finishing. A desire to increase in-group status may explain, at least in part, why 82.5% of participants chose the hard route, though they could have finished even if they chose the easy route. This is aligned with the tenets of self-categorization theory, in which hierarchical self-categorizations form: I am a hiker; I am a hiker who hiked the entire AT; I am a hiker who hiked the entire AT, and I took the hard route (Turner, Hogg, Oakes, Reicher & Wetherell, 1987).

Of those who took the hard route, 47% cited reasons that could be interpreted to equate hard and easy with "right" and "wrong." Interpreted as such, morality could be construed as social identity content for those who chose the hard route. In a sense, the word "easy" may have negative connotations: *"the wording on the sign 'easy way' put me against that route, had it said 'alternate route' I may have considered it...*" In contrast, taking the hard route *"Seemed like the right thing to do".* Eleven percent of those who chose the hard route explicitly referred to themselves as "purists." In AT lingo, purists only hike sections of trail marked by white paint, eschewing alternate routes that usually require less effort (e.g., less-difficult terrain). As such, purists may form another hierarchical self-categorization. Self-categorization as a purist may, for some, dictate behaviours: *"The hard way has White blazes so since I was a purist, I had to go that way.*" The words "had to" may be indicative of behavioural inflexibility. Seven percent of those who chose the hard route used the words *"always"* or *"never"* in their responses. One who "always" engages in high effort may have high in-group status yet be vulnerable to overuse injury.

Those who engage in higher effort may gain a sense of moral superiority, perceiving themselves to be of higher in-group status than those who engage in lower effort. In this vein, those who took the easy route may be perceived as inferior. This interpretation is supported by the pejorative responses of these hikers who took the hard route: *"The "Easy Way" looked*

lame."; "A sign that says "easy way" might as well say "boring way.""; *"The easy way is for the weak."*; *"I'm not a pussy."; "because that was the way for LL Beaners and grandmas"*; *"I assume those signs are for the average person, and I am stronger than the average person."*; *"Why take an easy way? That's dumb."*; *"The easy way seemed like cheating"*. Though some hikers disparaged the hard route, calling it *"asinine"* and *"stupid and poorly planned"*, they nevertheless took the hard route. It is possible that they prevented derision and reduction of in-group status by taking the hard route.

Of those who took the easy route, 74% were interpreted as employing excuses (Scott & Lyman, 1968). Excuses can be used by a member in the attempt to prevent in-group status from being reduced after the member engages in behaviours that are not aligned with social identity content. The reasons given by 31% of those who took the easy route involved details of suffering the hikers experienced, which may match the form of excuse dubbed "sad tale" in which people describes their state at the time of the behaviours: *"It was near the end of my day, I was tired, dehydrated and it was miserably hot, near 100 degrees. Not one to take shortcuts, but I was all about an easier way that day."; "I was having a very hard day, and couldn't bring myself to do the hard route. It was the only "hard" alternate I skipped the whole trail."* These hikers indicated they did not *usually* engage in this type of effort-evading behaviours. One interpretation is that they are claiming to have higher in-group status than someone who *regularly* engaged in lower-effort behaviours.

Of those who took the easy route, 26% made statements that resembled a form of excuse called "biological elements" (e.g., too old, too short; Scott & Lyman, 1968). Some indicated that they did try to take the hard route despite the biological element (e.g., *"I tried the hard way but couldn't get up"; "Tried several times to climb those rocks and just couldn't get up there"*). It may be that by trying, hikers can mollify in-group critics despite failure, earning higher in-group status than hikers who did not even try. One hiker who took the easy route noted injury as a biological element: *"My injured knee would not allow the extension necessary to reach the top."* This injury appeared to be severe enough to impair function. If the hiker's knee had only been slightly hurting, as in the early stages of overuse injury, the hiker may have been relegated to lower in-group status for taking the easy route.

3.3.2.3 Social creativity. Social creativity involves presenting alternate social identity content than what group members commonly endorse (Haslam & Reicher, 2006). One condition which precipitates social creativity can be found in the perceived legitimacy of the basis for status evaluations. Of those who took the easy route, 24.5% made statements that were interpreted as indicators that they did not equate in-group status with high-effort behaviours. For example, instead of agreeing they should be censured for lower-effort

behaviours, these hikers implied intellectual superiority over those who took the hard route: *"I could not up by the Hard way without a lot of work, took easy way…I have a brain, I can skin a cat more than one way."*; *"It was pouring rain, and it seemed like an intelligence test - why would I try to slither down a rock face rather than take a trail. As SoBo* [southbound hiker], *we were rebels and didn't have the "purist" attitude we saw in many NoBos* [northbound hikers]*."* The emphasis on intelligence could be construed as social identity content. The latter hiker also appeared to tout nonconformity as an alternate social identity content, which was echoed by this hiker: *"I didn't need to hike the 'hard way' in New York to prove anything to myself. I had plenty of "hard ways" along the Trail. Didn't need another artificial one. Also, I found doing walking to my own rhythms was preferable to hiking according to what someone else thought I should be doing."* This nonconformity social identity content might imply a belief that, rather than being relegated to lower in-group status, hikers who took the easy route should be perceived favorably for not doing something deemed unnecessary and artificial.

3.4 Discussion

The current study was conducted to address the need for theory-based identification of psychological factors implicated in the experience of overuse injury pain. Drawing upon a social identity approach, participants' social identification, social identity content, and mental toughness were found to contribute to overuse injury pain occurrence and to effort choice.

It was hypothesized that AT hikers who experienced overuse injury pain, and who persisted despite overuse injury pain, would differ from those who did not by reporting stronger social identification. The hypothesis was based on indicators from previous research (e.g., Haslam et al., 2009) that highly-identified group members tend to exert more effort than members with lower identification. However, higher scores on the measure of overall social identification strength did not appear to have any bearing on the overuse pain injury experiences in this study. Indeed, the hypotheses were only partially supported in that only two of the five components of the multi-dimensional measure of social identification differentiated overuse injury pain groups. Further, counter to hypotheses, women with overuse injury had lower scores of social identification on the self-stereotype component. Female hikers who experienced overuse injury may retrospectively perceive themselves to be different from other group members due to the additional suffering which may account for these results.

At first glance, the non-significant and counter-hypotheses findings appear to undermine the assertion that social identity theory could provide an underlying explanation for overuse injury experiences. Alternatively, this mixed finding constitutes support for

researchers who assert that social identification is a complex construct which cannot adequately be conceptualized nor measured as a "general connection to an in-group" (Leach et al., 2008; p. 144). The nature of the connection, not just the strength, must be considered, such that only certain components of social identification would be expected to be related to specific behaviours and outcomes, as shown in these results. With this conceptualization, and these results, it may be that physical activity participants to whom a social identity is of utmost importance may be most prone to engaging injury-inducing behaviours. As such, high scores on the centrality measure may be indicative of higher susceptibility for overuse injury occurrence. In contrast, group members whose social identification is predicated on the other components (i.e., solidarity, satisfaction, homogeneity) of social identification may not be prone to engaging in injury-inducing behaviours. That is, feelings of commitment to the group at large, general gladness to be a member, and perceptions that group members are generally similar may not be risk factors for overuse injury occurrence. However, these components may be related to other aspects of overuse injury such as severity. Finally, overall strength of social identification may not be directly related to overuse injury occurrence because behaviours of high identifiers may be contingent on the social identity content an individual endorses.

Of the 12 exploratory social identity content items, all but four were aligned with the theory-based hypotheses. As expected, social identity content which emphasized goal acquisition differentiated overuse injury pain groups, with large effect sizes, and also differentiated those who chose the higher-effort route from those who chose the lower-effort route (i.e., effort choice groups). This echoes results of a qualitative study in which injured runners cited goal acquisition as a contributor to overuse injury (Russell & Wiese-Bjornstal, 2015). Those runners, and hikers in this study, stated that they ignored low-level pain in order to continue towards accomplishing a goal (e.g., complete a marathon or the trail). However, the contribution of this study is the nuanced knowledge that having a goal is related to overuse pain when the goal is related to social identity such as when goal acquisition is perceived as a source of in-group status. Per analysis of qualitative data, some who chose the higher-effort route may not have been content to achieve the goal, but rather, needed to achieve the goal "the right way". Hikers may garner higher in-group status not just by achieving the goal, but by achieving it whilst adhering to social identity content. Previous research has shown that those who exhibit high effort but fail are perceived more positively than those who do not exhibit high effort and fail (Rejeski & Lowe, 1980), but there is a theoretical explanation for the current finding: Group members who do not achieve goals are able to retain in-group status by having adhered to the group's values. The practical implication is that hikers may

need assistance to determine when to adjust or give up goals (Brandstatter, Herrmann, & Schuler, 2013; Creed & Hood, 2014), but the assistance may be theoretically more effective if it addresses the underlying need for self-esteem enhancement that in-group status provides.

Results for the social identity content items pertaining to enjoyment and having fun were aligned with hypotheses in that those without overuse injury rated these items significantly higher than those who reported overuse injury. On one hand, these results appear to support the proposition that those who highly endorse enjoyment and having fun are less apt to engage in injury-inducing behaviours as implied by social identity theory. On the other hand, these results may reflect the retrospective nature of the study, in that those who experienced injury may later report less enjoyment given the suffering. An examination of a prospective nature would be of particular value in aiding interpretation of results obtained with these items.

Unexpectedly, male hikers with overuse injury reported higher endorsement of relational social identity content (i.e., making friends, building relationships) than male hikers without overuse injury. This appeared counter-intuitive. It was envisioned that those rating socioemotional bonds of more importance would be apt to engage in behaviours such as socializing rather than effort persistence when in pain. The qualitative analysis provided insight into this finding, as hikers reported alterations of effort (e.g., pace, mileage) to maintain proximity with other hikers. Closer proximity, or higher desired proximity, to group members can be an indicator of one's social identification (Novelli, Drury, & Reicher, 2010). Though female hikers deemed the relational social identity content of significantly higher importance than male hikers, relational social identity content did not differentiate overuse injury pain for women. Female hikers may use different behaviours (e.g., share food) than male hikers to manifest adherence to relational social identity content (Carter, 2014). Qualitative analysis supported this possibility, in that some women indicated they did not have the physical capability to keep up with faster hikers as a means of enacting relational social identity content. In this way, the higher endorsement of relational identity content by male hikers could be interpreted to lend support for explanations of injury-inducing behaviours based on social identity theory, but more research is needed.

Two other social identity content items (i.e., exert as much effort as possible, try hard) were not aligned with hypotheses, in that they did not significantly differentiate overuse injury pain groups nor effort choice groups. This finding also appeared counter-intuitive, as both items allude to endorsement of high effort, and those who strongly endorse high effort would be expected to be more apt to incur overuse injury than those who do not. It may be that those who endorse high effort also endorse other social identity content such as enjoyment, and, in a

sense, the two could cancel each other out such that behaviours are not aligned with only one social identity content as predicted. Likewise, a hiker who did not strongly endorse these effort-based social identity content may have strongly endorsed another injury-related factor such as high centrality. Or, as implied in the qualitative analysis of the effort choice results, the presence of other group members may have impacted behaviours such that behaviours did not merely reflect an individual's social identity content. Additionally, a hiker who endorses trying hard may not actually try hard in the form of excessive physical effort. Examinations of actual behaviours associated with endorsements of these and all social identity content could clarify these findings.

As hypothesized, the minority of group members who chose the low-effort route used more words, more embellishment, to defend the choice. Of the hikers who chose the lower-effort route, most used excuses, suggesting that lower-effort behaviours were not perceived positively in this group. The denigration of hikers who took the lower-effort route by hikers who chose the higher-effort route supports Haslam's (2004) assertion that group members influence each other by "acting to enforce group norms…Dress norms for example, can be imposed by telling people exactly what to wear or by making fun of them when they wear something that is perceived to be inappropriate" (p. 37). Thus, deriding group members for behaviours can be a method of conveying what a group's social identity content is to one's own group members, yet derision of those who choose lower-effort behaviours may indirectly result in overuse injury as well. Finally, qualitative analysis extended previous research. Whilst the relationship between the presence of others and higher effort is well-established (e.g., Rejeski & Lowe, 1980), these findings indicate that the nature of the hikers present at the time, rather than mere presence, impacted effort. For example, if the hikers present in a situation endorse goal social identity content, hikers may be more apt to engage in higher effort.

As hypothesized, mental toughness, as measured by the single-item measure, differentiated between overuse injury pain groups, whilst the single-item measure and the SMTQ confidence subscale differentiated between the effort choice groups. Noticeably, the social identity content of "being mentally tough" also differentiated overuse injury pain groups. This suggests that appearing to be mentally tough is a means of being perceived positively by group members, thus increasing one's in-group status. Though there is a distinction between possession of mental toughness and the desire to appear mentally tough to in-group members, it seems unlikely that hikers with mental toughness indiscriminately choose high levels of effort or sustain effort despite pain. From a social identity perspective, it would be more reasonable that hikers with high mental toughness engaged in higher-effort

behaviours because they were in a situation where in-group status was salient. This distinction is relevant to intervention design, which can target the social identity content of mental toughness, rather than the level that hikers possess.

The mixed methods component of this design was valuable in that the qualitative results aided interpretation of quantitative findings. Also, employing a theoretically-grounded analytical approach *a priori* enabled an interpretation of qualitative findings in relation to social identity/self-categorization theories, thus yielding theory-based constructs. Additional study of these constructs may inform the development of injury-prevention interventions. Given that theory-based injury-prevention interventions are more effective than atheoretical interventions (McGlashan & Finch, 2010), this analytical approach may contribute to future injury-reduction efforts. Additionally, the quantitative portion was strengthened by the counterbalanced presentation of questionnaires to control for order effects.

Limitations are inherent to the design employed in this study. Its cross-sectional nature makes it difficult to know whether the constructs actually played causal roles in the processes related to overuse injury pain and effort choices. Additionally, the retrospective method employed is limited by potential recall bias. Because the current study employed the recommended means for decreasing recall error, recall error in the current study was reduced such that responses were likely to be generally accurate though some error might exist. Creation of the new method for identifying physical activity participants with overuse injury pain was an important step in the current study. It enabled examination of participants in the early stages of overuse injury who would have been excluded using methods commonly used in injury research. This method and other measures developed in this study need further testing for validation and reliability. Of note, two sub-scales of the SMTQ were not used in analyses because of less-than-satisfactory internal consistency. Other measures of mental toughness may need to be employed in future research.

Future studies of a prospective and experimental nature would help determine whether social identity constructs have a causal effect on overuse injury. As high-status group members are integral in the process of developing perceptions of a group's social identity content, they may assist in modifying social identity content from those associated with overuse injury (e.g., goal) to those not (e.g., intelligence; Haslam & Reicher, 2006; Haslam, Reicher, & Platow, 2011). This could be assessed via experimental manipulation. Studying the effect of social identity constructs on actual behaviours, such as alterations of pace and mileage, as well as severity, rather than injury occurrence, may enhance knowledge of overuse injury mediators. Future study could include quantitative examination of the constructs which emerged in the qualitative portion of this study, including the social identity

content that may be protective factors for overuse injury. Finally, given the solitary nature of long-distance backpacking, study of these aspects of overuse injury could be advanced with study of situations where behaviours are observed by group members.

It is imperative that researchers develop theory-based interventions to reduce overuse injury pain in SRA. This study provides initial evidence that the social identity approach is a viable theoretical basis to inform such interventions. Ultimately, these interventions may assist SRA participants who are facing the choice of continued exertion that could result in overuse injury or effort reduction which could result in the derision of valued others.

CHAPTER 4

Shake it Off? Prospective Examination of Social Identity, Mental Toughness, Overuse Injury Severity, and Initial Validation of the Test of Intentions to Reduce Effort (TIRE)

4.1 Introduction

When one feels pain from an overuse injury in physical activity contexts, the decision to maintain effort, to 'shake it off', could result in worsening of the injury and more severe consequences (e.g., restricted mobility, arthritis, surgery; Maffulli, Longo, Gougoulias, Caine, & Denaro, 2010; Rossler et al., 2014). In contrast, the decision to reduce effort (e.g., rest more) when pain is first experienced could prevent the injury from increasing in severity. Given the consequences of this decision, it is important to examine the variables that influence this decision. To this end the current research seeks to identify key variables that are involved in the decision-making process, focusing on those individuals who are likely to engage in behaviours that induce higher severity of overuse injury.

Despite the importance of this topic, research specific to overuse injury has been scarce (Clarsen, Myklebust, & Bahr, 2013; Roos et al., 2015). In part, this is due to inclusion criteria used in injury research. Typically, participants are designated as "injured" for research purposes if the pain the participant feels is severe enough to prevent the participant's engagement in activity (i.e., time loss) and/or warrant medical attention (Petrie, 1992; Pike, 2004; Schroeder et al., 2015; Timpka et al., 2015; Wiese-Bjornstal, Smith, Shaffer, & Morrey, 1998). However, initially, overuse injury pain is typically low and whilst at this stage would not necessarily warrant medical attention or reduced activity (Roos & Marshall, 2014; Turner, Barlow, & Ilberry, 2002). That is, sufferers are able to continue participating in physical activity without time loss, and they may not deem the pain of sufficient severity to warrant medical attention. In this way, time-loss and medical attention criteria have precluded the study of the full spectrum of overuse injury, particularly before severity escalates beyond low-level pain. In addition to being used to determine the occurrence of overuse injury, time-loss measures have also served as operationalization of injury severity (i.e., the more time a person cannot participate in physical activity, the more severe the injury is considered to be; Maddison & Prapavessis, 2005; Smith, Smoll, & Ptacek, 1990). Given the limitation of this measure regarding overuse injury, there is a need to consider alternate indicators of overuse injury severity (Clarsen et al., 2013; Salamon, Davies, Fuentes, Weisman, & Hainsworth, 2014).

Given the paucity of research specific to overuse injury, researchers have acknowledged that psychological factors specific to overuse injury are fairly unknown (Johnson, Tranaeus, & Ivarsson, 2014; Petrie & Hamson-Utley, 2011; Williams & Andersen, 2007). Recently, a handful of qualitative studies specific to overuse injury psychological factors have been conducted (Russell & Wiese-Bjornstal, 2015; Tranaeus, Johnson, Engstrom, Skillgate, & Werner, 2014; van Wilgen & Verhagen, 2012). In these initial studies, physical

activity participants revealed the tendency to continue participation when low-level overuse injury was first experienced, and they reported that this tendency exacerbated injury severity. The ability to measure this tendency of maintaining effort despite pain would help researchers identify individuals' susceptibility to more severe overuse injury. Though these studies were important steps in identifying miscellaneous variables specific to overuse injury, there is a need for identification of theory-based variables (McGlashan & Finch, 2010). This assertion is based on findings that injury-prevention interventions were more effective when they involved manipulation of theory-based variables rather than miscellaneous variables.

Altogether, three gaps in the research literature have been identified: 1) need for alternate operationalizations of severity of overuse injury; 2) need to identify theory-based psychological factors specific to overuse injury severity; and 3) need for a measure to identify individuals' susceptibility to increasing overuse injury pain severity. Next, information is presented to show how each gap was addressed in the present study.

4.1.1 Operationalization of Severity of Overuse Injury

To address the first gap, three additional operationalizations of overuse injury severity were considered: pain levels, functional limitation, and performance decrement. Support for these alternate indicators is illustrated in the stages of overuse injury (Launay, 2015). Stage 1 involves pain after physical activity, typically reflecting minor physical damage (e.g., tiny tears in a knee tendon). In Stage 2, pain occurs *during* physical activity, perhaps due to more severe damage (e.g., larger tears). In Stage 3, the pain experienced during physical activity rises to the level of functional limitation (e.g., the knee does not have full range of motion or fully support weight). The functional limitation forces the person to alter participation (e.g., time loss, hike at decreased pace/mileage). Participation in physical activity may continue prior to, or despite, functional limitation, but performance typically decreases (e.g., slower race times; Tenforde et al., 2011). It would be expected that those who reduce effort in response to low-level pain would incur lower pain levels as well as prevent functional limitation and overall performance decrements (e.g., a race season). Therefore, these alternate methods of assessing overuse injury severity, rather than relying solely on time loss and medical attention as indicators of occurrence and severity, were incorporated into the current study.

An additional consideration in assessing severity is gender. Overuse injury occurrence has been found to be greater for women than men in physical activity contexts (Roos et al., 2015). The effect of gender on severity is unknown so needs to be explored.

4.1.2 Social Identity Theory and Overuse Injury

To address the second gap (i.e., need to identify theory-based psychological factors related to overuse injury severity), social identity theory was selected as the theoretical basis for the current study. Social identity theory involves the study of the psychological meaningfulness of group membership and stemmed from research in the area of social psychology (Tajfel, 1972). Since 2014, researchers in the sport/exercise psychology domain have proposed that social identity theory could be incorporated into the study of physical activity contexts, and particularly, the study of injury (Bruner, Dunlop, & Beauchamp, 2014; Rees, Haslam, Coffee, & Lavallee, 2015). Therefore, the current study, along with a handful of others (e.g., Barker, Evans, Coffee, Slater, & McCarthy, 2014; Fransen et al., 2015), are amongst the first to apply social identity theory to physical activity contexts. In the previous study of hikers (Chapter 3), two social identity constructs, social identity content and social identification, were found to be related to overuse injury occurrence. It was hypothesized that these two social identity constructs would be related to the severity of overuse injury as well.

Social identity content involves the values endorsed by group members that make group membership attractive to members (Barker et al., 2014; Livingstone & Haslam, 2008; Turner, Hogg, Oakes, Reicher & Wetherell, 1987). In the previous study (Chapter 3), nine social identity content items specific to hikers were related to overuse injury occurrence and higher-effort behaviours, and qualitative analysis revealed additional social identity content that appeared pertinent. In the current study, it was expected that various social identity content would likewise impact severity of overuse injury. As shown in the previous study (Chapter 3), there were gender differences in endorsement of social identity content. It may be that behavioural differences stemming from social identity content explain the higher overuse injury rate of women compared to men (Carter, 2014; Roos et al., 2015). Therefore, gender differences in social identity content need to be examined

Social identification is the degree to which individuals regard membership in a group as having importance and emotional significance, in part because group membership is a source of positive self-esteem (Tafjel, 1974; Turner et al., 1987). A means for deriving self-esteem enhancements from group membership is to engage in behaviours which could elevate one's status in the group (Haslam & Reicher, 2006). In physical activity contexts, a means of gaining higher in-group status could be maintaining effort despite low-level overuse injury pain. Therefore, members with high social identification (i.e., those who attach great importance to group membership) may formulate intentions to do so. In this way, high social identification is predicted to be a risk factor for higher overuse injury severity.

Though social identity theory provides a basis for understanding overuse injury via social identity content and social identification, injury outcomes have been found to be contingent on individual characteristics (Andersen & Williams, 1988; Petrie & Hamson-Utley, 2011). One individual characteristic with potential relevance to overuse injury is mental toughness. Mental toughness encompasses maintenance of goal-driven behaviours despite stressors and has been associated with maintenance of physical effort despite pain (Arthur, Fitzwater, Hardy, Beattie, & Bell, 2015) and a tendency to increase effort when facing stressors (Kaiseler, Polman, & Nicholls, 2009; Nicholls, Polman, Levy, & Backhouse, 2008). Given these tendencies, those who possess a higher level of mental toughness may intend to maintain effort when low-level overuse injury pain is felt, and thus may be more apt to incur higher overuse injury pain severity. However, it is doubtful that those who possess high mental toughness would indiscriminately exert effort despite pain. It is likely they will exert effort despite pain only when a desired outcome, such as in-group status, is at stake. Therefore, mental toughness is expected to moderate the influence of social identification on overuse injury pain severity, such that severity is high when both social identification and mental toughness are high.

4.1.3 Measure to Identify Susceptibility to Overuse Injury Severity

To address the third gap (i.e., need for a measure to identify individuals' susceptibility to overuse injury pain severity), the Test of Intentions to Reduce Effort (TIRE) was constructed. The TIRE measures behavioural intentions (i.e., the perceived likelihood of engaging in behaviours; Ajzen, 2002) to reduce effort (e.g., hike slower) when overuse injury pain is felt. The conceptual underpinning of the measure was rooted in social identity theory, given evidence that social identity constructs influence behavioural intentions (Fielding, McDonald, & Louis, 2008; Hagger & Chatzisarantis, 2006; Karjaluoto & Leppaniemi, 2013; Livingstone & Haslam, 2008; Terry, Hogg, & White, 1999).

Part of scale validation involves testing whether the content of the scale is related to theoretically relevant constructs (Vaughn & Daniel, 2012). This can be in the form of the scale being related to both theoretically relevant antecedents and outcomes of the construct. In the current research, this would be evidenced by significant correlations of the social identity constructs and mental toughness, theorized to be antecedents, with the TIRE. The TIRE should also demonstrate predictive validity. In this case, it should predict severity outcomes, such that those who are more likely to reduce effort in response to low-level pain would be expected to incur less severe overuse injury pain. Those who are more likely to maintain effort despite overuse injury pain would be expected to incur more severe overuse injury pain.

Given the above considerations, the overarching purpose of the present study was two-fold: 1) conduct initial validation of the TIRE, and 2) assess support for the hypothesized relationships between the psychological factors and overuse injury severity. A summary of the hypothesized relationships described above are presented in Figure 4.1.

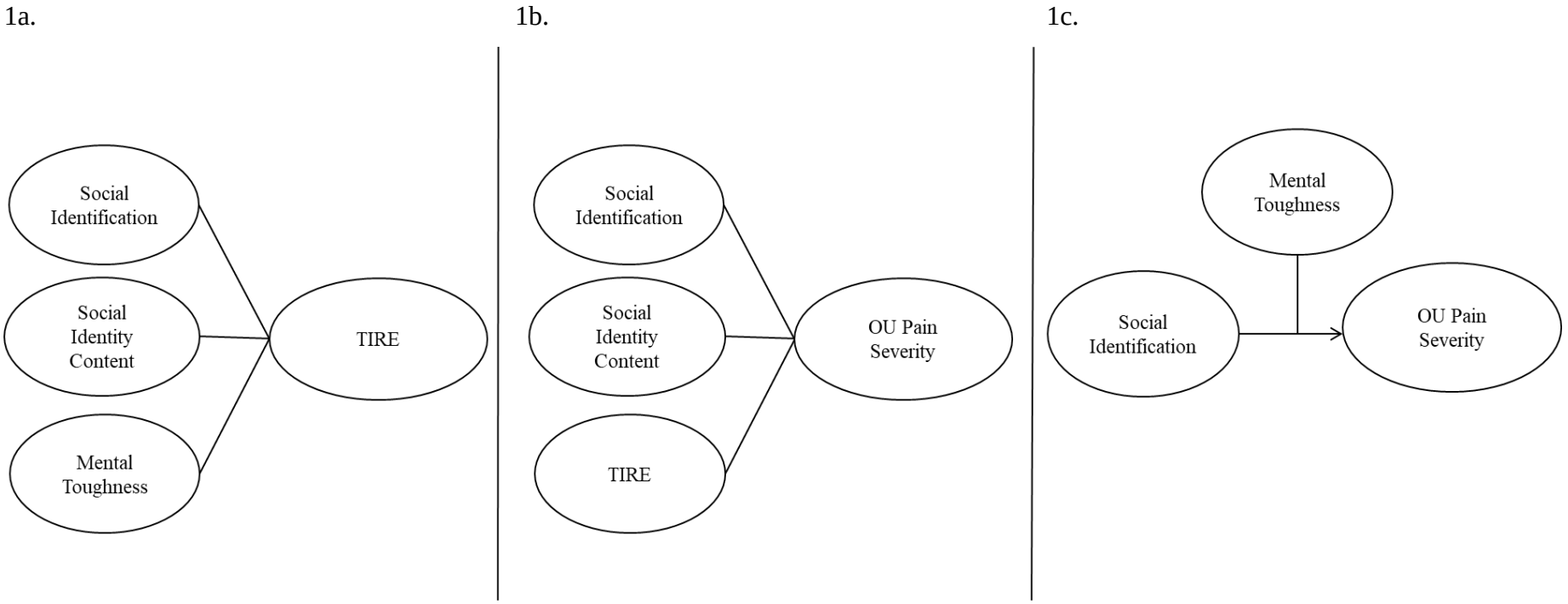


Figure 4.1. A visual summary of the hypothesized relationships in this study. TIRE = Test of Intentions to Reduce Effort. 1a. Cross-sectional associations of social identity constructs and mental toughness with behavioural intentions. 1b. Prospective associations of social identity constructs and behavioural intentions with overuse injury pain severity. 1c. Prospective relationship between social identification and overuse pain severity, moderated by mental toughness.

4.2 Method

After obtaining approval from the university's ethics committee, participants were recruited as described in Chapter 3, but the material and strategies were altered to recruit individuals who intended to hike the Appalachian Trail (AT) in the upcoming year. The recruitment materials indicated that participation involved completion of two online surveys. One survey was to be completed before participants attempted to hike the AT, hereafter referred to as the pre-hike survey. The other survey was to be completed after participants ended their attempt to hike the AT, hereafter referred to as the post-hike survey. Copies of the pre-hike and post-hike surveys are in Appendix E.

Upon accessing the link displayed in recruitment materials, participants provided informed consent, which included consent to provide an email address where the remainder of the materials needed to complete participation could be sent. Participants then completed the pre-hike survey. In the pre-hike survey, participants indicated their intended start date, which was required to be after the date the pre-hike survey was taken; the date the pre-hike survey was taken was registered by the survey software. Participants who completed the pre-hike survey were sent a word document designed to help them track information they would need to complete the post-hike survey (e.g., number of days they felt overuse injury pain; number of miles they hiked before ending their hike). Approximately three months after their intended start date, participants received an email with the link to the post-hike survey and were asked to complete it only after they had stopped hiking. Two follow-up emails were sent thereafter asking participants to complete the post-hike if they had not already done so.

4.2.1 Participants

Hikers attempting to hike the AT within a year were selected because group membership is a relevant construct: they contrast themselves from other groups of hikers on the AT (e.g., hikers who are out for a day, hiking a trail section, or completing the AT in *more* than one year; Appalachian Trail Conservancy, retrieved 8/3/15). These hikers were also recruited because they have high rates of overuse injury pain. In the previous study of AT hikers (Chapter 3), 63.5% reported overuse injury pain symptoms. Participants who gave informed consent and took the pre-hike survey (N = 283; women = 29.7%; age M = 37.91, SD = 14.55) indicated they would attempt to hike the AT within a 12-month period. Almost all (i.e., 90.0%) were nationals of the United States. Of participants who took the pre-hike survey, 60.1% (N = 170; women = 31.8%; age M = 37.64, SD = 15.14) took the post-hike survey. Of those taking the post-hike survey, 52.3% (n = 90) successfully completed the 2,000+ mile trek. Non-finishers on average completed 34.2% of the entire trail.

4.2.2 Measures in Pre-Hike Survey

Participants provided demographic information. They then completed measures summarized in Figure 4.2.

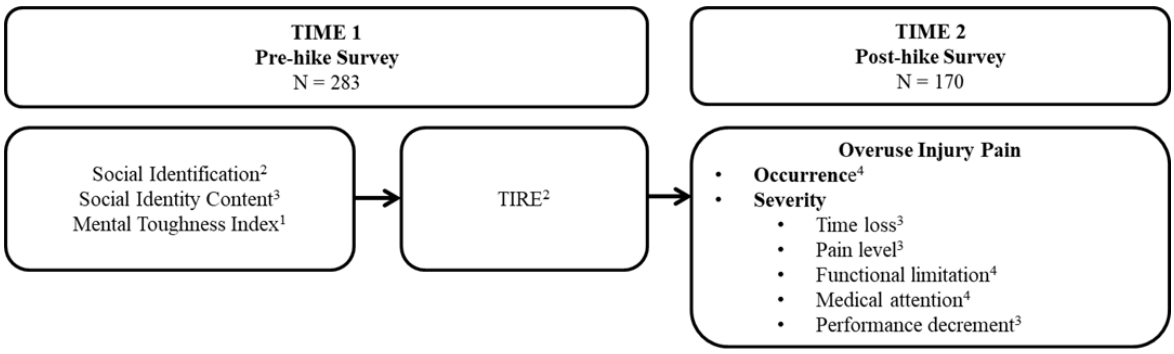


Figure 4.2. Measures administered at Time 1 (pre-hike) and Time 2 (post-hike). TIRE = Test of Intentions to Reduce Effort. Superscripts indicate type of measure, 1 – 3 being continuous: [1]Unidimensional, [2]Multidimensional, [3]Single-item, [4]Categorical.

4.2.2.1 Social identity measures. Before completing the social identity measures, participants read guidance specifying members of the group "AT thru-hikers" as those attempting to complete the AT in one year, excluding section hikers or day hikers. Social identification was measured via a multi-dimensional assessment, *In-group identification* (Leach et al., 2008). See description in Chapter 3.

Eight *social identity content* (SIC) items were employed to measure the perceived importance of various meaningful reasons for identifying with AT hikers as a group. Stem and anchors were constructed in accordance with social identity content measures (Barker et al., 2014; Livingstone & Haslam, 2008). Participants were asked to think of themselves as AT thru-hikers, and then rate the level of importance for each item on Likert-type scale ranging from 1 (*not at all important*) to 7 (*extremely important*). In the previous study (Chapter 3), nine social identity content items specific to hikers attempting to hike the AT in less than a year were found to be related to overuse injury occurrence and choice of higher-effort behaviours. Some of the items behaved similarly (e.g., relational: making friends/building relationships; goal: completing the thru-hike/not giving up/not quitting; effort: trying hard/exert as much effort as possible; pleasure: enjoying the experience/having fun), so only the first of the related items was used in the current study, along with the item "being mentally tough". Additional social identity content were yielded from the qualitative portion of the previous study; three (i.e., not whining, being sensible, being a purist) were incorporated as items in the current study.

4.2.2.2 Mental toughness. The *Mental Toughness Index* (MTI; Gucciardi, Hanton, Gordon, Mallett, & Temby, 2015) was used to assess the individuals' perceptions of the degree to which they possess mental toughness. Participants responded to eight items (e.g., "I strive for continued success"; "I consistently overcome adversity") on a Likert-type scale ranging from 1 (*False, 100% of the time*), to 7 (T*rue, 100% of the time*). Strong composite reliability (> .86) of scores of athletes, employees, and military trainees were reported. Evidence of content, factorial, and predictive validity was provided. Factorial validity was assessed with a sample of 497 white-collar employees in Australia $\chi^2(246) = 618.06$, RMSEA = .06, CFI = .92, TLI = .91, and SRMR = .05. Predictive validity was demonstrated by the scores' association with goal progress and performance.

4.2.2.3 Behavioural intentions in response to overuse injury pain. The *Test of Intentions to Reduce Effort (TIRE)* was developed to identify individuals more susceptible to higher severity of injury due to their intentions to maintain effort despite low-level overuse injury pain. After reading a description of overuse injury pain (see pre-hike survey in Appendix E), participants completed 14 items. Stem and anchors were constructed in accordance with guidelines for constructing behavioural intention measures (Ajzen, 2002). The 14 items focused on 7 actions identified by AT hikers as actions they took when they felt overuse injury pain (Chapter 3, Table 3.6). Five reflected effort reduction (i.e., hike fewer miles; hike slower; take more rest breaks; take a day off; quit thru-hike). Two (i.e., take over-the-counter pain relievers; seek professional medical help) were employed to explore discriminant validity from effort-reduction actions.

For the first seven items, the stem "I intend to take this action" was used. Participants rated the minimum amount of overuse injury pain they would have to feel before they would take each of the seven actions, on a Likert-type scale ranging from 0 (*none*) to 10 (*worst pain imaginable*). This pain scale is aligned with that of the well-established Numerical Rating Scale (NRS), used to assess pain intensity (Hawker, Mian, Kendzerka, & French, 2011; Hjermstad et al., 2011; Williamson & Hoggart, 2005).

For the next seven items, participants were directed to imagine that, during their attempts to hike the AT, they felt overuse injury pain with a level 4 in their lower bodies. A pain level of 4 on the NRS is on the boundary of mild and moderate pain and is on the cusp of interfering with function; the ability to ignore it is compromised, and medical consultation may be recommended (Jones, Vojir, Hutt, & Fink, 2007). As such, intentions formed at this critical point seem relevant to whether overuse injury pain is resolved at lower levels, or whether it increases in severity. Participants read additional descriptors of the imagined overuse injury pain (e.g., able to hike, but the pain is felt whilst hiking) which matched that of

Stage 2 overuse injury pain with no functional limitation (Launay, 2015). Participants rated how likely they were to take each of the seven actions if they experienced the Stage 2 overuse injury pain on a Likert-type scale ranging from 1 (*extremely unlikely*) to 10 (*extremely likely*). Scores were reverse-scored such that, for all 14 items, higher scores indicated stronger intentions to maintain effort despite pain, indicative of higher risk of escalating overuse injury pain severity.

Items were piloted with four groups: people before they started their AT hike attempts in 2015 (n = 27), two groups of former AT hikers (n = 6, n = 10), and sport psychology Ph.d students (n = 3), with adjustments made subsequently. Because actions were identified by AT hikers, and because AT hikers were involved in the pilot development of these items, items appeared to demonstrate face validity.

4.2.3 Measures in Post-Hike Survey

4.2.3.1 Overuse injury occurrence. Occurrence was assessed using the method and protocol developed in the previous study (Chapter 3), modified to focus on overuse injury pain only, rather than all types of pain and injury. Participants read a refined description of overuse injury pain (see post-hike survey in Appendix E). Participants were then asked if they experienced overuse injury pain during their attempts to hike the AT. Those who responded yes provided open-ended descriptions about each overuse injury pain they experienced, including their beliefs about the implicated cause(s) of each. Descriptions were coded into three categories: experienced overuse injury pain; did not experience overuse injury pain; or insufficient description. Reliability of coding was assessed in the previous study, in which the researcher and a research supervisor used the protocol to independently code a random sample of 50 participants' descriptions. The two agreed on categories for 47 of the 50 (kappa = .89; $p < .001$). After discussion to resolve disagreement, the researcher categorized the remainder of the descriptions.

4.2.3.2 Overuse injury pain severity. Participants who indicated they experienced overuse injury pain responded to severity items in regard to their "most painful overuse pain". Measures addressed different aspects of pain severity: time loss, pain level, functional limitation, and performance decrements.

Time loss index. Time-loss measures have served as operationalizations of injury severity based on the premise that the more time a person cannot participate in a physical activity due to injury, the more severe the injury is (Maddison & Prapavessis, 2005; Smith, Smoll, & Ptacek, 1990). Time-loss indices have been created specific to each specific physical activity context, involving a comparison of time lost due to injury relative to the exposure time of risk (i.e., amount of time spent in the activity). The index in the current

study was adapted for hiking and specific to overuse injury pain rather than injury in general. Prior to starting their thru-hike attempts, participants were asked to track the number of days they felt overuse injury pain. Participants were provided with a word document designed to help them track the number. After ending their hike attempts, participants who indicated they suffered overuse injury pain provided an estimate of the total number of days they did not hike due, specifically, to overuse injury pain. Each participant's number of days was divided by the total number of days the participant spent on the attempt to hike the AT, and multiplied by 100, to yield the index. Higher indices are indicative of higher severity.

Pain level. The well-established Numerical Rating Scale (NRS; Hawker et al., 2011; Hjermstad et al., 2011) was used to assess pain intensity. Participants rated the level of pain they felt for their most painful overuse injury pain on a Likert-type scale from 0 (*none*) to 10 (*worst pain imaginable*). Higher pain level was indicative of higher severity. The correlation between pain level and time-loss index scores was significant (r = .30), which is indicative of convergent validity (Kline, 2005).

Functional limitation. This item was developed to assess the functional limitation of those who experienced overuse injury pain. Participants were asked to mark which best described their experience with the most painful overuse pain. The four response items corresponded with stages defined by Launay (2015) and modified for hiking: Stage 1 *I did not feel the pain while hiking. The pain usually started sometime after I stopped hiking, but did seem to be related to the hiking;* 2 *I felt the pain sometimes while I was hiking, but I was able to keep hiking. I did not have to change my hiking in any way*; 3 *I felt the pain while I was hiking. I had to decrease my hiking, or stop hiking, because of the pain*; and 4 *I felt the pain any time I moved. I felt the pain while hiking, AND even when I was not hiking*. Participants with overuse injury pain who marked Stage 2 were categorized as having no functional limitation. Those who marked Stage 3 were categorized as having functional limitation, the higher stage being indicative of higher severity. Convergent validity was supported in that Stage 2 participants reported significantly less time loss (d = .55) and lower pain level (d = .70) than Stage 3 participants.

*Performance decrement***.** A performance measure specific to hiking the AT was employed. For the *miles index,* participants were asked to provide the number of miles they hiked during their attempts. This value was divided by the full length of the trail (i.e., 2,190 miles), and the result was multiplied by 100. Performance decrements were indicated by a lower index; a lower index is indicative of higher severity. There was a significant, negative correlation (r = - .49) between the miles index and the time-loss index, indicative of convergent validity between these two severity measures (Kline, 2005). Additional items not

pertaining to this study's research questions were also completed by participants; full questionnaires for both surveys are available. For both surveys, participants were randomly assigned via survey software such that the order of questionnaires was counterbalanced.

4.2.4 Plan of Analyses

4.2.4.1 Initial validation of the TIRE. First, the factorial validity of the TIRE was assessed. As the TIRE is new, and the items were derived from 750+ hikers in the previous study (Chapter 3) rather than pre-conceived factors, exploratory approaches to the data, rather than confirmatory approaches, were deemed appropriate (Kline, 2005; Tabachnick & Fidell, 2007). Thus, exploratory factor analysis (EFA) was used to assess the factor structure of the 14 items. Given the different response scales (i.e., 0 – 10 for amount of overuse pain; 1 – 10 for likelihood of responses to stage 2 pain), absolute values of standardized mean scores were computed for the 14 items. Implausible outliers (e.g., I intend to quit if I feel no pain, yet I am extremely unlikely to quit if I feel low-level Stage 2 pain) were identified and removed from analysis. Means and correlations for the 14 items were calculated, followed by EFA using principal axis factor analysis. Expecting retained factors to correlate (e.g., hiking slower in response to overuse pain might correlate somewhat with taking over-the-counter pain relievers), an oblique rotation (direct oblimen) was used to extract factors, with delta set at zero. Monte Carlo parallel analysis was conducted to determine the initial number of factors to be retained (Henson & Roberts, 2006). Sampling adequacy was assessed using the Kaiser-Meyer-Olkin (KMO) measure; values above .69 are considered acceptable, indicating that factor analysis is appropriate for exploring correlation coefficients, and for yielding distinct, reliable factors (Kaiser & Rice, 1974).

Factor retention analysis involved several considerations: a) Kaiser criterion (i.e., eigenvalues > 1 are considered significant when sample size is over 250, the number of variables is between 10 to 15, and the average communality is greater than .6; Stevens, 2001); b) scree test, which is considered fairly reliable for sample sizes over 200 (Stevens, 2001); c) items with communalities > .60 were considered sufficiently high to be retained, regardless of sample size, whilst values around .50 require sample sizes of 100 to 200 (MacCallum, Widaman, Zhang, & Hong, 1999); d) given sample size over 250, items with factor pattern coefficients greater than .36 were characterized as significant, with values above .40 being meaningful in terms of contribution to variance to the factor (Stevens, 2001); e) factors with three items would be regarded as reliable, if the items' factor pattern coefficients were >.80; f) factors with two items were to be retained if the items were highly correlated (> .70) and were not highly correlated with other items; g) factors which demonstrated acceptable internal consistency (Cronbach's alpha values above .70) were to be retained. After determining the

number of factors to retain, factor scores (i.e., a composite variable score for each person on the factor) were calculated using the regression method (DiStefano, Zhu, & Mindrila, 2009). Inter-factor correlations were examined. Throughout, the term "loading" refers to the relationship between a factor pattern coefficient and a factor.

After assessing factorial validity of the TIRE, cross-sectional associations between the psychological measures (i.e., social identification, social identity content, mental toughness) and the TIRE factors were explored (Figure 4.1a). To do so, descriptive statistics, outliers, and order effects were assessed for pre-hike measures, using scores of all participants who took the pre-hike survey. Correlations were conducted between the psychological measures and the TIRE factor scores derived from the EFA.

4.2.4.2 Psychological factors and overuse injury severity. The next set of analyses was conducted to explore the prospective relationships between pre-hike psychological measures and TIRE with severity of overuse injury that occurred during participants' attempts to hike the AT (Figure 4.1b). First, attrition effects were assessed: the means of pre-hike measures of those who only took the pre-hike survey were compared to the means of pre-hike measures of those who took both surveys via M/ANOVAs. Overuse injury pain occurrence was categorized, after which descriptive statistics, outliers, and order effects of post-hike severity measures were assessed for all participants who took the post-hike survey. Using the scores of those categorized as having overuse injury pain, correlations were conducted between pre-hike and continuous post-hike severity measures (i.e., time loss, pain levels, performance decrements). M/ANOVAs were conducted with the categorical post-hike severity measure (i.e., functional limitation) with the scores of those categorized as having Stage 2 or 3 overuse injury pain.

To explore the moderating role of mental toughness between social identification and overuse injury severity (Figure 4.1c), moderation regression and simple slopes analyses were performed using the SPSS macro PROCESS (Hayes, 2012). The post-hike severity measures served as dependent variables. PROCESS automatically mean centers main effects (social identification and mental toughness) and computes interaction terms. Though significant interaction terms are viewed as evidence of moderation, examination of interactions via simple slopes is supported as a means of probing interactions that may be significant at some values of the moderator whilst not significant at other values. In these simple slopes analyses, a designation of "low" reflected one standard deviation below the mean score of the measure, whereas "mean" and "high" corresponded with scores equal to mean and one standard deviation above the mean, respectively.

Given the gender considerations described above, all variables (i.e., psychological factors, severity outcomes) were analyzed to determine whether there were gender differences. No significant gender effects were found. Due to space limitations, details pertaining to gender analyses are not presented here but can be obtained from the researcher.

4.3 Results

4.3.1 Preliminary Analyses

The pre-hike measures were completed by 283 participants. Descriptive statistics and correlations of pre-hike measures are presented in Tables 4.1 and 4.2. In Table 4.3, descriptive statistics of the pre-hike measures for the 170 participants who took the post-hike survey, along with attrition effects, are presented. Of pre-hike uni-dimensional measures, an attrition effect was detected for social identity content item try hard; those who took both surveys had a significantly higher mean (p = .04) than those who only took the pre-hike survey. Therefore, results pertaining to this SIC item should be interpreted with caution. There were no significant differences between means of the groups' composite in-group identification subscales, Wilk's λ = .986, F (5, 278) = .81, p = .55, η_p^2 = .01.

Of the 170 hikers who took the post-hike survey, 15.3% (n = 26) were categorized as not reporting overuse injury pain; 4.7% (n = 8) were designated insufficient description. Of the 80.0% (n = 136) categorized as having overuse injury pain, 61.0% (n = 83) took time off due to overuse pain, averaging 4.08 days off (sd = 4.13). Only 12.5% indicated they sought medical attention for the overuse injury pain. Regarding those with overuse injury pain, descriptive statistics are presented in Table 4.4; correlations of pre-hike and continuous post-hike severity measures (i.e., time loss, pain level, performance decrements) are in Table 4.5; results of ANOVAs regarding the categorical severity measure, functional limitations, are in Table 4.6.

Table 4.1

Descriptive Statistics and Cronbach Alphas of Pre-Hike Psychological Measures of Hikers Attempting to Hike the Appalachian Trail (N = 283)

Measure	α	Range	Mean	SD	Skewness	Kurtosis
In-group Solidarity	.81	1.67 - 7.00	5.09	1.24	-0.46	-0.32
In-group Satisfaction	.84	1.25 - 7.00	6.02	0.96	-1.69	4.54
In-group Centrality	.84	1.00 - 7.00	5.07	1.49	-0.75	-0.08
In-group Self-stereotype	.75	1.00 - 7.00	4.28	1.22	-0.05	-0.04
In-group Homogeneity	.72	1.50 - 7.00	4.37	1.19	0.11	-0.17
SIC Being Mentally Tough	-	1.00 - 7.00	6.61	0.75	-3.36	17.46
SIC Try Hard	-	1.00 - 7.00	6.24	1.02	-2.09	6.53
SIC Make Friends	-	1.00 - 7.00	4.80	1.41	-0.20	-0.45
SIC Complete Thru-hike	-	1.00 - 7.00	6.24	1.13	-1.86	3.85
SIC Enjoy	-	1.00 - 7.00	6.39	1.04	-2.53	8.10
SIC Not Whining	-	1.00 - 7.00	5.08	1.58	-0.64	-0.22
SIC Being Sensible	-	1.00 - 7.00	5.93	1.17	-1.26	1.84
SIC Being Purist	-	1.00 - 7.00	4.61	1.87	-0.46	-0.92
Mental Toughness Index	.84	2.88 - 7.00	5.79	0.74	-0.70	0.51
TIRE Factor 1 Effort Reduction Due to Stage 2 Overuse Pain	.95	-1.80 - 2.18	0.00	0.94	0.35	-0.28
TIRE Factor 2 Effort Reduction Across Overuse Pain Levels	.90	-2.06 - 3.02	0.00	0.92	0.22	0.01

Note. SIC = Social Identity Content. TIRE = Test of Intentions to Reduce Effort.

Table 4.2

Correlations of Pre-Hike Psychological Measures and Test of Intentions to Reduce Effort (TIRE) Factors of Hikers Attempting to Hike the Appalachian Trail (N = 283)

	Measure	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	TIRE Factor 1 Effort Reduction Due to Stage 2 Overuse Pain	1															
2	TIRE Factor 2 Effort Reduction Across Overuse Pain Levels	.58**	1														
3	In-group Solidarity	-.05	.03	1													
4	In-group Satisfaction	-.03	.02	.66**	1												
5	In-group Centrality	-.08	-.05	.56**	.63**	1											
6	In-group Self-stereotype	-.06	-.08	.53**	.42**	.45**	1										
7	In-group Homogeneity	-.12	-.02	.44**	.44**	.40**	.65**	1									
8	SIC Being Mentally Tough	.02	.06	.27**	.39**	.23**	.12*	.18**	1								
9	SIC Try Hard	-.03	.03	.31**	.39**	.22**	.16**	.22**	.47**	1							
10	SIC Make Friends	-.06	.04	.46**	.35**	.37**	.31**	.28**	.08	.24**	1						
11	SIC Complete Thru-hike	.14*	.15**	.10	.20**	.17**	.02	.13*	.26**	.28**	.02	1					
12	SIC Enjoy	.12	.06	.29**	.33**	.20**	.23**	.15*	.21**	.26**	.27**	.01	1				
13	SIC Not Whining	.17**	.19**	.20**	.13*	.12*	.07	.08	.15*	.20**	.23**	.09	.24**	1			
14	SIC Being Sensible	.08	.18**	.19**	.18**	.04	.05	.04	.23**	.26**	.14*	.11	.20**	.43**	1		
15	SIC Being Purist	.09	.13*	.06	.18**	.12*	.04	.11	.19**	.20**	.07	.30**	.12*	.20**	.16**	1	
16	Mental Toughness Index	.07	.16**	.26**	.28**	.14*	.10	.15*	.14*	.14*	.08	.11	.14*	.18**	.17**	.15*	1

Note. SIC = Social Identity Content. TIRE = Test of Intentions to Reduce Effort. Higher, positive TIRE factor score is indicative of higher overuse injury pain severity risk.

*$p < .05$; **$p < .01$.

Table 4.3

Attrition Effects: Pre-hike Measures for Participants Who Only Took Pre-hike Survey (n = 113) and Participants Who Took Pre- and Post-hike Surveys (n = 170) and Results of ANOVAs

	Took Pre-hike Survey Only (n = 113)				Took Pre- and Post-hike Surveys (n = 170)							
Measure	Range	α	Mean	SD	Range	α	Mean	SD	*F*	*df*	*p*	*d*
In-group Solidarity	1.67 - 7.00	.79	4.97	1.27	1.67 - 7.00	.82	5.16	1.22	-	-	-	.16
In-group Satisfaction	1.75 - 7.00	.87	5.91	1.11	1.25 - 7.00	.80	6.08	0.83	-	-	-	.18
In-group Centrality	1.00 - 7.00	.82	4.88	1.50	1.00 - 7.00	.84	5.20	1.47	-	-	-	.21
In-group Self-stereotype	1.00 - 7.00	.78	4.14	1.29	1.50 - 7.00	.74	4.36	1.17	-	-	-	.18
In-group Homogeneity	1.50 - 7.00	.75	4.21	1.24	2.00 - 7.00	.69	4.47	1.15	-	-	-	.22
SIC Being Mentally Tough[1]	1.00 - 7.00	-	6.51	0.96	4.00 - 7.00	-	6.68	0.55	3.52	1,160.40	.09[1]	.24
SIC Try Hard[1]	1.00 - 7.00	-	6.07	1.29	4.00 - 7.00	-	6.35	0.78	5.23	1,166.24	.04[1]	.29
SIC Make Friends	1.00 - 7.00	-	4.75	1.35	1.00 - 7.00	-	4.83	1.46	0.20	1,281	.65	.05
SIC Complete Thru-hike[1]	1.00 - 7.00	-	6.16	1.32	2.00 - 7.00	-	6.30	0.99	1.05	1,193.52	.34[1]	.13
SIC Enjoy	1.00 - 7.00	-	6.31	1.26	2.00 - 7.00	-	6.45	0.86	1.19	1,281	.28	.13
SIC Not Whining	1.00 - 7.00	-	5.06	1.69	1.00 - 7.00	-	5.09	1.51	0.03	1,281	.87	.02
SIC Being Sensible[1]	1.00 - 7.00	-	5.88	1.33	3.00 - 7.00	-	5.96	1.05	0.34	1,200.42	.58[1]	.07
SIC Being Purist	1.00 - 7.00	-	4.50	1.88	1.00 - 7.00	-	4.69	1.86	0.66	1,281	.42	.10
Mental Toughness Index[1]	2.88 - 7.00	.88	5.70	0.84	3.88 - 7.00	.81	5.85	0.67	2.78	1,202.59	.11[1]	.20
TIRE Factor 1	-1.80 - 2.18	.96	0.00	0.98	-1.79 - 2.17	.94	0.00	0.91	0.00	1,281	.95	.01
TIRE Factor 2	-2.06 - 2.81	.89	0.04	0.91	-2.05 - 3.02	.91	-0.03	0.92	0.36	1,281	.55	.07

Note. SIC = Social Identity Content; TIRE = Test of Intentions to Reduce Effort. TIRE Factor 1 = Effort Reduction Due to Stage 2 Overuse Pain. TIRE Factor 2 = Effort Reduction across All Overuse Pain Levels.

[1]Levene's values for these items were significant; Welch's test statistic was used to indicate significant differences between groups.

Table 4.4

Descriptive Statistics: Pre-hike Psychological Measures and Post-hike Severity Measures of Hikers Who Experienced Overuse Injury Pain During Attempts to Hike the Appalachian Trail (n = 136)

Measure	Range	Mean	SD	Skewness	Kurtosis
Pre-hike					
In-group Solidarity	1.67 - 7	5.12	1.20	-0.31	-0.46
In-group Satisfaction	1.25 - 7	6.06	0.85	-1.77	6.82
In-group Centrality	1 - 7	5.17	1.44	-0.82	0.16
In-group Self-stereotype	1.5 - 7	4.31	1.13	0.18	0.27
In-group Homogeneity	2 - 7	4.44	1.15	0.49	-0.09
SIC Being Mentally Tough	4 - 7	6.69	0.54	-1.83	4.13
SIC Try Hard	4 - 7	6.32	0.81	-1.09	0.66
SIC Make Friends	1 - 7	4.88	1.42	-0.27	-0.50
SIC Complete Thru-hike	2 - 7	6.32	0.97	-1.56	2.70
SIC Enjoy	2 - 7	6.40	0.89	-1.77	4.07
SIC Not Whining	1 - 7	5.09	1.50	-0.66	-0.10
SIC Being Sensible	3 - 7	5.96	1.04	-0.90	0.35
SIC Being Purist	1 - 7	4.73	1.86	-0.58	-0.80
Mental Toughness Index	3.88 - 7	5.83	0.68	-0.43	0.06
TIRE Factor 1 Due to Stage 2 Overuse Pain	-1.77 - 2.17	0.00	0.91	0.42	-0.30
TIRE Factor 2 Across Overuse Pain Levels	-2.05 - 3.02	-0.04	0.92	0.16	0.06
Post-hike Severity					
Time-loss Index	0 - 21.43	2.69	4.34	2.27	4.87
Pain Level	2 - 10	6.40	1.61	-0.33	0.15
Performance Decrement	1.19 - 100	72.76	34.56	-0.82	-0.91

Note. SIC = Social Identity Content; TIRE = Test of Intentions to Reduce Effort.

Table 4.5

Correlations between Pre-hike Psychological Measures and Post-hike Severity Measures of Hikers Who Experienced Overuse Injury Pain During Attempts to Hike the Appalachian Trail (n = 136)

Measures		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Post-hike Severity																				
1	Time-loss Index	1																		
2	Pain Level	.30**	1																	
3	Performance Decrement	-.49**	-.07	1																
Pre-hike																				
4	In-group Solidarity	.09	-.01	-.14	1															
5	In-group Satisfaction	.08	-.01	-.11	.58**	1														
6	In-group Centrality	.11	.02	-.10	.48**	.66**	1													
7	In-group Self-stereotype	.17*	-.02	-.21*	.51**	.37**	.42**	1												
8	In-group Homogeneity	.21*	.10	-.13	.35**	.32**	.36**	.63**	1											
9	SIC Being Mentally Tough	.10	.01	-.02	.13	.25**	.22**	.12	.13	1										
10	SIC Try Hard	.11	.10	.01	.21*	.19*	.12	.02	.02	.22*	1									
11	SIC Make Friends	.02	<.01	<.01	.51**	.31**	.25**	.29**	.25**	-.01	.17*	1								
12	SIC Complete Thru-hike	.10	.16	.14	-.03	.06	.16	-.02	.07	.13	.20*	-.06	1							
13	SIC Enjoy	-.02	.09	.02	.26**	.21*	.17*	.11	.05	.12	.17*	.27**	-.01	1						
14	SIC Not Whining	.02	.17*	.03	.22**	-.02	.02	.07	.05	-.01	.15	.18*	.00	.07	1					
15	SIC Being Sensible	-.03	-.01	.01	.13	.04	<.01	-.02	-.01	.05	.11	.11	-.07	.15	.37**	1				
16	SIC Being Purist	.05	.18*	-.02	.12	.16	.15	.09	.18*	.22*	.36**	.04	.37**	.16	.18*	.06	1			
17	Mental Toughness Index	.15	.09	-.20*	.35**	.36**	.19*	.13	.22*	.28**	.25**	.16	-.03	.07	.20*	.16	.23**	1		
18	TIRE Factor 1 Due to Stage 2 Overuse Pain	-.04	.20*	.04	<.01	-.07	-.04	-.09	-.10	-.01	.01	-.13	.20*	.14	.07	.04	.11	.01	1	
19	TIRE Factor 2 Across Overuse Pain Levels	.04	.22*	-.02	.11	-.01	.06	-.02	.05	.04	.05	.03	.14	.05	.15	.15	.19*	.18*	.56**	1

Note. SIC = Social Identity Content. TIRE = Test of Intentions to Reduce Effort.

*$p < .05$; **$p < .01$.

Table 4.6

Differences in Pre-hike Psychological Measures between Participants with Stage 2 (No Functional Limitation) and Stage 3 (Functional Limitation) Overuse Injury Pain

	Stage 2 (n = 39)		Stage 3 (n = 59)				
Measure	Mean	SD	Mean	SD	F	p	d
Post-hike Severity							
Time-loss Index	0.94	2.63	3.12	4.82	6.65	<.01[1]*	.55
Pain Level	5.51	1.68	6.59	1.45	11.44	<.01*	.70
Performance Decrement	77.31	32.60	71.03	36.71	0.75	.39	.13
Pre-hike							
In-group Solidarity	5.29	1.08	5.06	1.27	-	-	-
In-group Satisfaction	6.22	0.69	6.08	0.68	-	-	-
In-group Centrality	5.15	1.54	5.24	1.34	-	-	-
In-group Self-stereotype	4.31	1.15	4.44	1.11	-	-	-
In-group Homogeneity	4.51	1.09	4.58	1.27	-	-	-
SIC Being Mentally Tough	6.67	0.53	6.64	0.61	0.04	.85	.03
SIC Try Hard	6.33	0.81	6.31	0.86	0.03	.87	.02
SIC Make Friends	4.97	1.22	4.88	1.57	0.10	.76	.05
SIC Complete Thru-hike	6.10	1.17	6.46	0.73	3.46	.10[1]	.29
SIC Enjoy	6.33	0.87	6.39	1.02	0.08	.78	.04
SIC Not Whining	4.92	1.51	5.10	1.51	0.33	.57	.08
SIC Being Sensible	6.21	0.83	5.81	1.09	3.63	.05[1]**	.28
SIC Being Purist	5.03	1.95	4.68	1.78	0.83	.36	.14
Mental Toughness Index	5.97	0.61	5.71	0.71	3.66	.06	.28
TIRE Factor 1 Due to Stage 2 Overuse Pain	-0.31	0.89	0.13	0.83	6.32	.01*	.37
TIRE Factor 2 Across Overuse Pain Levels	-0.18	1.02	-0.03	0.84	0.64	.43	.12

Note. SIC = Social Identity Content; TIRE = Test of Intention to Reduce Effort. Lower performance decrement scores are indicative of higher severity. Higher, more positive TIRE scores are indicative of higher risk of more severe overuse injury.

[1]Levene's values for these items were significant; Welch's test statistic was used to indicate significant differences between groups.

*p < .05; ** p = .05

4.3.2 Initial Validation of the TIRE

To examine validity of TIRE scores, responses of the 283 participants to the 14 TIRE items were examined. Implausible outliers were identified (e.g., I intend to quit if I feel no pain, yet I am extremely unlikely to quit if I feel stage 2 pain), such that 27 cases were removed. Descriptive statistics and correlations of TIRE items for the remaining 256 hikers are presented in Table 4.7.

Table 4.7

Means, Standard Deviations, and Correlations of Pre-hike Test of Intention to Reduce Effort (TIRE) Items of Hikers Attempting to Hike the Appalachian Trail (n = 256)

	Item	Range	Mean	SD	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Amount of pain to hike slower	2 - 10	5.18	1.69	1													
2	Amount of pain to rest more	1 - 10	4.99	1.58	.76**	1												
3	Amount of pain to hike fewer miles	2 - 10	5.66	1.57	.81**	.70**	1											
4	Amount of pain to take a day off	1 - 10	7.09	1.55	.48**	.51**	.56**	1										
5	Amount of pain to quit thru-hike	5 - 10	9.52	0.86	.26**	.27**	.35**	.42**	1									
6	Amount of pain to take OTC	0 - 10	4.77	2.18	.37**	.40**	.36**	.42**	.27**	1								
7	Amount of pain to get medical help	3 - 10	8.20	1.44	.42**	.43**	.46**	.46**	.52**	.43**	1							
8	Hike slower due to stage 2 pain	1 - 10	5.00	2.36	.46**	.45**	.51**	.28**	.22**	.23**	.28**	1						
9	Rest more due to stage 2 pain	1 - 10	4.91	2.34	.40**	.46**	.44**	.31**	.19**	.23**	.30**	.86**	1					
10	Hike fewer miles due to stage 2 pain	1 - 10	5.39	2.40	.45**	.44**	.50**	.31**	.21**	.21**	.23**	.91**	.82**	1				
11	Take a day off due to stage 2 pain	1 - 10	6.74	2.53	.18**	.23**	.31**	.36**	.24**	.14*	.21**	.53**	.58**	.58**	1			
12	Quit thru-hike due to stage 2 pain	3 - 10	9.43	1.15	.10	.16*	.14*	.08	.33**	.08	.19**	.16*	.13*	.19**	.32**	1		
13	Take OTC due to stage 2 pain	1 - 10	4.08	2.80	.16*	.14*	.23**	.17**	.10	.61**	.20**	.45**	.43**	.42**	.40**	.08	1	
14	Get medical help due to stage 2 pain	1 - 10	7.55	2.37	.17**	.20**	.20**	.20**	.22**	.24**	.42**	.35**	.35**	.32**	.51**	.46**	.37**	1

Note. OTC = over-the-counter. Pain refers to overuse injury pain. Response scale for the first seven items is 0 - 10; response scale for the last seven items is 1 - 10. Higher scores for all items indicate a higher risk for taking an action that could contribute to overuse injury.

*$p < .05$. **$p < .01$.

4.3.2.1 Factorial validity. The factorial validity of the TIRE was examined with an EFA. The results of the EFA are shown in Table 4.8, Figure 4.3, and Table 4.9.

Table 4.8

Factor Loadings of Pattern Matrix and Structure Matrix of the Items on the Test of Intentions to Reduce Effort (TIRE) with Direct Oblimen Rotation for Four-Factor (a), Three-Factor (b), and Two-Factor (c) Models

a.

		Four Factor Model				
	Item	h^2	1	2	3	4
1	Amount of pain to hike slower	.77	**.86/.86**	-.15/-.34	-.11/.16	.01/-.26
2	Amount of pain to hike fewer miles	.75	**.80/.85**	-.19/-.40	-.01/.27	-.01/-.31
3	Amount of pain to rest more	.68	**.78/.82**	-.16/-.36	-.03/.23	<-.01/-.28
4	Amount of pain to take a day off	*.45*	**.55/.63**	.01/-.21	.17/.36	-.13/-.34
5	Amount of pain to get medical help	*.51*	**.43/.57**	.12/-.15	**.40/.54**	-.18/-.39
6	Hike fewer miles due to stage 2 pain	.88	.18/.43	**-.87/-.92**	.02/.28	<-.01/-.35
7	Hike slower due to stage 2 pain	.89	.19/.41	**-.86/-.92**	-.01/.30	-.04/-.31
8	Rest more due to stage 2 pain	.79	.16/.39	**-.80/-.87**	.03/.30	-.07/-.35
9	Take a day off due to stage 2 pain	*.55*	-.06/.21	**-.51/-.62**	**.41/.54**	-.07/-.31
10	Get medical help due to stage 2 pain	*.54*	-.10/.17	-.18/-.36	**.62/.69**	-.17/-.36
11	Quit thru-hike due to stage 2 pain	*.35*	-.03/.12	-.04/-.16	**.61/.58**	.09/-.08
12	Amount of pain to quit thru-hike	*.38*	-.32/.43	.10/-.11	**.46/.53**	-.02/-.22
13	Amount of pain to take OTC	.78	.27/.47	.18/-.11	-.02/.23	**-.81/-.84**
14	Take OTC due to stage 2 pain	.75	-.20/.12	-.29/-.46	-.01/.23	**-.79/-.81**
	Initial Eigenvalues	-	5.77	1.87	1.53	1.22
	Percentage of Variance	-	41.2%	13.4%	11.0%	8.7%
	Factor α	-	.86	.91	.72	.76

b.

		Three Factor Model			
	Item	h^2	1	2	3
7	Hike slower due to stage 2 pain	.95	**.94/.97**	.07/.48	<.01/.34
6	Hike fewer miles due to stage 2 pain	.87	**.90/.93**	.08/.47	-.01/.31
8	Rest more due to stage 2 pain	.79	**.84/.88**	.06/.44	.04/.34
1	Amount of pain to hike slower	.86	.02/.42	**.93/.93**	-.01/.27
3	Amount of pain to rest more	.70	.08/.43	**.79/.83**	.02/.28
2	Amount of pain to hike fewer miles	.73	.12/.47	**.78/.85**	.04/.31
13	Amount of pain to take OTC	.71	-.17/.21	.26/.42	**.79/.81**
14	Take OTC due to stage 2 pain	.74	.28/.46	-.20/.16	**.78/.82**
	Initial Eigenvalues	-	4.39	1.39	1.21
	Percentage of Variance	-	54.9%	17.7%	15.1%
	Factor α	-	.95	.90	.76

c.

		Two Factor Model		
	Item	h^2	1	2
7	Hike slower due to stage 2 pain	.95	**.98/.98**	<.00/.54
6	Hike fewer miles due to stage 2 pain	.87	**.93/.93**	.01/.53
8	Rest more due to stage 2 pain	.78	**.88/.89**	<.01/.49
1	Amount of pain to hike slower	.89	-.08/.47	**.98/.94**
2	Amount of pain to hike fewer miles	.74	.05/.52	**.83/.86**
3	Amount of pain to rest more	.67	.04/.48	**.79/.82**
	Initial Eigenvalues	-	4.00	1.25
	Percentage of Variance	-	66.6%	20.9%
	Factor α	-	.95	.90

Note. Factor pattern and factor structure coefficients are presented (factor pattern/factor structure). Factor pattern coefficients greater than .36 are in bold type. h^2 = communality coefficients. Communality coefficients less than .6 are italicized. OTC = Over-the-counter pain relievers.

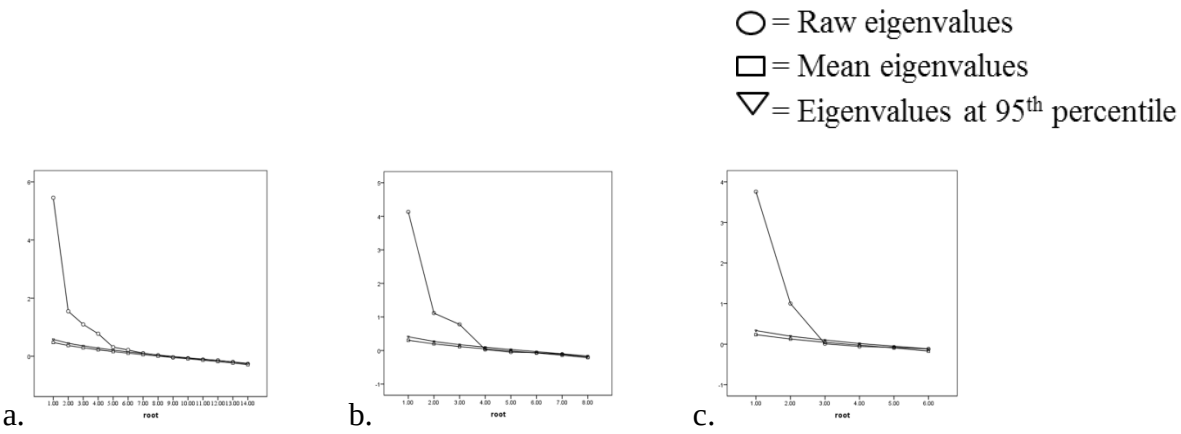


Figure 4.3. Scree plots produced from parallel analyses with a) 14 items, b) 8 items, and c) 6 items. The number of markers above the point where the lines intersects indicates the number of factors to be retained.

Table 4.9

Factor Correlations of Three Solutions for Items of the Test of Intentions to Reduce Effort

Four Factor Model					Three Factor Model				Two Factor Model		
Factor	1	2	3	4	Factor	1	2	3	Factor	1	2
1	-				1	-			1	-	
2	-.26	-			2	.44	-		2	.56	-
3	.28	-.26	-		3	.34	.29	-			
4	-.31	.29	-.28	-							

Note. See text for description of different factors within each model.

The first solution yielded a four-factor model. Monte Carlo parallel analysis with the 14 items and 1000 replications supported a solution of up to seven factors. The scree plot was ambiguous; inflexions supported retention of up to five factors. Based on Kaiser criteria, four factors were extracted, which explained 74.3% of the variance of behavioural intentions. Communalities averaged .65, but communalities for six items were below .60. The six items pertained to quitting, getting medical help, and taking a day off, which could be regarded as more extreme actions one might take in response to overuse pain, as opposed to, for examples, slowing down or taking an Ibuprofen.

The factor pattern coefficients were above .40. Five items loaded on the first factor, which explained 41.2% of the variance. Four of these items loaded exclusively on the first factor and appeared related to effort reduction (e.g., hike slower, take a day off) across pain levels, whilst the fifth, get medical help, did not. The second factor, explaining 13.5% of the variance, consisted of four items, of which three loaded exclusively on the second factor. These four items appeared to encompass effort reduction actions in response to stage 2

overuse pain. Five items loaded on the third factor, explaining 11.0% of the variance; three of the items loaded exclusively. The content appeared to represent more extreme actions one might take in response to overuse pain (i.e., quit, seek medical help), or taking a day off due to low-level, stage 2 pain. All five of these items had communalities below .60. Finally, the fourth factor consisted of the two intentions regarding taking over-the-counter pain relievers; the two items loaded exclusively on this factor, and explained 8.7% of the variance. As expected with the oblique rotation, there were small to moderate correlations between the factors.

To improve the clarity and psychological meaningfulness of the solution, the factor analysis was conducted again after removing all items with communalities below .6, including the two items with cross-loadings. Monte Carlo parallel analysis with the remaining 8 items and 1000 replications supported a three-factor model, as did the scree plot and Kaiser criterion. The three factors explained 87.3% of the variance of behavioural intentions. Communalities ranged between .70 and .95, and averaged .79. The factor pattern coefficients were above .77. Three items loaded exclusively on the first factor, which explained 54.9% of the variance. All three were related to effort reduction across pain levels. The second factor, explaining 17.7% of the variance, consisted of three items loading exclusively on the factor. These three effort-reduction actions were specific to stage 2 overuse pain. The third factor consisted of the two intentions regarding taking over-the-counter pain relievers; the two items loaded exclusively on this factor, and explained 15.1% of the variance. Correlation of the two items (r = .61) was below the value for retention of two-item factors (r = .70), and therefore is considered unstable. The three factors correlated moderately, reflecting use of the oblique rotation.

Given the third factor was deemed unstable, another factor analysis was conducted after removing the two items regarding over-the-counter pain relievers. Monte Carlo parallel analysis with the remaining 6 items and 1000 replications supported a two-factor model, as did the scree plot and Kaiser criterion. The two factors explained 87.5% of the variance of behavioural intentions. Communalities ranged between .67 and .95, and averaged .82. The factor pattern coefficients were above .78. The three items, related to effort reduction actions (i.e., rest more, hike fewer miles/slower) across pain levels, loaded exclusively on the first factor, which explained 66.6% of the variance. The second factor, explaining 20.9% of the variance, consisted of the same three effort-reduction actions, but in response to Stage 2, low-level pain; the three items loaded exclusively on the factor. As expected with the oblique rotation, the two factors correlated moderately.

In comparing the three models, KMOs values for the four-factor, three-factor, and two-factor models were .81, .80, and .81, respectively. The total variance accounted for by the 4-factor, 3-factor, and 2-factor models was 74.3%, 87.3%, and 87.5%, respectively. The internal consistencies of the four-factor, three-factor, and two-factor models were acceptable (i.e., α = .88, .88, and .89, respectively). However, the two-factor model appeared most stable across all of the factor retention analytic criteria. In addition, it demonstrated a simple, interpretable structure: All items in the first factor encompassed effort-reduction intentions in response to low-level, stage two overuse injury pain, hereafter referred to as Factor 1. All items in the second factor encompassed effort-reduction intentions across all overuse pain levels, hereafter referred to as Factor 2. To sum up the EFA process, a two-factor solution was deemed optimal and thus was used in the current study.

4.3.2.2 Construct validity. Significant correlations of scores on measures of social identity and mental toughness with TIRE scores were considered to be indicative of construct validity. There were no significant correlations between social identification and TIRE factor scores. Correlations between scores of four social identity content items (i.e., complete thru-hike, not whining, being purist, being sensible) and one or both TIRE factors scores were significant and positive, ranging from r = .14 to r = .19. Higher mental toughness scores were significantly correlated (r = .16) with higher intentions to maintain effort despite low-level pain, as evidenced by the significant, positive correlations. Overall, the pattern of correlations provided equivocal support for the construct validity of the two-factor TIRE.

4.3.2.3 Predictive validity. Significant relationships between scores on the TIRE, administered before the hike, and severity of overuse injury that occurred during the hike were considered to be indicative of predictive validity of the TIRE. Scores on both TIRE factors significantly correlated with higher pain levels (r = .20, r = .22). The TIRE factor regarding intentions to reduce effort in response to Stage 2, low-level pain significantly differentiated Stages 2 and 3 (p = .01, d = .37). That is, those who did not intend to reduce effort if they felt low-level pain were more apt to incur functional limitation. The relationships between TIRE factors and severity outcomes indicated some support for the predictive validity of the TIRE factors.

4.3.3 Psychological Factors and Overuse Injury Severity

As hypothesized (Figure 4.1b), there were significant relationships between pre-hike psychological measures and overuse injury severity. Significant correlations were found between two scores on two sub-scales of the social identification in-group measure (i.e., self-stereotype, homogeneity) and the time-loss index (r = .17, r = .21, respectively). Scores of the in-group self-stereotyping were also significantly and negatively correlated with the miles

index (r = - .21), implying that perceiving one's self to be similar to other hikers is associated with performance decrements. Social identification scores were not significantly correlated with pain levels, nor did social identification significantly differentiate functional limitation occurrence, Wilk's λ = .958, F (5, 92) = .81, p = .55, η_p^2 = .04, observed power = .278.

Higher scores on social identity content items related to not whining and being a purist were significantly correlated with higher pain levels (r = .17, r = .18). Participants with functional limitation reported significantly lower emphasis on social identity content of being sensible than those whose overuse injury did not induce functional limitation, the difference nearing significance (p = .05, d = .28). Scores of the other five social identity content items were not significantly related to measures of overuse injury severity.

Mental toughness scores were only directly related to one severity measure, performance decrements (r = - .20). However, mental toughness was hypothesized to moderate the influence of social identification on overuse injury pain severity, such that severity was high when both social identification and mental toughness were high (Figure 4.1c).

Per Table 4.10, mental toughness' role as moderator was supported with four significant interaction terms. Simple slopes analyses were used to probe these interactions (Hayes, 2012). Graphs of simple slopes of significant interactions are presented in Figure 4.4. Graphs of simple slopes for all interactions can be viewed in Appendix F.

After controlling for the main effects of in-group homogeneity and mental toughness, the interaction term was significant and accounted for 9% of variance of the time loss index (b = .92, SE = .43, t = 2.12, p = .04). For this interaction (Figure 4.4a), the slope for low mental toughness was non-significant and negative, b = -.10, 95% CI [-.731, .528], t = -.32, p = .75. The slope for the mean value of mental toughness was non-significant and positive, b = .52, 95% CI [-.071, 1.115], t = 1.75, p = .08. The slope for high mental toughness was significant and positive, b = .50, 95% CI [.153, 2.14], t = 2.28, p = .02, with a large effect size.

The interaction term for mental toughness with in-group self-stereotyping was significant and accounted for 5% of variance of pain levels (b = .43, SE = .18, t = 2.42, p = .02). For this interaction (Figure 4.4b), the slope for low mental toughness was significant and negative, b = -.42, 95% CI [-.784, -.059], t = -2.30, p = .02, with a medium effect size. The slope at the mean value of mental toughness was non-significant and negative, b = -.13, 95% CI [-.382, .118], t = -1.05, p = .30. The slope for high mental toughness was non-significant and positive, b = .16, 95% CI [-.169, .482], t = .95, p = .34.

The interaction term for mental toughness with in-group self-stereotyping accounted for 3% of variance of performance decrements (b = 8.46, SE = 3.00, t = 2.82, p = .01).

Regarding Figure 4.4c, lower miles index scores were indicative of performance decrements (i.e., higher severity). A negative relationship between social identification and the miles index meant that for higher values of social identification, the severity is higher. The slope for low mental toughness was non-significant and positive, b = .05, 95% CI [-.174, .276], t = .45, p = .65. At the mean value of mental toughness, the slope was non-significant and negative, b = -.14, 95% CI [-.295, .020], t = -1.73, p = .09. The slope for high mental toughness was significant and negative, b = -.33, 95% CI [-.510, -.143], t = -3.52, p < .01, with medium effect size.

Regarding the probability of the categorical severity outcome, functional limitation, the interaction term for mental toughness and in-group solidarity was significant (p = .03, b = .85, SE = .38, t = 2.20). A higher probability of functional limitation was indicative of higher severity. As shown in Figure 4.4d, the slope for low mental toughness was negative and neared significance (p = .05), with a large effect size (b = -.80, 95% CI [-1.58, .011], t = -1.99). At the mean value of mental toughness, the slope was non-significant and negative, b = -.22, 95% CI [-6.55, .220], t = -.97, p = .33. When mental toughness was high, the slope was non-significant and positive, b = .36, 95% CI [-.182, .907], t = 1.31, p = .19. Overall the moderated regression revealed that mental toughness moderated some relationships between social identification and severity outcomes.

Table 4.10

Results of Moderation Analyses with Pre-hike In-group Identification Sub-scales as Predictors, Pre-hike Mental Toughness Scores as Moderator, and Post-hike Overuse Injury Pain Severity (i.e., Time-loss, Pain Level, Functional Limitation, Performance Decrements) as Outcomes

	Outcome: Overuse Injury Pain Severity											
	Time-loss Index						Pain Level					
Predictors	*b*	*SE B*	*t*	*p*	*CI*	R^2	*b*	*SE B*	*t*	*p*	*CI*	R^2
Constant	2.55	.36	7.09	<.01	1.84, 3.27		6.31	.16	38.57	<.01	5.99, 6.63	
Solidarity	.09	.34	.28	.78	-0.58, 0.77		-.10	.13	-.74	.46	-0.36, 0.16	
MTI	.94	.56	1.69	.09	-0.16, 2.04		.29	.23	1.27	.21	-0.16, 0.73	
MTI x Solidarity	.48	.49	.99	.33	-0.48, 1.44	.03	.33	.20	1.64	.11	-0.07, 0.74	.03
Constant	2.62	.38	6.83	<.01	1.86, 3.38		6.35	.16	40.33	<.01	6.04, 6.66	
Satisfaction	.19	.43	.44	.66	-0.66, 1.04		-.05	.22	-.24	.81	-0.49, 0.39	
MTI	.89	.53	1.67	.10	-0.16, 1.95		.24	.23	1.03	.30	-0.22, 0.69	
MTI x Satisfaction	.34	.70	.48	.63	-1.05, 1.73	.03	.26	.30	.88	.38	-0.33, 0.86	.02
Constant	2.64	.37	7.14	<.01	1.91, 3.37		6.40	.14	44.20	<.01	6.11, 6.68	
Centrality	.24	.20	1.19	.24	-0.15, 0.63		<.01	.11	.04	.97	-0.21, 0.21	
MTI	.90	.54	1.67	.10	-0.17, 1.97		.21	.21	.99	.32	-0.21, .63	
MTI x Centrality	.28	.27	1.04	.30	-0.25, 0.81	.03	.04	.14	.29	.77	-0.23, 0.31	.01
Constant	2.62	.36	7.26	<.01	1.90, 3.32		6.36	.14	45.82	<.01	6.09, 6.64	
Self-stereotype	.43	.38	1.14	.26	-0.32, 1.18		-.13	.13	-1.05	.30	-0.38, 0.12	
MTI	.79	.47	1.69	.10	-0.14, 1.72		.19	.19	1.02	.31	-0.18, 0.56	
MTI x Self-stereotype	.80	.58	1.39	.17	-0.34, 1.94	.07	.43	.18	2.42	.02*	0.08, 0.77	.05
Constant	2.54	.35	7.23	<.01	1.84, 3.23		6.40	.14	44.44	<.01	6.11, 6.68	
Homogeneity	.52	.30	1.74	.08	-0.07, 1.12		.11	.14	.84	.40	-0.16, 0.39	
MTI	.64	.43	1.50	.14	-0.21, 1.48		.16	.21	.78	.44	-0.25, 0.57	
MTI x Homogeneity	.92	.43	2.12	.04*	0.06, 1.77	.09	.03	.21	.15	.88	-0.38, 0.45	.02

Table 4.10 (Continued)

	Outcome: Overuse Injury Pain Severity											
	Performance Decrements						Functional Limitation					
Predictors	*b*	*SE B*	*t*	*p*	*CI*	R^2	*b*	*SE B*	*t*	*p*	*CI*	
Constant	149.89	97.07	1.54	.13	-42.13, 341.91		.25	.23	1.08	.28	-0.20, 0.70	
Solidarity	-5.38	20.46	-.26	.79	-45.28, 22.86		-.22	.22	-.97	.33	-0.65, 0.16	
MTI	11.21	17.22	-.65	.52	-45.85, 35.09		-.58	.38	-1.52	.13	-1.32, 0.16	
MTI x Solidarity	.52	3.54	.15	.88	-6.49, 7.53	<.01	.85	.38	2.20	.03*	0.09, 1.60	
Constant	-45.40	158.14	-.29	.77	-358.22, 267.43		.39	.23	1.70	.09	-0.06, 0.85	
Satisfaction	28.36	26.76	1.06	.29	-24.57, 81.30		-.08	.36	-.23	.81	-0.78, 0.61	
MTI	23.03	28.80	.80	.43	-33.94, 80.00		-.56	.36	-1.55	.12	-1.27, 0.15	
MTI x Satisfaction	-5.29	4.83	-1.10	.28	-14.84, 4.26	.01	.21	.52	.40	.69	-0.81, 1.23	
Constant	5.23	65.62	.08	.94	-124.56, 135.02		.43	.22	1.99	.05	0.01, 0.85	
Centrality	24.38	13.53	1.80	.07	-2.38, 51.14		.10	.15	.65	.51	-0.21, 0.40	
MTI	12.87	11.27	1.14	.26	-9.41, 35.16		-.65	.34	-1.93	.05	-1.30, 0.01	
MTI x Centrality	-4.41	2.30	-1.92	.06**	-8.95, .13	.02	.03	.22	.12	.91	-0.40, 0.45	
Constant	-72.82	80.32	-.91	.37	-231.70, 86.06		.41	.21	1.92	.05	-0.01, 0.83	
Self-stereotype	45.11	18.11	2.49	.01	9.28, 80.94		.05	.20	.26	.80	-0.35, 0.45	
MTI	28.24	13.55	2.08	.04	1.44, 55.04		-.67	.33	-2.00	.05	-1.33, -0.01	
MTI x Self-stereotype	-8.46	3.00	-2.82	.01*	-14.39, -2.54	.03	.35	.28	1.25	.21	-0.20, 0.90	
Constant	33.56	77.84	.43	.67	-120.41, 187.54		.41	.22	1.89	.06	-0.02, 0.83	
Homogeneity	20.39	17.69	1.15	.25	-14.61, 55.38		.07	.19	.39	.70	-0.30, 0.45	
MTI	8.41	13.41	.63	.53	-18.12, 34.93		-.70	.34	-2.04	.04	-1.37, -0.03	
MTI x Homogeneity	-3.86	2.99	-1.29	.20	-9.76, 2.06	.01	.20	.27	.75	.45	-0.32, 0.72	

Note. MTI = Mental Toughness Index. Solidarity, Satisfaction, Centrality, Self-stereotype, and Homogeneity are sub-scales of the in-group identification measure. Because functional limitation is a categorical outcome, R^2 values are not applicable

* $p < .05$; ** $p = .06$.

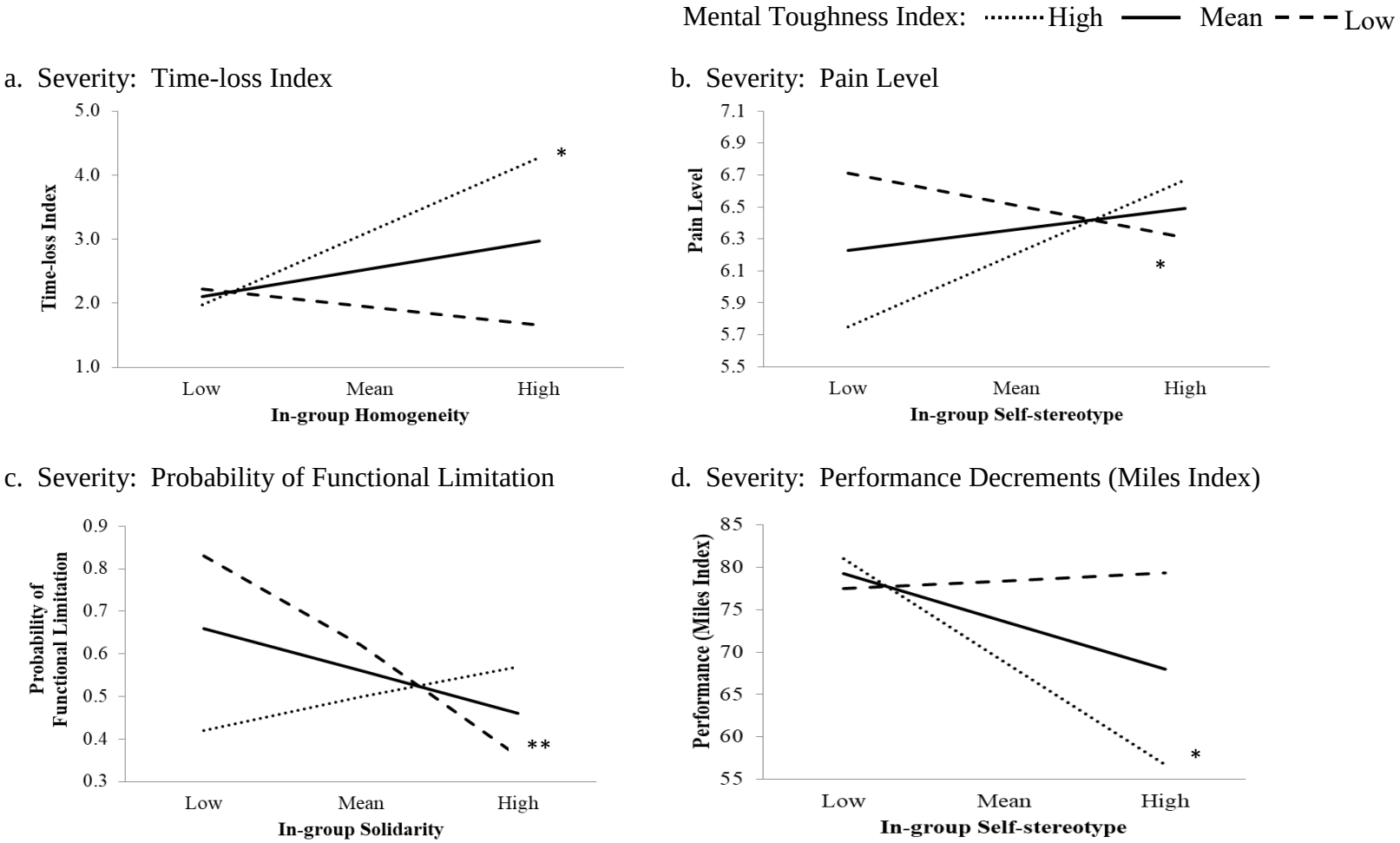


Figure 4.4. Significant interactions between social identification and mental toughness on overuse injury severity. Predictors were social identification in-group identification sub-scales (horizontal axis). The moderator was mental toughness index scores. The outcomes were overuse injury pain severity measures (vertical axis). Lower performance is indicative of higher severity.

*$p < .05$; **$p = .05$

4.4 Discussion

In this study, initial validation of a measure to identify susceptibility to higher-severity overuse injury was examined, and theory-based psychological factors related prospectively to overuse injury severity were identified. Below is a discussion of the findings, implications, and future directions pertaining to each purpose.

4.4.1 Initial Validation of the TIRE

One purpose of this study was to conduct initial validation of the TIRE. Factorial validity of the TIRE was supported, in that the final, two-factor, six-item solution met all of the established factor-retention criteria. The two factors demonstrated clarity and psychological meaningfulness in that all items pertained to intentions to reduce effort (i.e., hike slower, rest more, hike fewer miles) rather than intentions not related to effort, such as intentions to seek medical help. Intentions to seek medical help may be contingent on non-injury considerations (e.g., income, health insurance, distance from hospital; Beattie, Currie, Williams, & Wright, 1998) which may explain why these behavioural intentions were not aligned with intentions to reduce effort. The factor analysis revealed that these effort-reduction items were distinct from more extreme forms of effort reduction such as time loss (i.e., taking a day off) and activity cessation (i.e., quitting a thru-hike).

In addition to factorial validity, the study provided preliminary evidence for construct validity. The significant relationships of TIRE factor scores with four social identity content items (i.e., complete thru-hike, not whining, being purist, being sensible) was aligned with research in other contexts (e.g., virtual world, environmental activism) in which social identity constructs have been found to influence intentions (Chan & Hagger, 2012; Fielding, McDonald, & Louis, 2008; Haslam, 2004; Karjaluoto & Leppaniemi, 2013; Keats, Emery, & Finch, 2012; Livingstone & Haslam, 2008). To my knowledge, this is the first study to produce support for the influence of social identity constructs on behavioural intentions in physical activity contexts. As additional evidence of construct validity, TIRE factor scores also correlated significantly with mental toughness scores. This was based on the tendency of people with high mental toughness to rely predominantly on increased effort as a strategy of coping with stressors including injury (Kaiseler et al., 2009). They would be expected to maintain effort if they encountered the stressor of low-level injury pain. Predictive validity was supported in that TIRE factor scores significantly predicted various severity outcomes.

Whilst these results provide some evidence for the TIRE's construct and predictive validity, the results were equivocal. The effect sizes of the above relationships were small; larger effect sizes ($.30 \geq r \leq .5$) would have been stronger support for the construct and predictive validity of the TIRE (Kline, 2005). Also, there were no significant relationships between the TIRE factor scores and the social identification measure nor between the TIRE factors scores and the four other social identity content items (i.e., being mentally tough, trying hard, making friends, enjoying the experience). In light of these findings, it may be tempting to dismiss the validity of the TIRE, as well as to dismiss the validity of social identity approach as a theoretical framework for the study of overuse injury. However, it could be that that small effects sizes and lack of significant relationships reflect a statistical artefact, restricted range, rather than a lack of validity of the measure and theory.

Restricted range can occur when the data for one or both of the variables has a narrow range, which results in an attenuation of correlations (Goodwin & Leech, 2006). For examples, in the current study, mean scores of 283 hikers on all five social identification in-group sub-scales ranged from 4.28 (1.22) to 6.02 (.96) out of a maximum 7. In contrast, in other studies, the means scores of 827 undergraduate students on all five of the same scales ranged from 2.72 (1.39) to 5.14 (1.22) (Leach et al., 2008). With regards to the social identity content items in the current study, the hikers' mean score on the results or results-oriented social identity content item (i.e., complete thru-hike) was 6.24 out of a maximum 7, with a standard deviation of 1.13. The mean score of elite, youth cricketers on the comparable results social identity content item was about 5.10 (standard deviation not given; Barker et al., 2014). Thus, in comparison to other contexts, it appears that the current sample evidenced higher means which perhaps contributed to reduced range. The restricted range effect could be exhibited by three of the social identity content items that did not yield a significant relationship with TIRE factor scores (i.e., try hard, being mentally tough, enjoy the experience) as the means scores on these items ranged from 6.24 to 6.61 out of 7. In contrast the mean scores of three of the social identity content items that did yield significant relationships with TIRE factors scores (i.e., not whining, being sensible, being purist) ranged from 4.61 to 5.93 out of 7.

Further testing of the TIRE measure using samples with more variability in scores of measures of social identity constructs is needed to more fully assess the construct validity supported by the social identity approach. Additional testing is also needed to assess the psychometric properties of the measure (e.g., convergent validity of intentions with actual

behaviours; discriminant validity with pain catastrophizing; test-retest reliability). Further factor structure testing via confirmatory factor analysis is also needed. Further improvement of the TIRE's utility includes modification of items so that effort-reduction intentions applicable to any physical activity context, not just hiking, can be measured.

Creation of the measure of behavioural intentions in response to overuse injury pain was a significant step in injury research. It extended prior qualitative research (e.g., Russell & Wiese-Bjornstal, 2015; Tranaeus et al., 2014) which revealed the tendency of participants to continue physical activity despite low-level overuse injury pain until the injury became incapacitating. This measure provides researchers with a quantitative means for examining this phenomenon. Another advantage of this measure, like other measures pertaining to pain, is that it enables researchers to examine the phenomenon of overuse injury pain without participants having to be in pain (Sullivan, Bishop, & Pivik, 1995); thus it can be employed in injury-prevention efforts.

The findings pertaining to this measure are suggestive of directions for future research, should future research support its psychometric properties. These effort-reduction intentions could be targeted in interventions designed to reduce overuse injury occurrence and severity. Additionally, the knowledge that social identity content influence overuse injury susceptibility is significant because social identity content of group members can be manipulated (Barker et al., 2014; Haslam, Reicher, & Platow, 2011). For example, group leadership may be able to stigmatize social identity content related to intentions to maintain effort despite pain (e.g., not whining) and induce members to adopt social identity content related to reduction of effort when low-level pain is first felt (e.g., being sensible).

However, further testing of the psychometric properties of the measure is needed before these proposed interventions could be tested. But in the first steps taken with this study, the value of this measure was demonstrated: Three items alone, administered before the injury occurred, predicted which hikers were more apt to incur more severe overuse injury.

4.4.2 Psychological Factors and Overuse Injury Severity

The second purpose of this study was to assess support for the hypothesized, prospective relationships between psychological factors and overuse injury severity. Hypotheses were supported in that all of the psychological constructs that were measured (i.e., social identification, social identity content, mental toughness) were related to various overuse injury severity measures (i.e., time loss, pain levels, functional limitation, performance decrements).

The hypothesis that social identification would be related to overuse injury severity was partially supported. There were no significant findings between the overall strength of social identification and overuse injury severity, and only three (i.e., centrality, self-stereotyping, homogeneity) of the five components of the multi-dimensional social identification measure were significantly associated with severity. As noted in the discussion of the previous study (Chapter 3), the nature of an individual's social identification, rather than merely the overall strength of it, may be the best predictor of behaviours and outcomes in social identity groups (Leach et al., 2008). Therefore general measures of overall strength of social identification may not be of sufficient sensitivity, as shown by the results of the current study. Two of the components with significant relationships with severity (i.e., centrality, self-stereotyping) were the same ones found to be related to overuse injury occurrence in the previous study (Chapter 3).

Two of the components of social identification with significant relationships with severity (i.e., self-stereotyping, homogeneity) involve members' perception of similarity between themselves and group members (Leach et al., 2008). Being perceived as similar to other group members is a means of achieving higher status in social identity groups (Turner, 1982). If a perceived similarity is that members engage in high-effort behaviours, other members do likewise in order to retain similarity to other group members. This rationale is similar to research in other contexts (e.g., theatre) which have demonstrated that highly-identified group members exerted more effort than members with lower social identification (Haslam, Jetten, & Waghorn, 2009). When this same tendency to exert more effort is applied in physical activity contexts, it could have deleterious effects in the form of more severe overuse injury.

Of note, it should not be inferred from these findings that an intervention should be developed to reduce social identification given higher scores on these components of social identification are associated with higher overuse injury occurrence and severity. As many a parent who has attempted to lead children away from wayward influences can attest, attempts to lower social identification—to reduce a group member's affiliation for a group—can be non-viable and end up increasing the members' social identification (Bourhis & Giles, 1977; Brown & Ross, 1982; Hogg & Reid, 2006). Thus, the practical implication extending from this finding, if supported by future research, is to use these measures such that high scores on these specific components may identify group members with higher susceptibility to more severe overuse injury.

Hypotheses regarding social identity content were not fully supported. Only three of the eight social identity content items were related to severity in the anticipated directions. The restricted range effect, described above, could be responsible for the lack of significant relationships between five of the social identity content items and severity. In light of this statistical artefact, it would be premature to dismiss social identity content as a contributor to overuse injury severity, but the findings are equivocal. However, the findings that were significant may have practical implications: Identification of social identity content that are negatively associated with overuse injury severity (e.g., being sensible) can inform the design of injury interventions in that interventions may involve endorsement of these social identity content.

Hypotheses regarding the relationship of mental toughness and severity were supported, given that high mental toughness was associated with higher overuse injury severity when social identification was also high. That is, high mental toughness and high social identification predicted more severe overuse injury pain than high mental toughness and low social identification. Previous research indicated that people with high mental toughness tend to possess the ability to maintain effort whilst pushing through physical pain (e.g., Arthur et al., 2015; Jones, Hanton, & Connaughton, 2002). The current study extends those findings by indicating that individuals with high mental toughness may not automatically push through pain though they have the ability to do so. Rather, the ability to push through pain may be, in a sense, triggered by an incentive to do so, and high social identification may be just such a trigger. Results of previous qualitative research also indicated that higher injury severity may be a negative outcome of possessing high mental toughness for individuals in competitive sport and group exercise contexts (e.g., Cavallerio, Wadey, & Wagstaff, 2016; Crust, Swann, Allen-Collinson, Breckon, & Weinberg, 2014). The current study extends this research by providing quantitative evidence of the negative outcome of high mental toughness for hikers, outside of competitive sport and group exercise contexts. A practical implication of this finding is that individuals in physical activity contexts with high mental toughness can be identified as high-risk for more severe overuse injury. Interventions can be aimed at these individuals to help them develop and rely on coping skills other than the coping skill of increasing effort (Kaiseler, Polman, & Nicholls, 2009).

Another pattern emerged in the moderation analysis that was not hypothesized, in that low mental toughness and low social identification predicted more severe injury than low mental

toughness and high social identification. This could also be explained within the social identity approach. Group members with low social identification are not expected to be concerned with receiving positive evaluations in relation to their social identity groups. In physical activity contexts, minimizing pain reports is a means of preventing negative evaluations of group members and a way to earn respect and impress others (Crocket, 2014; Martin Ginis & Leary, 2004; Nixon, 1996; Tranaeus et al., 2014). Highly-identified group members who wish to be perceived favorably might be less apt to give pain reports. Those with low social identification, unconcerned with negative evaluations of group members and in-group status, may be more apt to report pain as high and to perceive pain as functional limitation. In essence, social identification levels affect cognitive appraisals (Turner, 1982) and could affect appraisals of pain symptoms (Levine & Reicher, 1996). Whilst this theoretical rationale appears to explain these effects, the current study was an initial step in testing the moderation effect of mental toughness. Further testing is needed to determine if the underlying mechanism of this effect as proposed here has support.

4.4.3 Strengths and Limitations

A strength of this study is that it was underpinned by social identity theory. Researchers have recommended that this theory be applied in sport/exercise psychology research given its utility in understanding how aspects of group membership are related to behaviours, including injury-inducing behaviours (Rees et al., 2015). Applications of this theory have only just begun in sport/exercise contexts (e.g., Barker et al., 2014; Bruner, Bailey, & Benson, 2016), and so this study represents novel advancement of theoretical applications. This theoretical framework is particularly valuable, given a finding that only 11% of injury-prevention studies incorporated a theory or model, yet injury-prevention interventions are most effective when a theoretical basis is incorporated (McGlashan & Finch, 2010).

The current study also had methodological strengths. The methodology of assessing injury enabled examination of the full spectrum of overuse injury, including those in the early stages. The occurrence of overuse injury in this study was high (i.e., 80.0% of participants). In part the high occurrence rate reflected the nature of a 2,000-mile hike attempted in a compressed time period. It also corresponds with high rates of overuse injury (e.g., 68% of female high-school distance runners, 59% of male; Tenforde et al., 2011) reported by athletes when medical attention and time-loss inclusion criteria were not utilized. Of the hikers who incurred overuse injury pain during their attempts to hike the AT, 39.5% did not take time off due to pain, and

85.0% did not seek medical help, yet 43.4% reported functional limitation due to overuse pain. This corresponds with evidence that the number of overuse injuries captured with time-loss/medical attention criteria was 90% less than the number captured when the criteria were not used (Clarsen et al., 2013). Thus, foregoing conventional time-loss and medical attention criteria, and employing multiple measures of severity, enabled the study of psychological factors related to low-level overuse injury pain preceding functional limitation. An additional strength of the study is the prospective nature of the study, providing evidence that high mental toughness, high social identification, and high TIRE scores predicted higher risk of higher overuse injury severity. However, further testing of the TIRE is needed to further explore its validity (e.g., confirmatory factor analysis to provide an in-depth analysis of the factor structure) and reliability (e.g., test-retest reliability).

A limitation to be considered in interpretations of the results is that the use of participants in an extreme form of physical activity may have induced the restricted range effect (Goodwin & Leech, 2006). In the current study, restricted range may have impacted analyses of the social identification measures as well as social identity content measures given that the current sample evidenced higher means on these measures than samples in other contexts. It may be that restricted range issues due to low variance obstructed the ability to detect significant or stronger relationships. This may be why effect sizes of most of the relationships between psychological factors, TIRE factors, and severity outcomes were small. However, due to the multi-factorial nature of injuries, with numerous types, causes and risk factors, a psychological factor that can be linked to all overuse injuries, be it shin splints or arthritis, can be considered meaningful despite small effect size (McGlashan & Finch, 2010). Thus, the relationships merit attention despite statistically small effect sizes.

Additional limitations include attrition rate, in part due to the nature of administering online surveys. The sample was also likely biased in that hikers with high social identification were likely the ones most likely to be willing to fill out two online surveys. More research would determine if these findings replicate with group members who are less enthused about group membership, including members of newly-formed groups in physical activity contexts who only meet definitions of minimal group (e.g., formed by toss of a coin; Tajfel, 1974). Also, these findings are specific to a niche group of hikers, so research with other physical activity participants are needed to determine if the findings are generalizable. It may be that in contexts

in which groups have defined leaders, or in which group members are in constant contact, the findings will differ.

The current study advanced efforts to identify physical activity participants with more susceptibility to higher overuse injury severity. Rather than merely identifying psychological factors related to overuse injury, the novel application of social identity theory to physical activity contexts heightened understanding of the underlying mechanisms. With additional research, the findings could ultimately aid the development of interventions to prevent overuse injury occurrence and reduce severity.

CHAPTER 5

"Only You Can Understand Me Because You've Done What I've Done": A Qualitative Analysis of Social Identity and Overuse Injury in CrossFit® Settings

5.1 Introduction

Many harms are associated with injury incurred in physical activity contexts including inability to work or attend school, financial costs of medical treatment, depressive symptoms, psychological distress, exercise relapses, increased lifetime physical inactivity, as well as surgery, arthritis, and restricted mobility (Evans & Hardy, 1995; Korkmaz, Bülent, Çatıkkaş, & Yücel, 2014; Maffulli, Longo, Gougoulias, Caine, & Denaro, 2010; Roos et al., 2015; Rossler et al., 2014; Sallis et al., 1990; Schroeder et al., 2015; Turner, Barlow, & Ilbery, 2002; von Korff & Dunn, 2008). To reduce these harms, researchers have attempted to identify and prevent contributors to injury.

However, researchers in both epidemiology and sport/exercise psychology have identified a limitation with previous injury-prevention research in that acute and overuse injuries were typically studied together as one entity, injury (Johnson, Tranaeus, & Ivarsson, 2014; Roos et al., 2015). This failed to take into account significant differences between the two types of injuries. That is, acute injuries (e.g., broken toe) stem from a single identifiable event (e.g., dropping a heavy object on toe) whereas the causal mechanisms of overuse injuries (e.g., shin splints) involve excessive movement. For an acute injury, the initial pain is typically severe enough to interfere with normal movement (i.e., functional limitation), inducing the sufferer to take time off from physical activity (i.e., time-loss) and/or seek medical assistance. In contrast, initial overuse injury pain is typically low and of a vague, fluctuating nature defying medical diagnoses (Clarsen, Myklebust, & Bahr, 2013; Ekenman, Hassmen, Koivula, Rolf, & Fellander-Tsai, 2001; Russell & Wiese-Bjornstal, 2015; Shuer & Dietrich, 1997; Tranaeus, Johnson, Engstrom, Skillgate, & Werner, 2014). Thus sufferers in the early stages of overuse injury may continue engaging in physical activity despite the low-level pain (i.e., pushing through pain). Pushing through pain can result in the severity of the injury increasing such that sufferers ultimately experience functional limitation, time-loss, and the need for medical assistance (Launay, 2015).

Intuitively, the psychological antecedents associated with excessive training and pushing through pain would appear to differ from those of dropping an object, as would the psychological factors associated with pains of different patterns of severity. However, with few exceptions (e.g., Brewer, 1999; Ekenman et al., 2001), past research of psychological antecedents of injury typically did not take these differences into account. Therefore, researchers concluded that the antecedents specific to overuse injury are fairly unknown and need to be identified (Johnson et al., 2014; Petrie & Perna, 2004; Williams & Anderson, 2007). A handful of qualitative studies

have been conducted to identify psychological factors specific to overuse injury of runners (Russell & Wiese-Bjornstal, 2015), handball players (Tranaeus et al., 2014), rhythmic gymnasts (Cavallerio, Wadey, & Wagstaff, 2016), and athletes from a variety of sports (van Wilgen & Verhagen, 2012). Though these initial studies served as critical first steps, a key recommendation going forward was for researchers to identify psychological factors whose relationship to injury is supported with a theoretical rationale (McGlashan & Finch, 2010). This recommendation is based on evidence that manipulation of theory-based variables was more effective in injury-prevention interventions than manipulation of miscellaneous injury-related variables.

The physical activity context of CrossFit® was chosen for this study. The number of CrossFit® gyms (e.g., > 7,000 in the United States, > 450 in the United Kingdom; Crossfit.com, retrieved 6/14/17) would appear to be a welcome addition to the arsenal of fitness programs combating the harms of physical inactivity (e.g., cardiovascular disease; obesity). However, researchers report that 19.4% (Weisenthal, Beck, Maloney, DeHaven, & Giordano, 2014) to 26.0% (Montalvo et al., 2017) of CrossFit® members surveyed incurred injury during participation in CrossFit® programs. Though the rate of overuse injury of CrossFit® members is unknown, 35.5% of the injuries of CrossFit® members reported by Montalvo et al. (2017) were designated as chronic onset.

Some researchers denounce forms of physical activity associated with harmful injury, positing that health may best be served by moderate modalities (e.g., aerobic fitness programs, brisk walking) rather than engagement in physical activity with a perceived high injury risk (Maffulli et al., 2010; Marshall & Guskiewicz, 2003; Poston et al., 2016; Shephard, 2003). However, these recommendations ignore the perspective of CrossFit® members who find the modalities of the CrossFit® context, along with the atmosphere and connectedness, to be invaluable contributors to physical activity adherence (Bruner, Bailey, & Benson, 2016; Dawson, 2017). In essence, exercise science experts and CrossFit® members appear conflicted in their perceptions of injury relative to benefits of CrossFit® membership. It may be that CrossFit® members possess information about injury in the CrossFit® experience that is not known or considered by experts. Based on recent queries of research databases, to the best of my knowledge, no research has been published regarding the psychological factors related to injury, specific to CrossFit® contexts, nor research representing the voices of CrossFit® members on this topic.

This study will address the need to identify theory-based psychological factors specific to overuse injury pain, specific to the CrossFit® context, whilst incorporating the voices of CrossFit® members themselves. In the next section, the rationale for social identity and self-categorization theories to serve as a theoretical basis for the study of overuse injury is given.

5.1.1 Social Identity Approach and Overuse Injury

Researchers have proposed that social identity and self-categorization theories may be a basis for explaining various aspects of injury (Levine & Reicher, 1996; Rees, Haslam, Coffee, & Lavallee, 2015). A description of theoretical constructs, and the deductive reasoning for their proposed relationship to overuse injury, is presented here.

The social identity approach provides a theoretical description of the influences of group membership on behaviours (Turner, 1982). The approach consists of two theories: social identity theory and self-categorization theory (for overview, see Haslam, 2004). Per social identity theory, inter-group processes involve perceptions group members have of their own group (i.e., in-group) in relation to other groups (i.e., out-groups; Hogg & Abrams, 1988; Tajfel, 1978; Tajfel, 1982). In-group members may compare attributes of the in-group to attributes of an out-group to determine how the groups are distinct from each other. If an individual makes a positive evaluation of one group's attributes compared to the attributes of another group, the individual may attach a sense of positive distinctiveness to membership in that group (i.e., we are different than that group in a way that makes us better than that group; Tajfel, 1978). This in turn leads to the perception that the positively evaluated in-group has higher status relative to the out-group (e.g., CrossFit® is superior to traditional aerobic fitness programs). To understand why one group may have a higher overuse injury rate than another, it may be worthwhile to examine what the sources of positive distinctiveness are (e.g., we work harder than them) to determine if that source is related to overuse injury.

When out-group members fail to recognize the positive distinctiveness of another group, the criticism can be perceived as a social threat by in-group members (Brown & Ross, 1982). Negative evaluation of a social identity group can be perceived as a social threat when the group loses, or could lose, its status such that in-group members would be at risk of losing a valued source of positive self-esteem. Given criticisms of the CrossFit® programs in the media, including criticisms regarding injury (e.g., Diamond, 2015), probing in-group members' reactions to social threats may elicit members' beliefs about injury.

In contrast to inter-group processes examined via social identity theory, self-categorization theory elaborates primarily on *intra*-group processes (Turner, Hogg, Oakes, Reicher & Wetherell, 1987). Intra-group processes involve members' views of their own in-group, such as perceived similarities and differences between in-group members (e.g., comparing one CrossFit® member to another CrossFit® member). Comparisons of attributes between members of a group involve these social identity constructs: social identity content; in-group status; prototypicality; and in-group homogeneity.

Attributes which are perceived to be specific, meaningful reasons for identifying with the in-group are referred to as social identity content (Livingstone & Haslam, 2008). In essence, social identity content are the characteristics that members perceive to be the defining characteristics of the group. Social identity content can dictate normative behaviours for group members. For example, when a group's social identity content is perceived to be pushing hard, members may align behaviours accordingly by doing exercise repetitions to exhaustion rather than stopping after a set number of repetitions. Because this social identity content may induce excessive effort, or pushing through pain, it may be linked to overuse injury. Alternatively, if the social identity content emphasized is friendship, and a member enacts this attribute by conversing with other in-group members before and after exercise sessions, then this social identity content may not be related to overuse injury.

In-group status involves evaluations of members in relation to the defining characteristics of the group (Turner et al., 1987). Members who behave in alignment with the group's social identity content are considered to be more prototypical, thus possessing a higher in-group status. Those with higher status are more likely to be accepted by other group members (Baumeister & Tice, 1990).

Prototypical group members are those perceived as having high in-group status because they exemplify the group's social identity content and are dissimilar from out-group members (Turner et al., 1987). If the social identity content is perceived to emphasize performance, a prototype may exemplify that social identity content by being one of the best performers in the group. In some cases, prototypes may be group leaders. Group members may be susceptible to persuasion from, and mimicry of, prototypes and group leaders (Haslam, Reicher, & Platow, 2011). If a prototype or group leader engages in training-through-pain behaviours, in-group members may do so as well. Therefore, the nature of prototypes may be relevant to injury-inducing behaviours of group members.

In-group homogeneity involves an in-group member's perception that in-group members possess similar attributes (Leach et al., 2008). Highly-identified members may engage in actions they perceive to make them similar to other group members. Thus, if some members appear to train through pain, others may do so, too, in accordance with in-group homogeneity. As shown, it can be deduced that both social identity and self-categorization constructs (i.e., positive distinctiveness, social identity content, in-group status, prototypicality, and in-group homogeneity) may underlie overuse injury.

Altogether, there are gaps in the extant literature in that theory-based psychological factors specific to overuse injury are unknown; the study of overuse injury in CrossFit® contexts is scarce and does not take into account the perspectives of CrossFit® members which may oppose that of experts; and the link between social identity constructs and overuse injury is derived from deductive analysis but lacks empirical support. Therefore, the purpose of this study was to explore relationships between social identity theoretical constructs and overuse injury pain in CrossFit® contexts, whilst ensuring the experiences of CrossFit® members themselves were taken into account. Answers to the following questions were sought: 1) What are members' perceptions of pain and injury in the CrossFit® context? 2) What evidence, if any, is there to link social identity constructs to overuse injury in the CrossFit® context?

5.1.2 Researcher's Perspective

It is best practice in qualitative research for the researcher to declare ontological and epistemological stances, that is, the paradigm that shapes decisions such as methodology (Creswell, 2013). This research is shaped by the pragmatic stance. The pragmatic paradigm involves a focus on human experience rather than abstract concerns, asking "What is the nature of human experience?" rather than asking "What is the nature of knowledge and reality?" (Morgan, 2014). Within the pragmatic paradigm, research can be perceived as a means for learning of the factors relevant to a problem in the human experience, so that, ultimately, actions can be taken to solve the problem. Pragmatics endorse the view that "there is no deterministic link that forces the use of a particular paradigm with a particular set of methods" (Morgan, 2014, p. 1045), eschewing typical paradigm-method demarcations (e.g., positivist paradigm as a basis for quantitative/deductive methods; non-positivist paradigms as the basis for qualitative/inductive methods). Thus, the pragmatic paradigm supports the use of both qualitative and deductive processes to suit the purposes of this study.

It is also best practice in qualitative research to identify researchers' preconceptions (e.g., personal experiences and motivations that may impact what is to be investigated), a practice known as reflexivity (Malterud, 2001). By acknowledging preconceptions, researcher bias is not eliminated, but in the attempt to account for it, objectivity is heightened. My experiences with multiple overuse injuries have influenced my research. In the early stages of overuse injury, prior to functional limitation, the admiration of coaches and team members appeared to be related to my choice to continue training despite overuse injury pain. From experiences in military and law enforcement physical training contexts, I perceived that complaints of low-level overuse injury pain would invoke negative evaluation by group leaders and members. These experiences underlie the hypothesis that a desire to gain approval of a social identity group's leaders and members is related to overuse injury severity.

Additionally, my membership at gyms, including CrossFit®, influenced my perspective. I was a member of the CrossFit® gym used in this study, hereafter referred to as Gym 1, for five months. Whilst a member at Gym 1, I interacted with members (i.e., MT1, GO1, FM2, MM1) who later became participants interviewed in this study. I had no interactions with any CrossFit® members outside of the CrossFit® gym during my membership. I ended my CrossFit® membership approximately two years before the time of this study because I accepted a position as a running coach which provided me with sufficient exercise, making CrossFit® participation redundant. I perceived CrossFit® positively as I did any sport/exercise program which enables people to gain the physical and psychological benefits of physical activity.

5.2 Method

Given the scarcity of research pertaining to psychological factors specific to overuse injury and CrossFit® contexts, qualitative methods were selected for this study because they have been deemed appropriate to scarcely-researched areas in sport/exercise contexts (Moran, Matthews, & Kirby, 2011). Given that perceptions of exercise science experts appeared to differ from CrossFit® members, qualitative methodology appeared applicable as it is aimed at accessing the voices that in some way have been excluded from the knowledge-building process (Cresswell, 2013; Creswell & Miller, 2000). Qualitative methodology can be used to explore a culture-sharing group's beliefs and behaviours pertaining to issues facing the group, the group in this study being CrossFit®, the issue being overuse injury.

5.2.1 Study Design

Two qualitative methods were used to collect data in the current study: observations and interviews. The rationale for using both is based on various reasons (Merriam, 2009), including : 1) A researcher may detect stimuli that CrossFit® members may perceive as routine and therefore not notice or comment upon. 2) Observations can be used to triangulate information gained in interviews, so that support and discrepancies can be identified and explicated. 3) Background knowledge of theoretical constructs and, in this case, injury antecedents may prime the observer to identify material that an interviewee may not recognize as relevant. 4) Interviewees may possess an agenda which constrict the researcher's ability to fully explore topics, particularly controversial ones. For example, CrossFit® programs have been criticized for being cult-like (Dawson, 2017); thus, participants may be defensive when discussing perceived threats to their social identity (Brown & Ross, 1982; Haslam & Reicher, 2006). 5) Interviewees may not wish to discuss sensitive issues about in-group members with an out-group member, so observations may be needed to detect dissent.

The study was designed based on the variable-oriented approach (Miles, Huberman, & Saldana, 2014). This approach to qualitative methods is aligned with the pragmatic paradigm as it employs a combination of deductive and inductive processes. As illustrated by Long, Readdy, and Raabe (2013), the variable-oriented approach relies on instruments (e.g., interview guides) and data analytic strategies (e.g., coding) such that data gained inductively can be deductively linked to a priori theoretical constructs (i.e., positive distinctiveness; in-group status; prototypicality; in-group homogeneity). In this way, qualitative endeavors, based on the variable-oriented approach, yield theory-based psychological variables rather than miscellaneous variables (Tracy, 2010). Therefore, methods based on the variable-oriented approach are aligned with the purpose of this study.

5.2.2 CrossFit® Context

The research was conducted at a CrossFit® gym in a city in the southeastern United States. The membership (n = 144) at Gym 1 consisted of a mixture of collegiate students, family members, and working professionals. The following information and findings of this study are specific to this CrossFit® gym only.

Gym owners paid an annual fee ($3,000) to the corporate CrossFit® entity in order to have their gyms be designated as a CrossFit® affiliate (Crossfit.com, retrieved 6/14/17). Beyond payment of the annual fee, the requirements for being an affiliate owner included possession of a

Level 1 CrossFit® trainer certificate which was obtained by attending and passing a three-day course in which principles of CrossFit® programs were taught. Aside from marketing obligations, affiliate owners were responsible for all other decisions regarding their gyms including what workout would be offered each day, hereafter referred to as the prescribed workout. At Gym 1, gym owners hired trainers to supervise the various workout time slots; gym owners served as trainers for some sessions. Trainers' responsibilities included directing members though workouts. At these gyms, owners required a 1:15 ratio of trainers to members during workouts. Upon joining the gym, new members completed a four-hour, mandatory induction course before being permitted to participate in workouts. Prior to every workout, members were required to reserve a time slot online.

In CrossFit® lexicon, prescribed workouts are called "Rx". One prescribed workout was provided each day for all members to do, regardless of the time slot. At these gyms, the prescribed workouts were developed by GOs and trainers. Prescribed quantities (e.g., weight to be lifted, repetitions, times, speeds) were intended to be of sufficient effort levels (e.g., intensity, duration) for the best performers at these gyms to improve performance over time. Prescribed workouts were "scaled" and "modified" by members. Scaling involves reducing prescribed quantities to suit the members' ability levels or other individual factors (e.g., injury concerns). In this way, all members participated in the same activities at the same effort level, but using the amounts suited to the individual. Modification involves replacement activities. As an example, if members were directed to do squats in a prescribed workout, a member with a sore knee may modify the prescribed workout by rowing instead.

5.2.3 Observations

5.2.3.1 Participants. Participants in the observations component of the study were people who entered the premises of the gym during observation sessions, including members of the gym, trainers, owners of the gyms, visiting CrossFit® members (i.e., members of gyms in other cities who were in the local area and therefore permitted to attend workouts at these gyms) and a chiropractor who appeared on gym premises once a week to be consulted by members. To preserve anonymity, participants were given an identifier code, constructed such that the first letter of the code indicated sex (F representing a female, M a male). The second letter indicated role (M representing a member, T a trainer, GO a gym owner) and was followed by a numerical designation which indicated the chronological order in which the researcher observed the participant. Thus, MM1 was the first male CrossFit® member I observed who warranted an

observation to be recorded. Ultimately, identifier codes were assigned to 85 participants (44 male members, 32 female members, 6 male trainers, 1 female trainer, and 2 gym owners) though more members were observed.

5.2.3.2 Informed consent/Voluntary participation. Due to the low risk of harm to those being observed by researchers in naturalistic settings, and due to high unpredictability of individuals' presence in these settings, informed consent is typically not required of all individuals who enter the setting being observed (Hesse-Biber & Leavy, 2004; Thorne, 1980). Instead, informed consent is provided by a "gatekeeper" who is responsible for access to these settings. Thus, GO1, the primary owner of Gym 1, provided informed consent (Appendix G). To address voluntary participation of members being observed, members were notified of the study two weeks before observations started via flyers at the gyms and posts on the gym's social media (Appendix H).

5.2.3.3 Sampling strategy. Observations (N = 31) were purposely timed to start in December in anticipation of a surge of new gym members pursuant to New Year's resolutions, a trend in American gyms that was confirmed by GO1. Observations of interactions between new and established members appeared particularly valuable to determine how social identity constructs specific to CrossFit® were conveyed to new members (Donnelly & Young, 1988). Because members signed up online to attend a workout, exact identification of participants and sample size for observations of workouts could not be determined in advance. Therefore, to maximize the number and type of members and trainers observed, the principle of maximum variation (Cresswell, 2013) was applied to selection of events to observe (n = 29 workouts, n = 1 intra-gym competition, n = 1 mandatory induction course for new members) and selection of workout times to observe (morning, n = 7; afternoon, n = 10; evening, n = 12). Each workout was conducted within an hour, so one observation was defined as a one-hour period, with additional observation in the ten minutes or so before and after workouts at which times members interacted. Each workout was attended by 1 to 16 members, with 1 to 3 trainers present. To prevent observed behaviours from being staged, participants were not notified in advance about which workout periods would be observed.

5.2.3.4 Procedures. Upon entering the CrossFit® gyms for observations, I recorded the number/sex of people present, usually listing the participants' identifier codes (e.g., MM1, FM8) and descriptions (e.g., blue t-shirt) to help me track participants. During all observations, I sat on a bench which was approximately 20 feet away from the area where CrossFit® workouts were

conducted, with a clear view of the entire gym interior. To reduce reactive effects (i.e., effects of researcher's presence on how those being observed talk and behave; Emerson, Fretz, & Shaw, 2011), I minimized my interactions with members. Interactions included exchanging pleasantries and responding to members' questions about the research project. I usually responded with a short summary without specifying the topics of social identity and overuse injury pain. This was done so that I could determine if those topics arose spontaneously in the natural setting without me artificially inducing discussion of the topics.

During observations, I jotted notes, writing as quickly as possible about actions and dialogue to jog my memory later, following recommendations for jottings (Emerson et al., 2011). Jottings consisted of visual observations, as well as verbal observations (e.g., comments I overheard between members; directions given by trainers during workouts). When a participant spoke with me, I did not write. Subsequent to the exchange, I wrote what was said whilst the content was fresh in my mind. I typed the jottings to form field notes (N = 106 single-spaced pages). See Appendix I for sample jottings and field notes.

5.2.4 Interviews

5.2.4.1 Participants. Interviewees (N = 14) consisted of four female members, eight male members, one male trainer, and one male gym owner. Participants' characteristics are presented in Table 5.1. The mean duration of interviews was 75 minutes, 21 seconds.

Table 5.1

Characteristics of Interviewees in CrossFit® Context

Interviewee	Age	Months of CF Membership	CF Participation (Times per Week)	Competitive Status	Ability Level	Interview Duration (Minutes)
FC 12	43	13	4 - 5	Competition for beginners; intra-gym competition	Meets some	56.20
MC 43	34	6	4	Attends workouts	Often last in workouts	68.33
FC 2	33	60	3-4	Attends workouts	One of top 10 women at Gym 1	60.42
MC 42	33	65	3	Attends workouts	Meets some	52.52
MC 29	32	6	4	Intra-gym competition	Does not meet; lowest ability	93.68
FC 24	20	42	4 - 5	Two CF competitions (1 individual, 1 team)	Meets most	80.55
MC 44	25	8	4 - 6	Intends to compete	Always meets; always in top 20% of males	49.97
FC 31	28	48	2	Attends workouts	Meets some	74.62
MT 1	25	41	7	Competes in CrossFit® Games	One of best MCs at these gyms	80.58
MC 34	48	41	3	Attends workouts	Meets some	71.20
GO 1	52	78		Attends workouts	Meets some	142.62
MC 1	34	48	3-5	Workouts during week only	Meets some	73.65
MC 32	48	20	5	Attends workouts	Meets most	83.13
MC 30	27	7	5-6	Intends to compete	One of best MCs at these gyms	67.38

Note. Additional information about participants is not presented here to preserve anonymity. Ability level refers to participants' ability to meet "Rx" numbers in prescribed workouts (e.g., amount of weight or repetitions); rankings pertain to ranks at this gym.

5.2.4.2 Sampling strategy. The principle of maximum variation was applied to selection of interviewees (Miller & Crabtree, 2004) to obtain a sample with a range of attributes: membership duration (beginner; number of months); injury experiences (none; wears braces; currently injured; quit due to injury; returned after injury); competitive status (attends workouts vs. participates in competitions); ability levels (does/doesn't meet amounts in prescribed workouts); ages; and athletic backgrounds (none; recreational; high-school; collegiate; professional). Before and after workouts, I approached members who appeared to meet the desired characteristics, asking them to participate, emphasizing participation was voluntary. I attempted to make these contacts in the parking lot when other members were not present to preserve anonymity. Convenience sampling was used in that interviewees included those who volunteered to be interviewed, in response to a flyer posted at the gym and on the gym's social media page requesting volunteers (Appendix J). Snowball sampling was also used in that the researcher solicited recommendations from each interviewee of other members who might have valuable input.

5.2.4.3 Instrument. The interview guide (Appendix K) was created based on the variable-oriented approach (Long et al., 2013; Miles et al., 2014). This approach relies on interview guides with questions designed to deductively elicit responses related to a theoretical framework. Iterative adjustments were made to the interview guide based on review by three research supervisors with expertise in the theoretical constructs and qualitative methods. Adjustments were also made pursuant to five interviews and three observations used to pilot the guide. In accordance with depth interview practices (Miller & Crabtree, 2004), interviews were semi-structured. That is, interviewees were asked the "main tour" questions (the bolded questions in Appendix K), but optional, follow-up probes were asked when the interviewer sought to clarify or develop responses germane to the study. Per depth interviewing guidelines, the first set of questions consisted of rapport-building biographical questions. The subsequent sets of questions were designed to elicit responses regarding positive distinctiveness; in-group homogeneity; social threats; prototypical members; sources of in-group status; pain reports; and injury. The questions were ordered such that only the final two questions explicitly addressed overuse injury pain and injury, allowing participants' perceptions of these topics to spontaneously emerge. All interviewees brought up the topics of pushing through pain and injury prior to being explicitly asked about them.

5.2.4.4 Procedures. Locations of interviews (e.g., restaurants, coffee shops, Gym 1 office) were selected by the interviewees. Following normal procedures to put interviewees at ease, I engaged in general conversation; explained confidentiality, emphasizing that gym

owners, trainers, or other gym members would not be informed of the identities of interviewees; and stressed that they did not have to answer questions and could end the interview at any time. All interviewees provided informed consent (Appendix L), including consent for audio recordings. Recordings were transcribed by the researcher and a commercial agency.

5.2.5 Data Analyses

Interview data was analysed first, followed by analysis of the observation data. Analysis was aided by use of NVivo data analysis software version 11. Analysis of interview data, guided by the variable-oriented approach (Miles et al., 2014), occurred in three stages: transcript review, the inductive stage, and the deductive stage. For the transcript review, I listened to each interview recording whilst viewing the corresponding transcript. In this way, I ensured the words in each transcript matched the words in each recording, and I renewed my familiarity with the material. An initial member check was conducted, in that the transcripts were forwarded to interviewees who were invited to review them and provide additional commentary. In the inductive stage, descriptive coding was used to identify simple, emergent, lower-order codes across interviews. Higher-order codes were developed to represent relationships between lower-order codes. In the final, deductive stage, theoretical themes were developed by exploring relationships between the codes and theory-based psychological constructs. In this way, both deductive and inductive processes resulted in theory-based themes.

Analysis of observation data included a review of field notes. The data was then analysed via the same inductive and deductive stages detailed above, such that the observation data was merged with the interview data under codes and themes.

Throughout coding of both interviews and observations, the researcher provided sample codes and thematic products to research supervisors. Research supervisors assessed the internal homogeneity (i.e., each theme had adequate evidence which clearly supported the theme) and external homogeneity (i.e., there did not appear to be overlap between evidence supporting two different themes) of the materials. Iterative discussions between the researcher and research supervisors were used to seek understanding each other's perspectives of the results. Minor alterations were made until research supervisors indicated the final product appeared to sufficiently represent multiple perspectives.

5.2.6 Trustworthiness Criteria

In qualitative research, the need for researchers to provide evidence of validity, reliability, and generalizability has been debated (Sparkes, 1998; Tracy, 2010). Various trustworthiness criteria have been identified as a means of providing evidence, yet the criteria have been disputed amongst researchers. Methods used in this study incorporated several forms of triangulation which are recommended to meet trustworthiness criteria: multiple methods (i.e., interviews and observations); multiple sources of data (i.e., range of participants such as new members, trainers; observations spanning two months of morning, afternoon, and evening sessions); multiple hypotheses; multiple investigators (Merriam, 2009). Additional trustworthiness techniques included a reflexive journal consisting of memos. In the memos, elements of the research process (e.g., decisions made, responses to research supervisors' questions, actions taken) were documented throughout development, data collection, and analysis. This technique enabled other researchers and participants to know the processes for interpreting data and synthesizing multiple perspectives in this study (Cutcliffe & McKenna, 2004). Rich description was also employed such that readers could view the participants' own words to determine, to some degree, their own agreement with, or plausibility of, researchers' interpretations. Employing these techniques enables researchers to learn of multiple realities, of which no participant or researcher possesses complete knowledge (Smith & McGannon, 2017; Sparkes, 1998).

5.3 Results and Discussion

5.3.1 Members' Perceptions of Pain and Injury in CrossFit® Context

In discussions regarding how members reacted to pain experienced during CrossFit® workouts, the following descriptors were used to describe pain that warranted stopping a workout: Acute, disc pop out, feel tearing, cut shin, shoulder blade popped out, sharp, pulled muscle, can't keep going, asymmetrical, injury pain, bone feels hollow, immediate throbbing. Members indicated they would keep trying if they felt these descriptors of pain: Discomfort (e.g., winded, high heart rate), tweak, low-level pain, dull, symmetrical, earned pain (i.e., soreness from working hard), tired, and burning in muscle, particularly if the pain was felt close to end of time for workout, or close to achievement of a goal. The descriptors that matched those of overuse injury pain in the early stages, low-level pain, were associated with the behavioural response of keep trying. Members indicated they would stop to rest then resume the workout if they felt these descriptors of pain: Discomfort, muscle soreness, fatigue/exhaustion, can't breathe, feel like going to throw up, seeing dots. These descriptors are an amalgamation of CrossFit® members' responses, indicating there was no known agreement on what actions should be taken for what type of pain.

Trainers provided additional guidance that was not presented by any of the members. MT1 specified that if pain was felt in a joint, that was the pain warranting concern: "*Joints are something that aren't supposed to give you any pain feedback. If your knee hurts at the end of the workout, we're in a bad spot.*" GO1 predicated the decision to stop a workout or keep trying based on how the pain affected members' movement. If they "*can still do movement correctly*", he indicated they should continue the workouts, but if they couldn't do the movement correctly, or their form/technique broke down whilst attempting a movement, then they should stop doing the movement.

Members' explicit comments regarding injury were categorized as shown in Appendix M. Additionally, their comments regarding means for preventing injury in the CrossFit® context were compiled (Appendix N). These included actions already being taken at their gyms as well as actions that they recommended be enacted at their gyms. In essence, these listings denote miscellaneous variables linked to overuse injury. However, manipulation of miscellaneous variables in injury-prevention interventions are considered to be less effective at reducing injury via manipulation of theory-based variables (McGlashan & Finch, 2010). Therefore, in the next section, variables with the theoretical basis of the social identity approach are presented.

5.3.2 Links between Social Identity Constructs and Overuse Injury

Categorizations of responses to questions regarding social identity constructs (i.e., in-group homogeneity, positive distinctiveness, in-group status, prototypical members, social threats) can be viewed in Appendix O. The focus of this section is on the social identity constructs that appeared to be associated with overuse injury.

5.3.2.1 Social identity content and overuse injury. Social identity content consists of the attributes of a group which are perceived to be specific, meaningful reasons for identifying with the in-group. Interviewees described attributes which were perceived as similarities between members (i.e., in-group homogeneity); as positive reasons for CrossFit® membership relative to other sport/exercise contexts (i.e., positive distinctiveness); and were exemplified by the most impressive members (i.e., prototypical members). Attributes which spanned all three of these social identity constructs were considered to be social identity content. The social identity content identified in this manner were: high intensity; consistent attendance; camaraderie; results.

5.3.2.1.1 High intensity and attendance. Excessive intensity and frequency, and particularly a combination of the two, in physical training are the underlying mechanisms of overuse injury (American College of Sports Medicine, 2014; Ekenman et al., 2001; Stephan,

Deroche, Brewer, Caudroit, & Le Scanff, 2009; Wilder & Sethi, 2004). Given that intensity and frequency are inter-related, these two social identity content are examined together.

A commonality expressed by CrossFit® members was an affinity for intensity, or variations of intensity such as "*pushing hard*", "*hard-coreness*"; "*not afraid of discomfort*"; "*enjoy intense workouts*"; "*mentality to put self through torture*", "*busting my ass and giving it everything*". Members indicated they experienced higher intensity in CrossFit® workouts than in other forms of exercise. For example, FM15 said that participating in Zumba, a fitness class based on dance moves, didn't make her feel tired, nor did she breathe hard whilst she did it. In contrast, during a CrossFit® workout, she often thinks, "*Oh my God I'm dying*." MM34 stated that he liked CrossFit® because "*it's something that pushes me really to the limit of what I can tolerate*". He previously experienced that feeling in cycling, but, as he said "*still never anything quite as much as something that is really a great CrossFit® session*". According to MM42, "*People that voluntarily join CrossFit® are people that want to sort of push themselves more or exert more effort*." MM1 supported this observation, saying "*Some people just want it to be really intense*." FM31 seemed to be one, as she considered the intensity level of other workouts insufficient: "*I guess the [name of traditional gym] group class was not intense enough...I would sweat a little, but it wasn't like, it wasn't as intense.*" This affinity for intensity by CrossFit® is not an anomaly, as other sub-populations in physical activity contexts (e.g., adult male recreational runners; Bartlett et al., 2011) have expressed a preference for high intensity over moderate intensity (Ekkekakis, Parfitt, & Petruzzello, 2011).

Though CrossFit® members may have an affinity for high intensity, the exercise guidelines of the American College of Sports Medicine (2014) prescribe workouts of moderate intensity due in part to the association of high intensity with orthopedic injuries. High intensity is also advised against because it is generally associated with lower physical activity adherence. However, this counters the findings in this study in which consistent workout attendance was a perceived similarity between CrossFit® group members. Members indicated that they had much higher exercise adherence (i.e., frequency and longevity) via CrossFit® participation than participation in other forms of physical activity:

> *As an adult, I got into golf, a little bit of basketball here and there with friends, and then off and on with the gym, very sporadically. Really, CrossFit® has been the first time I was almost religious about it in terms of truly dedicated, five days a week. Obviously now it's been 20 months straight.* (MM32)

The increased adherence professed by CrossFit® members to a high-intensity program could be explained by a trend in exercise psychology research which proposes that pleasure is a

mediator between intensity and adherence (Ekkekakis et al., 2011). That is, those who prefer high intensity may derive pleasure from engaging in high-intensity exercise programs and thus may be more apt to engage consistently in high-intensity exercise programs relative to lower-intensity exercise programs. This explanation of pleasure regarding the intensity-adherence relationship appears logical. However, FM15's statement about CrossFit® suggests pleasure derived from high intensity is not the determinant for her continued CrossFit® membership: "*I don't love it [CrossFit®], but I keep coming back.*" She elaborated that she prefers workouts in which weightlifting is involved because she can lift as much as some other CrossFit® members, but she disliked workouts which featured endurance and stamina, yet she attended both types of workouts. Pleasure derived from high intensity does not appear to be her reason for "*coming back".*

The social identity approach provides a theoretical explanation for the relationship between high intensity and high adherence in that self-esteem, rather than pleasure, may be the ultimate reward for those who engage in high-intensity physical training. Self-esteem is the root of social identity, in that people are attracted to join groups—and maintain group membership—if group membership enhances their self-esteem (Tajfel, 1974). Thus, group members would continue engaging in a group's activities if doing so heightens their self-esteem, even when actual engagement in the group's activities is not pleasurable. There has been some evidence that self-esteem is heightened after completing a difficult, high-intensity workout (Pronk, Crouse, & Rohack, 1995). Per MM43, a "*badge of honor"*, rather than pleasure, is what is earned from completing high-intensity workouts:

> *With any kind of like tough...like a tough guy kind of thing, like a cop. CrossFit® certainly has developed itself into that, or at least emerged into that...it's a badge of honor or something like that. Like, "I'm kind of a tough guy because I can do these CrossFit workouts and I push myself".* (MM43)

This view was echoed by FM31:

> *When I did do it [a tough workout], it felt so good. Like, it felt like, like I would look at the workout and I would be like, "There's no way. Like, this is way too hard. Is GO1 out of his mind?" I was like, "I'm not an athlete. I can't," you know, and, and I would finish it…I would be laying on the floor, about to pass out. "I just did that. I really completed that workout,"...and I was like, "I can't believe it."...That's what sucked me in, was I started to see, I was doing things that I didn't think I could do, number 1, and, number 2, I was seeing the difference that it made in me. It was helping me believe in myself, when I didn't before, and a lot of that has to do with the trainers too, because they believe in you when you don't believe in yourself.* (FM31)

For FM31, CrossFit®'s provision of high-intensity, tough workouts appeared to be the basis for an increase in her self-esteem, which in turn "*sucked her in*" such that she continued her membership in the CrossFit® group.

FM24 also suggested that pleasure derived from high intensity is not the determinant for CrossFit® members' adherence: "*We wake up the next day and come to it, no matter how sore we are, no matter what we feel like, like oh, 'I don't want to go', we still show up"*. In a sense, a value for attendance itself, rather than pleasure, is the determinant for consistent adherence. However, FM24's assertion that attendance "*no matter how sore we are*" appears to be disputed by MM32 who appraised the decision to attend in relation to severity of pain: "*I definitely come with aches and pains every day, don't get me wrong, but...one time where I really felt like I hurt myself, I wasn't going to go in for a few days through that."* For FM24, inflexible endorsement of attendance, attending "*no matter how sore we are*", resulted in a minor injury becoming more severe:

> *I kind of tweaked my back, and I was like "Oh I'm fine. It's probably like just a little muscle spasm strain, no big deal." That happened like November, and I kept going until February to the point where I couldn't sit, I couldn't sleep, I was crying, I popped Advil® every few hours*. (FM24)

The emphasis on attendance likewise affected the amount of rest of CrossFit® members I observed on a day in which Gym 1 was inadvertently not open one morning due to a scheduling glitch. Members who usually attended the 5:30 a.m. sessions (e.g., MM20, FM12, MM39) arrived, but, seeing the gym was closed, left. Later that day, I saw MM20, FM12, and MM39 attend the 5:30 p.m. CrossFit® class. I then observed them the next day, doing the day's CrossFit® workout at their normal 5:30 a.m. class time. Therefore, they attended 2, high-intensity CrossFit® workouts in less than 12 hours rather than missing the day's workout.

In both cases, the impetus for attending despite low-level pain, or attending despite lack of rest, again, might be self-esteem. A member's self-esteem could be enhanced via attendance because other group members admire them for regular attendance, as verbalized by MM32: "*Pretty much everyone that comes there on a regular basis, doesn't mean daily, but on a regular basis, I have a great affinity for and admiration for*." This was exemplified by an exchange I observed, in which FM14 expressed admiration for FM12 coming to participate in a CrossFit® workout despite a recent illness. FM12 told FM14 about having a sore throat and using antibiotics for the previous two days. FM14 responded, "*Yeah, but you're here*", in a tone indicative of praise.

Though attendance was emphasized, there was evidence that workout intensity was modified when a member attended despite feeling sub-par. When FM31 struggled with an illness, she did not attend CrossFit® for a couple of weeks. FM31 described the actions taken by GO2 who noticed she was absent: *She's been messaging me, "When are you going to be*

here? I miss you," and sending me these frowny faces and stuff. FM31 perceived these actions by GO2 to be "*really sweet".* When FM31 returned to CrossFit® after the absence, FM31 did the warm-up with the rest of the members, but then did a workout that GO2 designed specifically for FM31. The workout "*was something to get me sweating a little bit, but it wasn't too intense because I had been sick, and I didn't want to push myself too far."* GO2 told FM31, "*Any time you want to come in and you've been sick or something like that and you want the trainer to do that [tailor a workout to FM31's needs], they'll do that...because I'd rather you show up than not show up."*

MM42 indicated that GO1's proactive stance towards encouraging members' attendance differed from traditional gyms:

> *With a regular gym, they don't want people to come. They want people to buy the membership and then stay home. I mean it's profit maximizing, if I run a [name of traditional gym], to get as many people signed up as I can and to have as few people come into the gym as I can because then it's less wear and tear on my machines. I don't need to have as many machines.* (MM42)

In the induction course I observed, GO1 explained to new members why the business model at CrossFit® gyms differed. Whereas membership of other gyms might be 8,000 members, with few attending regularly, the membership at GO1's CrossFit® gyms was about 266 members, with most attending regularly. If CrossFit® members achieved visible results, they were more apt to continue being members at his CrossFit® gyms. The way to get those results, though, was attendance, coupled with high intensity, the ingredients of overuse injury. GO1 explained that injury of CrossFit® members was against his business interest, because CrossFit® members who got injured might stop attending: "*One of the big reasons that people stop being physically active is they encounter injuries. If they could avoid injuries, if they could heal better, for instance, then they might exercise more and might reap the benefits of exercise*". Therefore, it was in the interest of his business for CrossFit® members to avoid injury and ensure members obtained visible results. In the next section, CrossFit® members' desire for results is examined in relation to overuse injury.

5.3.2.1.2 Results. Members enumerated numerous results of CrossFit® participation, including performance (e.g., amount of weight lifted, speed of completing workout) and non-performance improvements (e.g., physical appearance, fitness, well-being). CrossFit® participation yielded a sense of positive distinctiveness relative to other exercise programs because the results that members gained were significant compared to results obtained via other physical activity contexts:

> *I've heard you can get the same type of workout doing something else, doing other classes, like boot camp type classes or whatever, cycling, spinning, whatever, and I*

> *don't agree with that at all...I didn't see the results at those group [name of traditional gym] classes, that I saw the results at CrossFit®.* (FM31)

For MM30, the performance results he gained from CrossFit® were better than those he gained via participation in training for professional American football:

> *Going to the global gyms after I finished playing [football] in college, I wasn't pushing myself. I wasn't challenged. I became complacent with the status quo. In hindsight, I wish I'd done CrossFit® supplementary to my training for playing professional football. I think that would've probably helped me out a lot. It might have gotten me to that next level to get a starting job. Because I can tell you today, I hit the highest numbers I've ever hit in terms of squat, in terms of dead lift, numbers I wasn't even coming close to [before CrossFit®].* (MM30)

Though MM30 was a high-caliber athlete, members of all abilities were able to experience satisfaction based on performance due to the varied nature of CrossFit® workouts. Numerous members emphasized that the variety of activities in CrossFit® workouts was a reason for membership. Perhaps the importance of varied activity in CrossFit® is that it provides a variety of sources of self-esteem for members. For example, MM29 described himself, saying "*I'm at the end of the pack in terms of results or, you know, where I finish*," but "*I'm good at box jumps I guess. That's about really all I can do to impress people athletically*." Similarly, FM12 said, "*I'm certainly not the, like, weight-wise the strongest person at the gym, but... I was able to do dips without bands fairly quickly...I mean not that there's a hundred of them, but...people were blown away by that."* By performing well at one specific activity, members were able to garner positive evaluations of group members.

However, the price of gains in performance results is intensity. As GO1 stated, "*Can't have results if not intense*." Yet intensity is accompanied by the aforementioned risks for injury. MM30 thought one reason that some CrossFit® members might not improve performance was that they were "*not working hard enough*":

> *It's really just how hard you push yourself. Are you complacent with hitting the same numbers every time, or on next testing day, are you trying for a 5, 10% gain? I think if you're not seeing gains, either you're not putting enough effort into it, or maybe you're eating poorly.* (MM30)

And thus the desire for results, and corresponding self-esteem enhancements, could drive members to work harder, or "*push themselves recklessly and get hurt*" (MM42).

The desire to obtain performance goals appeared related to behavioural responses to injury pain. MM29's decision to continue working out despite pain depended on how close to a target performance goal he was: "*If I have to do 60 kettle bell swings, and I'm on number 20, I'll probably take a break. If I'm at number 50, I'll probably push through it to finish the*

60…It'd be…how close I am to…target goal." FM2 also described how she evaluated a pain she felt during a CrossFit® workout:

> *Tonight we were doing knees-to-elbow, and I have, my right shoulder is giving me problems. It always has, ever since I started CrossFit. The part where you put your knee up hurt my shoulder…I felt like a shooting pain here. I was just like, "Let me just keep going. Workout's almost done. You've got like 30 seconds left," so I kept going. It was, just happened to be, one of those little tweaks, and then it went away, so that was good.* (FM2)

Because she was close to finishing, thereby obtaining higher performance results, she opted to push through the pain. Both instances demonstrate a nuanced relationship between overuse injury risk and desire for results. That is, it may not be that higher injury stems from the general desire for performance results, but rather, that members may be more vulnerable to injury when they are close to achieving a performance goal.

In addition to performance results, members also expressed interest in the appearance results associated with CrossFit® participation. Prior to starting CrossFit®, MM30 "*wasn't seeing any gains in terms of physical appearance… my best friend, who had done CrossFit® for 3 years at that point…He looked in shape. He looked good, and he said "CrossFit®'s the best thing I've done*." MM42, too, experienced changes in his appearance: "*I was a very skinny person, so I like the fact I gained 30 pounds in a year and a half.*" In my observations, I noticed that the upper body of MM6, a member I had seen two years before, was significantly larger and more muscular than in the past. At one point, MM7 walked by MM6 and said, "*Looking big, MM6*".

MM29, too, indicated that he started CrossFit® because he was seeking visible, appearance-related results "*in terms of the eyeball test, how I look. Because people would be like, "So, are you working out?" And I'd be like, "Yes, I've been working out religiously. Is this not apparent?" And they'd be like, "No, it's not apparent."* Having felt discouraged, he had ceased participation in previous exercise programs. He expressed his intent to quit CrossFit® as well if he didn't experience visible, appearance-based results. Thus, his exercise adherence appeared to be contingent on whether he did or didn't receive self-esteem enhancement based on physical appearance results. He acknowledged that, during his few months of CrossFit® attendance, he had gone from being able to do zero pull-ups to being able to do six, but the performance results appeared to be of secondary interest to him.

FM12 reported experiencing visible, appearance-related results: "*I love seeing the changes in my body"*, specifying that she could see her muscles, but her results went beyond muscular appearance. Due to the strength she gained via CrossFit® participation, she was "*able to lift things, and not have to ask for help…I used to always have to ask someone for*

help open jars stuff like that…I just feel more...more confident." For her, the result is not just improved appearance, but also improved strength and self-confidence.

FM24, too, initially, sought the appearance-related results when she started CrossFit®. To her, CrossFit® membership was, at first, "*more just to lose the weight and to keep it off*." After she first felt back pain, part of the reason for continuing on for four months was because she thought, "*I can't stop because I don't want to gain that weight*". Because she wouldn't stop, desiring the appearance results of CrossFit® participation, her injury became more severe. Due to another member's influence, her focus changed from appearance results to performance results when she started doing CrossFit® at Gym 1. FM24 started "*extra training and to push harder and to try and get better and stronger…that's what really…turned that switch on to, like, get better, to take it more serious, instead of just like a form of weight management."*

A key feature of results associated with CrossFit® participation, be it performance or appearance, was that results could be achieved quickly. As FM31 said, "*I've tried different things [exercise activities] over the years...the only thing that I see results quickly from is CrossFit®."* Her perception that results came quickly was shared by other members such as MM1 who said "*There was a lot of improvement like rapid performing. I went from one and a half pull-ups to several in a few months*". Likewise, FM24 stated, "*When you start [CrossFit®], and you'll see a dramatic change from when you first start to like two months*." Though the quick, rapid, dramatic results were a positively-evaluated feature of CrossFit®, MT1 attributed potential injury risk to excitement over these quickly-obtained results:

> *Overuse does happen. It's like…kids and candy. They love it. They'll eat it all day, but it'll give them cavities, and it'll make them bounce off the walls and make your life a living hell until they calm down and fall asleep or something. These guys [CrossFit® members] come in. They'll be so excited [about the results]. They'll do all this work. They'll do all this work. They'll do all this work. They'll get injured. They'll get miserable about it. They'll stop coming in.* (MT1)

MT1 elaborated, saying "*That is where we start getting down the path of overuse: too much all the time…They have no idea what we have in store for them the rest of the week, but they decide to do something [extra workouts] on their own*." This finding echoed findings in which physical activity by CrossFit® members outside of CrossFit® workouts was found to be a risk factor for injury (Montalvo et al., 2017). Thus, in the over-enthusiastic pursuit of results, and the self-esteem enhancements of obtaining results, some CrossFit® members could end up with overuse injury. In the next section, it is shown that this enthusiasm may be further exacerbated by camaraderie of the CrossFit® context, and that camaraderie, too, appeared related to overuse injury.

5.3.2.1.3 Camaraderie. Members expressed an affinity for the social aspects of CrossFit®, in some form, using descriptors such as "*social interaction*", "*community*", "*like family*", "*encouraging*", "*friendly*", "*outgoing*", "*welcoming*", "*inclusive*", and "*camaraderie*". During an observation, MM7, MM8, and MM27 sat near me, socializing after their workouts. I asked them why they do CrossFit® instead of other exercise programs. MM7 immediately answered, "*Camaraderie*." MM8 and MM27 nodded their heads in agreement. MM7 indicated CrossFit® was "*like being on a sport team*", similar to going to a team practice. MM7 clarified camaraderie further, explaining that others go to work then go to bar to socialize outside work. With CrossFit®, he could come to the gym and have non-work talk without needing to go to a bar for that. During observations, I noted the conversational content of CrossFit® members. Though some conversation was CrossFit®-specific (e.g., impending workouts, pain, equipment, perceptions of trainers), much of the conversational content was not (e.g., restaurants, sports, social plans, tv shows, life events, flirtatious comments).

Often, when I entered the gym, the cacophony of noise resembled that of a restaurant due to the sound of laughing and chatter of numerous members assembled in the stretching areas and on the benches. To me, this differed from the noise I heard when I entered the nine traditional gyms of which I had been a member. The noise at those gyms tended to consist mostly of the clatter of weights with a very faint sound of miscellaneous chitchat. At traditional gyms, conversation usually occurred between two members as opposed to the gregarious interactions of multiple members in one group that I observed at these CrossFit® gyms. Noticeably, CrossFit® members socialized both prior to the workouts, and, instead of rushing home, after the workouts. Repeatedly during observations, I heard members and trainers greet and address each other by name, leading me to reflect that I rarely knew the names of staff members, fitness class instructors, or other members of the traditional gyms at which I had been a member. FM31 expressed this sentiment as well when she talked about moving to another city. She expressed sadness at leaving her CrossFit® gym, as she would miss the members. When I asked if she had similarly missed members of group fitness classes she had previously attended at traditional gyms, she said not at all. She couldn't remember the names of the instructors of any of the group fitness classes she had taken.

The reason CrossFit® members knew each other's names was due, in part, to regular attendance. FM2 stated that in group fitness classes she took prior to CrossFit®, she "*rarely recognized a face because people were just random, and, but with CrossFit®, people usually do it at the same time every day. You get familiar with who you're working out with."* For MM32, familiarity with members extended to enjoyment of interactions with members:

> *I'm the least social person so the fact that I would enjoy it [social interaction in CrossFit®] or kind of willingly participate in it is shocking to me. I wouldn't believe it if someone told me that I would enjoy that aspect of it, but I do…There's interaction with the athletes who are in the previous class, that are just kind of getting ready to leave, and you're coming in, so you get to see them. Then those that are in the class after yours, so you almost have like three groups of people that you kind of see on a regular basis, every day…and I get to have interaction with. That's another neat aspect of it that of course I wasn't getting previously [in other physical activity contexts]*. (MM32)

Regular attendance and regular interactions with people did not appear to be the sole source of the camaraderie. According to GO1, the "*shared experience of the intense workout"* was the basis for camaraderie at these CrossFit® gyms. MM32 described how intensity underlies camaraderie:

> *You have a natural affinity to people that are also doing CrossFit® because pretty much they're the only ones that know how intense it is or how hard that particular day's workout was. You're able to have this sort of common experience, and that common experience I think leads to sort of a community sense of camaraderie…This is a crazy analogy, but there's a reason why Presidents of the United States, whether they're Republican or Democrat, you notice that after they leave the White House, they're all friends. Only they have been through what they've been through. Same thing with people in the military. There are certain activities that are these shared experiences that I think lead to people liking each other and all that, because there's this understanding that only you can understand me, because you've done what I've done.*

Though camaraderie was a source of positive distinctiveness for CrossFit® members, members had to engage in high-intensity workouts and attend regularly in order to partake of this camaraderie, a volatile mixture that can contribute to overuse injury.

Though some members emphasized intensity as a basis of camaraderie, other members emphasized the helpfulness of CrossFit® members. FM12 explained that she liked "*everybody being so helpful"*, one form of help being encouragement. FM12 indicated members could be perceived favourably in CrossFit® contexts by encouraging other members. She was "*very impressed by the good people who encourage the people who are struggling*". For example, they applauded and cheered on members who came in last in a workout. To FM12, an outcome of encouragement is that new members keep coming back, despite how hard CrossFit® workouts are in the beginning for new people: "*You see these people come in, and that's why they keep coming is because the really good people take a moment to encourage them".*

For some members, such as MM30, the outcome of encouragement was to push harder: "*I can think of multiple examples of when guys I'm directly competing with are encouraging me to move faster, move quicker, push harder*". This effect of encouragement

inducing members to do more was observed multiple times. For example, whilst climbing a rope, MM21 stopped about halfway up, appearing stuck. But when MM20 called up to MM21, "*Go, go, go!*", MM21 resumed climbing. This finding is not surprising, as verbal encouragement has been linked to higher effort (Chitwood, Moffatt, Burke, Luchino, & Jordan, 1997; Moffatt, Chitwood, & Biggerstaff, 1994). However, one common origin of overuse injury is that someone who is new to an activity, or has low physical fitness, engages in high effort in a new activity (Launay, 2015). FM12 thought the new people were "*inspired by*" the encouragement, yet some interviewees indicated that new CrossFit® members were particularly susceptible to injury. It may be that responding to encouragement from in-group members with exhibitions of higher effort plays a role. The trainers at Gym 1 appeared aware of this possibility. In one observation, MT4 was guiding FM14 through her first attempt at climbing up a rope. He directed her to climb only to the *third* knot (i.e., halfway up) so that he could assess her ability. He did not want her to go all the way up only to find she was too fatigued to return down safely. As FM14 climbed, another member started cheering for FM14, saying "*Go all the way [to the top]!".* MT4 countered the member's encouragement in a light tone, "*The goal was three. Don't listen to your peers. They'll get you in trouble.*"

As FM12 said, "*Encouragement is powerful*", so encouragement by group members of injury-prevention behaviours, or of effort appropriate to one's ability and experience, could be powerful in preventing injury. Given the influence of prototypical members and group leaders in social groups (Fransen et al., 2015; Haslam et al., 2011), they may be critical in educating new members about this tendency to respond to encouragement with excessive effort. Group leaders may also teach other members to help, rather than inadvertently harm, new members by wording encouragement in a way that doesn't emphasize excessive effort (e.g., saying "Good form! Keep good form!" rather than "Come on! Keep going!").

5.3.2.2 In-group status and overuse injury. In the above section, it was shown that CrossFit® members' social identity content included high intensity, consistent attendance, results, and camaraderie. Members who behaved in accordance with these values (e.g., push hard, attend regularly, perform well, encourage others) would be perceived favorably by other members, thus gaining higher in-group status. Two other aspects of in-group status were found to be relevant to pain and injury in the CrossFit® context: pain reports and publicity.

5.3.2.2.1 Pain Reports. Members (e.g., MM32, MM43, MM44) specified that a way to be perceived favorably in CrossFit® was to not whine or complain. MC43 indicated that a member could be respected *"Even if you're the slowest person there, if people see you working hard and trying to get better, and you've got a positive attitude, you know, you're not whining about you know this or that exercise*". Thus, "*not whining*" is a way to gain in-group

status. The fear of negative evaluation for not adhering to group norms of "not whining" may be part of the reason for group members not reporting injury pain in CrossFit® context. MM43 had shoulder pain, but stopping a movement that hurt his shoulder in a workout is something a "*wimp*" would do, and to talk about the pain would be to "*complain*": *especially when I first started, there was a lot of pulling shoulders and things like that. I know, like, "Okay, I probably shouldn't do this movement because my shoulder's still a little sore," but I'm like, "I don't want to be a wimp and complain again." It's like, "All right. Just try to do it".* This member perceived pain reports negatively as complaints that others would hear. The fear of being perceived as a complainer may stem from the nature of the pain of overuse injury, in that it is not accompanied by a visible deformity. "The only way they [people with overuse injury] can convey the seriousness of their condition is to tell people, and this introduces the risk of being perceived negatively as someone who complains" (Turner et al., 2002, p. 292). The nature of overuse injury pain may make others skeptical of the severity of the pain.

Like MM43, MM44 had shoulder pain, too. At first, he didn't tell trainers about the pain because he did not want them to think he was "*sandbagging*":

> *I wouldn't talk to the trainers. I just internalized it. I would say "I know about it", and I would just finally say "Oh my god I cannot do this right now, with my shoulder." That did not get good reaction from trainer because they think you are sandbagging.* (MM44)

These findings are similar to those in which floorball players were reluctant to express concern about pain to others until the pain had escalated to be "really painful or serious" because they did not wish "to be considered as whiners" (Tranaeus et al., 2014; p. 165). This tendency can be understood in terms of self-categorization theory. Withholding pain reports is a means of preventing negative evaluations of group members whereas expressing pain can result in being evaluated poorly (Crocket, 2014; Martin Ginis & Leary; 2004), the overarching stimulant being in-group status. Essentially, if pain reports are perceived as whining, members who wish to be perceived favorably might be less apt to give pain reports.

FM12 indicated that some members hide their problems from the trainers, but she believed it was the responsibility of the members to be honest with trainers:

> *If you're not being honest with them [trainers] about what's going on, you're trying to, you know, I think some people try to hide the fact that they are struggling with something because, of this, it makes them feel less something, you know, like, like, "Yeah I don't want to admit my body's not…", but that's a personal thing, and that's not the gym's fault.* (FM12)

In MM44's case, when the pain was so bad that he couldn't do more, he finally told the trainers about his pain. Rather than appearing suspicious that he was sandbagging, they were upset that he had not been open with them about what was going on. Believing he was not being evaluated negatively for reporting pain, he thereafter became more comfortable reporting pain: "*Now, during the warm ups, I will say 'MT6, hey, my shoulder is not feeling so hot today'".* After being made aware of the problem with his shoulder, the trainers came to him asking him about it:

> *I hadn't seen MT1 in weeks, and I was doing squats, and he walked over and said "Hey man how is your shoulder?". Just out of the blue. I hadn't talked to him about it. It was genuine concern there, probably because the workout that day had a lot overhead stuff, and he wanted to get his gears going on what might need to be scaled or addressed. He was genuinely understanding, and we talked about what I've been doing to fix it, and he gave me more advice on how to strengthen those rotator cuff muscles.*

The outcome of MM44's pain report was that the trainers found ways to help him adapt workouts despite the shoulder problem, but fearing the outcome of negative evaluation appeared to be the reason why he did not initially report the pain when it was in the initial, low-level stages. The need to take corrective actions in the early stages of overuse injury, to prevent it from worsening to the level of functional impairment, may be precluded by fear of negative evaluation related to in-group status.

In my observations, trainers solicited pain reports. In one, a female member said, "*My arms really hurt*." After hearing her, MT1 asked other members attending the workout, "*Who else is in this boat? The 'can't do push-ups' boat?*" Two female members raised their hands. He indicated that he would give them a different activity to do. Of note, the two female CrossFit® members did not tell him about the pain until he asked. Likewise, MM19 did not discuss pain he was having until MT4 asked him, "*How's the back*?" In the discussion, MT4 expressed that he himself was having pain, too, after which MM19 added "*Hips destroyed*", referring to pain he was experiencing from a previous workout. MM19 appeared comfortable telling the trainer about his pain only after the trainer asked him, and after the trainer expressed that he too had pain.

Without this direct solicitation of pain reports by trainers, members may be reluctant to express pain to a trainer due to self-presentational concern. Self-presentational concern involves the desire to manage the perceptions of others (Leary, 1992). Concern about being perceived negatively—particularly by group members—for whining about pain may prevent pain reports. Therefore, attempts by trainers to get members to report low-level pain may be more effective when preceded by reduction of self-presentational concern. That is, trainers

would explicitly emphasize that members who report pain to trainers are perceived positively by trainers. Trainers can explicitly encourage members to tell them about pain, even low-level pain, explicitly letting members know they will not consider pain reports to be sandbagging, but rather sensible efforts to resolve pain and prevent injury. However, another aspect to consider is the perceived authenticity of trainers' statements, as exemplified by MM43's comments:

> *I guess fundamentally I think there's these two, like, competing like ideologies or a talk that they give. One, it's the whole, "Okay, we're going to scale everything, and you work at your own level," and all that. All right. That's cool. That's nice that you're saying that, and it's a great ideology or plan. Then there's also this, like, push to push yourself…They're competing, right?…You want to push yourself, and then maybe you feel this pressure from the trainer to go a little bit harder than maybe you think you should. That balance, I think, is very interesting in, I guess, where you have a potential conflicts and problems with CrossFit®, when those kind of butt heads.* (MM43)

Here, MM43 implied that trainers urged members to train at a level appropriate to the individual, rather than excessive amounts that could incur overuse injury, yet the emphasis on pushing hard countered the emphasis of training at the appropriate level.

As one final consideration, a member's ability level may be considered in pain reports. For example, when MM30 felt a pain in his quadricep, he told MT4*, "Hey look, I don't think squatting's a good idea today. What do you recommend?*" Because of his high-performer status, MM30 might be more comfortable making pain reports to trainers. He was already perceived favorably as a high performer and didn't have to fear that pain reports would make him be perceived as whining or wimpy. Members of less ability, unable to gain positive evaluations via high performance, may attempt to be impressive by "not whining", and thus be more susceptible to injury.

5.3.2.2.2 Publicity. As indicated above, self-presentational concern about perceptions of others appeared to prevent pain reports. MM30 expressed self-presentational concern, stating: "*I care what people think about how I perform. I care about my perception in their eyes. To someone who is a top performer, who busts his ass, and pushes himself through pain."* Thus, self-presentational concern about perceptions of in-group members is explicitly linked to pushing despite pain. MM30 described an incident during rowing when he pushed through pain whilst being viewed by other members: *"My legs were on fire, my breathing, I felt like my throat was on fire, but again, I had MT1, I had MT6, I had everyone else around me as I was doing it to kind of get me through that."* Being viewed or evaluated by others is referred to as publicity, which is an element contributing to self-presentational concern (Leary & Kowalski, 1990). Numerous studies have shown that people in sport/exercise contexts tend

to increase physical effort when they are being viewed/evaluated by others (Leary, 1992; Leary, 1996; Rhea, Landers, Alvar, & Arent, 2003; Tenenbaum et al., 2005; Worringham & Messick, 1983). But here, MM30 linked the increase in physical effort to being viewed directly by in-group members. CrossFit® members who rely too heavily on increases in effort to impress other members and gain in-group status may be more apt to incur overuse injury.

Above, being observed by trainers was linked to MM30's efforts to push through fire-like pain. Being observed by trainers was also linked to MM30 not stopping during a workout:

> *I can remember last week, there's a WOD* (workout of the day). *MT2 was literally right in my face for the last two sets of it. I wanted to stop. I didn't physically think that I could get through it. It's one of those things where, the bar was set pretty high. I knew what I had to do to get there, and if pushing yourself and making yourself uncomfortable to get to them, then absolutely. I did everything that he told me. He said, "You're going to rest for 3 seconds, 3, 2,1, next rep. 3, 2, 1, next rep. 3, 2, 1, next rep." Had he not been there, I probably would've stopped. I probably would not have gotten the time I got. It's also one of those things where I didn't want to disappoint. He's, I don't want to say he's counting on me, but I almost likened it to that. I almost likened it to being part of that football team again where I'm a key contributor. I have a role to do. I have a job to do. Do your job. That's often what I think of when I'm doing these workouts, is that I don't want to under impress. I want to exceed expectations.* (MM30)

MM30 did not want to "*disappoint*" MT2 by stopping, and he did not want to "*under impress*". If MT2 hadn't been watching him, MM30 believed he would have stopped.

The effect of decreased rest and increased effort when a trainer watched a member was replicated numerous times in observations, even when the trainer did not speak to the member. For example, one workout involved 30 box jumps. I observed MM32 do some, then rest. When MT1 walked past MM32, his head turned towards MM32. When being viewed by MT1, MM32 immediately started doing box jumps again. After MT1 walked away, and MM32 was no longer in MT1's visual range, MM32 rested again. In another observation, with less than three minutes left to complete as many snatches as possible, FM15 lifted a bar with weights to shoulder height, paused, then returned it to the floor instead of lifting it above her head to complete the snatch. She then rested 29 seconds. MT1 started watching her. After completing more snatches, she rested 10 seconds before starting another snatch. As MT1 continued watching her, she rested 9 seconds between sets of snatches. MT1 then said, loud enough for all class attendees to hear, "*Come on, 50 seconds!*", indicating they only had 50 seconds to complete as many snatches as possible. He continued watching FM15. She then only rested 6 seconds between sets of snatches. After MT1 indicated time was up, FM15

made a loud "*Owww*" sound whilst putting her bar on the floor. MT1 asked FM15 "*All right*?" In this incident, FM15 was resting 29 seconds between snatches, but when being observed by a trainer, she decreased her rest, though the trainer did not say anything to encourage her to push harder. Though saying "owww" may not be a formal pain report, it elicited the response of having the trainer check on her.

Aside from members watching members, another means for publicity in the CrossFit® context involved photography. Trainers often took pictures of the CrossFit® members whilst they were doing the workouts. The pictures were later uploaded onto social media, so how a member looked, how a member behaved, was visible to all other group members. When FM31 started CrossFit®, she was intimidated by box jumps because she was afraid she'd get hurt. GO1 spent extra time with her after class. He literally held her hand until she was able to do box jumps. After that, FM31 did box jumps, but she only used the shortest box, 19" tall. One day, a female trainer spoke with FM31:

> *She told me I wasn't allowed to jump on the 19 anymore, because she was, like, "You're clearing that box, like, this is ridiculous…If I see pictures of you jumping on the 19 box, I'm going to be mad." She was like, "You need to be on the 22 or the 24".* (FM31)

The trainer pushed FM31 to move to a higher—more intense—level by using the publicity element of self-presentational concern via photographs.

For MM30 and FM31, the use of publicity elements induced them to push through pain and push through fear of getting hurt. But for MM34, the trainers' presence was associated with him pushing so hard that he felt he needed medical services:

> *All they [trainers] want is to know that I'm doing the best that I can. The problem being that they are all much younger. Sometimes their perceptions, I think, of what it is for me to push myself is actually well beyond what might be safe for me to push myself to. It had never really happened until about six months ago, where I just went ahead and went with it and pushed myself trying to do so, to the limit that this trainer perceived I should go to...I was having heart palpitations and I could not get my breath. I was over to have them call the squad [ambulance responding to medical emergencies] and then thankfully something happened that I was able to pull it together. What the idea of pushing myself is, is, I think, like I said, you really do have to, to a certain extent, know yourself.* (MM34)

MM34 did not place blame on trainers but rather on himself for not knowing his own limitations. To him, the solution was not that the trainers should modify their presence or behaviours, but rather, members were responsible for what he called "*resisting the social pressure*":

> *The being constantly injured was something that I disliked about it [CrossFit®], but now, both through a combination of accepting the fact that just because someone's screaming at me to do something doesn't mean that I have to do it.* (MM34)

To clarify use of the word 'screaming', during all of my observations and my own membership at Gym 1, in all instances in which trainers raised their voices louder than normal conversational level, the tone and comments (e.g., "Come on! Two more!") were of an encouraging, enthusiastic, passionate nature. I never observed a trainer screaming in a derogatory fashion.

FM31, who did not have any CrossFit® injuries during approximately four years of participation, echoed MM34's sentiment, saying it was the members' responsibility to tell the trainer "no":

> *I've actually seen an instructor encouraging someone to do too much weight and that person pushing herself, just because she was extremely competitive and knew it was too heavy, but did it anyways, and ended up hurting her back and being out for 6 months. Yeah, I've seen it happen…Shame on her for continuing to do something that she knew was too heavy and not telling the trainer no. You don't have to do it.* (FM31)

The difficulty in resisting trainers' urgings to push hard was described by GO1: "*Everybody is incentivized to be there because they want to please MT6 and they want to please MT1, and MT1 and MT6 are trying to get them to do it."* However, MM42, along with other interviewees, explicitly and spontaneously indicated they did not feel pressure by trainers:

> *I don't feel that pressure at all. I don't feel any impetus to try and please anybody. I see it as, I pay a monthly membership to get the workout that I want and I get to say hi to some people that I've seen a lot. It's enjoyable to work out with people that you like. There's not any sense of peer pressure. I've had my share of bad workouts and I've never gotten the sense that someone was disappointed in me.* (MM42)

Thus the desire to please trainers, to gain approval and therefore in-group status, appeared related to behaviours underlying overuse injury for some members, but not for other members.

Though FM31 expressed admiration for trainers, she exemplified "resisting the pressure" in her own CrossFit® participation:

> *I'd be like, "I don't care what you say. I ain't doing it. That's too heavy." I've had several times, when I was in [name of another city], at that CrossFit®, and the trainer was pushing me to metronome. I was like, "I'm not lifting that." I was like, "That is too much. That's too heavy." I was like, "I'll go up 5 pounds, but I'm not going up 10 pounds. That's too much."* (FM31)

FM2, too, expressed that her perceptions of whether she should do something sometimes differed from the perceptions of trainers:

> *Sometimes, they [trainers] can be wrong, you know, because they don't know what you're feeling. I hate when they're like, "You can do that," and you're like, "No, my shoulder hurts. I can't do that." I want to punch them in the face…I've had those*

> *moments where I'm, like, "I can't do this because wall ball hurts." They're like, "Try this." I'm just like, "I'm just not going to do that."* (FM2)

FM31 indicated that it is ultimately the members' responsibility to resist pressure to push hard, but she also indicated that trainers could get to know members well and take their natures into account when determining whether to urge a member to push harder:

> *Shame on the trainer for not knowing the individual enough to know when too much is too much. If you know someone, if you know that they're super, super, super-competitive, you know that they're going to do to whatever weight you tell them because they're so competitive and crazy…She's just that type. If she's got somebody pushing her and pushing her and pushing her, and pushing her, she's going to do it. No matter what her body is saying, she's going to do it, because she wants to be the best, and she wants to lift the heaviest, and she doesn't want to let anybody down, and all of that stuff.* (FM31)

To FM31, trainers needed to rein in the members with competitive natures to prevent them from getting injured, but MM30, who indicated that he has a highly competitive nature, appeared to prefer trainers urging him to push harder to induce performance gains. When MM30 felt injury pain, his solution was to back off in workouts, and, as noted above, consult the trainers for recommendations for dealing with the pain. In contrast, MM42 described himself as having a conservative nature. After injuring his back whilst doing deadlifts, he did not participate in deadlifts for over a year. However, GO1 and trainers eventually used "*good-natured cajoling*" to help him overcome his fear of deadlifts:

> *He and a couple of the trainers, I would start working after the class at a light to moderate weight and just having them watch form, watch speed, et cetera. Just kind of becoming comfortable with the fact that I could do the movement, just slower and at a light weight, non-dangerous way.* (MM42)

In this way, observation by trainers helped him grow more secure in his ability to do the movement without incurring injury. Because trainers are present all the time, and watching members, they are able to correct form of members. When the trainers tell members to stretch, the members stretch, knowing trainers and other members see them doing it. Thus, publicity could be linked to injury-prevention behaviours. However, MM42 also pointed out that publicity is variable because CrossFit® gyms are run differently. At some CrossFit® gyms he attended, trainers tell members what the workout is, start the timer, then don't watch members do the workout whereas at Gym 1 trainers watch members throughout the entire workout.

Altogether, being viewed and evaluated by in-group members may be a factor for some group members regarding pushing hard, or pushing through pain, or resting less, but publicity may also be a means for inducing members to enact injury-prevention behaviours.

If in-group status relied more on smart application of effort-management and injury-prevention principles, and prototypical members emphasized these principles rather than pushing hard and pushing-through-pain, members may be more apt to adhere to injury-prevention behaviours. However, as shown in the next section, injury-prevention behaviours may be most effective when integrated into a group's social identity content by a prototypical member rather than out-group experts.

5.3.2.3 Social threat and injury. Almost all interviewees answered some variation of 'will get injured' when asked what criticisms they heard of CrossFit®. CrossFit® members responded to the social threat regarding injury with social creativity and polarization.

5.3.2.3.1 Social creativity. Social creativity is a response to a social threat that can involve members comparing their in-group to other groups to demonstrate equality or superiority regarding the aspect being criticized (e.g., our injury rate is less than their injury rate; Haslam & Reicher, 2006). When asked to respond to the criticism regarding injury in CrossFit®, some members indicated the injury rate in CrossFit® was acceptable when compared to sports:

> *Any sport has risks, has risk of injury. And, that's really, it's really our personal responsibility to know them and to take care of them…I do not in any way feel like it's CrossFit®'s fault, any more than it's NFL's [National Football League, governing body for American football] fault that people get their like s*** knocked out of them at football games. I mean it sort of is, I mean, inherently dangerous, but I don't know. We, we allowed that because we're obsessed with it, you know, and so, that's just society. I don't know. I don't really understand all the finger-pointing at CrossFit®.* (FM12)

Interviewees indicated the prevalence of injury in CrossFit® was comparable not only to sports, but also to other fitness activities:

> *I know plenty of people who have injured themselves in a [traditional] gym because of improper form, and no one was there to show them how to properly do it…whereas in CrossFit®, you do have that coach that's going to walk around, correct you, and be able to tell you what you did wrong, and to fix it so that you won't get injured.* (FM24)

Some members pointed out that injury could also occur during everyday activities: *"You can hurt your back doing anything. It's not CrossFit® that you can just hurt your back in. You can lift a box that's too heavy."* (FM31)

Other members indicated that their injury experiences in CrossFit® were less severe than injury experiences in prior sport/exercise engagement:

> *When I would run, I would be in a lot more pain, and I would either turn an ankle, or my knee would swell up. I would have all sorts more aches and pains and injuries than I've ever experienced at CrossFit®…I've had one injury in 20 months. Compared to previous injuries that I had doing other forms of exercise, I used to have a lot more.* (MM32)

Some members indicated that the strength they gained via CrossFit® participation made them less susceptible to injuries, as exemplified by MM34: "*I think I've kind of built up my tendons and ligaments and scar tissue, and everything is just to the point where now I'm kind of adapted I guess*." Further, members emphasized the superiority of CrossFit® in that members and trainers were to be admired for their efforts to work through and resolve injury, rather than giving up and ceasing exercise due to injury. MM1 stated "*CrossFit® will find your weakness, so a lot of people, they get their weakness exploited, and they look for the door. It takes a lot of patience to figure out a way around it."*

In these comparisons to out-group members (i.e., those who participate in sports, other fitness/exercise activities, and activities of daily living), CrossFit® members did not perceive themselves to inferior regarding the injury dimension. In some instances CrossFit® members perceived themselves to be superior on this dimension.

5.3.2.3.2 Polarization. Some members responded to the social threat regarding injury by denouncing critics themselves for lacking knowledge of the CrossFit® context. MM42 thought that the perception that CrossFit®'s injury occurrences were more extreme than injury in other physical activity contexts was due to the publicity of extreme examples:

> *It's the availability bias right? You hear people talk about, "Well I did CrossFit for a week, but then I injured my back, and then I injured it twice more in that same month, so I quit CrossFit. Those stories stick with you…People that join CrossFit and don't have any issues probably don't talk daily about the fact that they don't have any injury issues, so it's easy to recall instances where you heard about someone getting injured or you saw someone getting injured. Standing in a class of six people and witnessing an injury means there were five other people that weren't injured.* (MM42)

MT1, too, thought the perception that CrossFit® has a high risk of injury was based on extreme examples, such as an incident in which a member (i.e., Kevin Ogar) of a CrossFit® gym, not Gym 1, became paralyzed during a CrossFit® session. The injury occurred when the member dropped a bar. The bar landed on some plates that were lying on the floor, and bounced back and hit the member's spine. The injury was due to safety of having weights lying around, not to the practice of Olympic weightlifting movements. In these ways, members negate critics by suggesting criticisms are based on incomplete and biased information.

Regardless of whether injury occurrence is higher or lower, or more extreme, in CrossFit® than in other physical activity contexts, some CrossFit® members indicated that the benefits of CrossFit® outweighed the injury risks. MM1 was overweight and had not adhered to any physical activity consistently before starting CrossFit®. CrossFit® membership enabled him to adhere consistently so that he lost weight and was healthy. He

ended up having a sore shoulder for 10 months, which was aggravated during CrossFit® workouts, but he weighed the sore shoulder against the benefits of CrossFit®: *It [CrossFit®]'s where I keep aggravating it, but…if I wasn't doing it, I don't know what I'd be doing.* MM32's experience was similar. He'd tried so many other exercise/sport programs, but nothing got him to steadily adhere. Therefore, though he tweaked his back whilst a member of CrossFit®, CrossFit® membership was still worthwhile to him. As MM34 said, "*If this is what I need to do to get in shape and be the best person that I can be, more power to me. I'll work out my way. You work out your way*". Thus, members denounce critics of CrossFit® who demonize CrossFit® without weighing the health and fitness benefits of exercise adherence against injury risks.

FM31's critic was her boyfriend. "*He's very worried about me doing it…he's afraid I'm going to hurt my back*." Due to his disapproval, "*I don't really talk about it with him, because I know he's worried about me, so we don't really bring it up, because if we do bring it up, I don't really want to have an argument about it.*" However, FM31 said, "*He's never tried it [CrossFit®]*." FM2 was resistant to disapproval from those who had no actual, personal experience with CrossFit®. When FM2 learned from a friend that students in an exercise science program at a university were being taught that CrossFit® was "*bad*", she expressed the opinion that "*you need to try it before you say anything else… you don't know what you're talking about…it's like trying to talk about cake when you've never tried cake.*" Likewise, MM36 believed people who do not participate in CrossFit® are not familiar with the actual context; they "*make it sound like we do one-rep maxes 20 times…They don't know about scaling*." As shown by FM31, FM2, and MM36, critics who were perceived as lacking exposure to actual CrossFit® workouts or members were not perceived as credible. In this way, recommendations from out-group critics may not be given credence by in-group members.

When critics have exposure to actual CrossFit® members, they may gain knowledge that counters stereotype-based criticisms. In doing so, their perceptions of CrossFit® membership may be swayed, as demonstrated by MM44. When suffering from a pain subsequent to CrossFit® workouts, MM44 described interactions with two physical therapists who indicated disapproval of his CrossFit® membership. One told him, "*You're going to hurt yourself. You're going to mess your shoulder up. I'd never let my kids do it*". After interacting with him, though, their perception appeared to change. They then told MM44, "*You seem like the kind of guy who's going to take care of yourself...if it hurts, stop. If you feel yourself going too far, take a break, but as long as you do exercises… and rehab your shoulder on your own, you'll be fine*". His description of this incident indicates that when

medical professionals who disapproved of CrossFit® activities were exposed to an actual CrossFit® member, they appraised membership as being "*fine*" for him rather than applying the broad stroke that it is "bad" for all members. Of note, members emphasized that CrossFit® gyms differ on many facets (e.g., trainer attentiveness/experience, programming of workouts, members' ability level). Criticisms of CrossFit®, or of high-intensity exercise training, in general were discounted by CrossFit® members when not perceived as applicable to their specific CrossFit® context.

Though members were aware of criticism regarding injury in CrossFit®, none of the interviewees felt this criticism warranted cessation of CrossFit® membership. Altogether, members' responses to social threats demonstrated their perception that criticisms were based on social stereotypes. Social stereotypes are beliefs that out-group members have about another group, often formed without knowledge of and interaction with group members themselves (Hogg & Reid, 2006). Social stereotyping can engender polarization, such that in-group members are likely to become more ensconced in their beliefs. Rather than being moved to agree with critics, members react to social threats to their group identity with an increased social identification with the group, a decreased desire to leave the group, and an increased antipathy toward the out-group (Brown & Ross, 1982). This is illustrated by the results of a study in which a non-Welsh English speaker told Welsh participants that the Welsh language is a dying language (Bourhis & Giles, 1977). In response, the accents of some of the Welsh participants became more noticeable, and some Welsh participants switched to speaking Welsh instead of English. Applied to CrossFit®, out-group critics who are derogatory of CrossFit® as a mode of exercise are likely to be ineffective in inducing CrossFit® members to cease participation or modify behaviours. Members are more apt to resist rather than comply with recommendations from out-group critics. For this reason, efforts to enact injury-prevention recommendations in CrossFit® contexts may be more effective when presented to group members by prototypical in-group members who are able to influence group members' beliefs and behaviours (Haslam et al., 2011; Hogg & Reid, 2006).

5.4 Summary and Conclusion

The purpose of this study was to explore relationships between social identity theoretical constructs and overuse injury pain in CrossFit® contexts, whilst ensuring the experiences of CrossFit® members themselves were taken into account. Therefore, members' perceptions of pain and injury in the CrossFit® context were explored via categorical analysis as well as theoretical analysis.

Members' endorsement of various elements in the CrossFit® context indicates that the elements were important and meaningful reasons for identifying with the group. Elements

included attendance, as members indicated their adherence to physical activity was higher when engaging in CrossFit® programs than other exercise programs. High attendance also enabled members who were not the most successful performers to gain in-group status. Members also expressed affinity for the high intensity of CrossFit® workouts which yielded desired performance and appearance improvements that members had been unable to achieve in other exercise programs. Camaraderie was another element pinpointed as a reason for identification with this group.

However, the very features of the CrossFit® context that make group membership palatable may be the ones that make it a petri dish for overuse injury. Members' frequent engagement in CrossFit® workouts meant they were more apt to meet recommendations of physical activity guidelines, yet the combination of frequent attendance with high intensity is a key ingredient of overuse injury (Wilder & Sethi, 2004). Improvements in appearance and performance were deemed desirable. However, attempts to gain these benefits too rapidly, particularly for those with prior low physical activity engagement, could make members more susceptible to overuse injury (Launay, 2015). The word "encouragement" has a positive glow associated with it, contributing to camaraderie in this CrossFit® context. However in physical activity contexts, encouragement may also very well have negative connotations, given it can induce members to engage in high effort, or effort-despite-pain, thus inducing overuse injury occurrence and severity (Chitwood et al., 1997; Moffatt et al., 1994).

The major contribution of this study was that it provided empirical support for the proposition that the social identity approach is applicable to study of overuse injury. The tendency of members to engage in high effort, to maintain effort despite pain, and to resist recommendations of exercise experts are known contributors to overuse injury, but it was not fully understood why physical activity participants have these tendencies (Hughes & Coakley, 1990; Williams & Andersen, 2007). These tendencies were explained in this study via mechanisms (e.g., pain reports, publicity, social creativity, polarization) based on social identity group membership. In essence, the self-esteem enhancements derived from group membership are the reasons CrossFit® members seek and maintain CrossFit® membership, yet in pursuit of self-esteem, members may inadvertently induce overuse injury.

CHAPTER 6

Discussion

The intent of this chapter is to synthesize the findings of the studies in this thesis in relation to the stated purposes of the thesis. Presented here are implications regarding theoretical, methodological, and practical aspects. Then a review of limitations is coupled with recommendations for future directions to remedy the limitations.

6.1 Theoretical Implications

One stated purpose of this thesis was to identify theory-based psychological factors related to overuse injury occurrence and severity. The underlying causal mechanism of overuse injury occurrence involves the choice to use high effort during physical activity (Roos et al., 2015; Wilder & Sethi, 2004). After onset, the choice to maintain effort, rather than reduce effort, is the causal mechanism for increasing severity of overuse injury.

Conformity to sport ethic has been proposed to explain the willingness of athletes to engage in the effort-despite-pain behaviours that increase injury severity (Hughes & Coakley, 1990). It may be understandable for professional athletes, or collegiate athletes in receipt of scholarships, to engage in these behaviours given their livelihood is contingent on doing so (Turner, Barlow, & Ilbery, 2002). Yet reviews of injury literature highlighted the lack of knowledge of why individuals who are not elite athletes engage in the high-effort and effort-despite-pain behaviours that contribute to overuse injury in physical activity contexts (Johnson, Tranaeus, & Ivarsson, 2014; Williams & Andersen, 2007).

Within this thesis, it was proposed that the theoretical framework of the social identity approach could be applied to the study of overuse injury to elucidate the psychological factors underlying overuse injury. Physical activity participants may not earn a paycheck based on success in physical activity endeavors, but the gains in self-esteem derived from group membership may be worth the risk of overuse injury.

Cumulatively, the three studies within this thesis revealed a possible progression of overuse injury after onset. Social identification could be the initial psychological factor to consider in decisions to reduce or maintain effort upon onset of overuse injury pain. Hikers and CrossFit® members who did not consider the social identity group to be of high personal importance did not seem inclined to maintain effort despite pain. A highly-identified member could next assess the social identity content. If the social identity content emphasized involve goal acquisition, the member may opt to maintain effort despite pain. If effort-related behaviours are perceived to be impressive to other group members, the member may opt to maintain effort in order to gain in-group status. However, members can only do so if they have sufficient mental toughness. The member may continue maintaining effort until the pain level rises, forcing a re-assessment. Or the member may continue maintaining effort until functional impairment occurs, such that the member has no choice but to reduce engagement

in the physical activity. Members who wait until increases in pain levels or functional impairment force them to reduce effort are more susceptible to higher severity of overuse injury and longer healing times (Wilder & Sethi, 2004).

The proposal was supported in that some, though not all, social identity constructs were found to be related to both overuse injury occurrence and severity. For hikers, quantitative measures of social identification were related to both onset and severity. For both hikers and CrossFit® members, various social identity content were related to high effort, as well as injury onset and severity. Table 6.1 presents a summary of findings regarding social identity content across the three studies.

Table 6.1

Summary of Social Identity Content Derived from Three Studies

	High Effort	Overuse Injury		Behavioral Intentions	Hikers	CrossFit® Members
		Onset	Severity			
Contributing Factors						
Attendance	x					x
Being Mentally Tough		x				
Camaraderie	x				x	x
Enjoyment (of challenge, high intensity)	x				x	x
Goal / Results	x	x		x	x	x
Morality	x		x	x	x	
Not Whining / Stoicism			x	x	x	x
Relational (Men)		x			x	
Protective Factors						
Being Intelligent	x				x	
Being Sensible / Practical	x		x	x	x	
Enjoyment (of experience)		x			x	
Non-conformity	x				x	
Self-compassion	x				x	

Note. The findings reflect both qualitative and quantitative results. Behavioural intentions refer to intentions to maintain effort despite overuse injury pain. Morality refers to association of high effort with right or good, and associating low effort with wrong or bad.

Both hikers and CrossFit® members perceived goal-related social identity content to be important, be it completion of a 2,000-mile hike, lifting more weight, or losing body weight. The application of social identity approach in physical activity contexts could enhance the understanding of goals in the extant literature, as well as the relation of goal social identity content to injury. The simple act of setting an identity-related goal enables a person to be perceived favorably (Gollwitzer, Sheeran, Michalski, & Seifert, 2009). In the

contexts of social identity groups, the desire for favorable perceptions of group members increases the importance of achieving the goals. When people set goals, and encounter setbacks to the goals, they are apt to increase effort in order to obtain the goal (Heckhausen & Schulz, 1995). When the setback consists of low-level overuse injury pain, the member's response of increasing effort may increase severity of the injury. CrossFit® members added a nuanced understanding of this relationship in that they appeared to increase effort intensity, or rest less, when they were close to achieving a goal. Thus, it may be that the time near the point of goal acquisition is when social identity group members are particularly vulnerable to overuse injury pain.

When people encounter setbacks to goal acquisition, they tend to demonstrate stress symptoms (e.g., higher cortisol release; Wrosch, Miller, Scheier, & Brun de Pontet, 2007). Social identity may enhance understanding of this stress response because setbacks to goal acquisition could result in loss of group membership and in-group status which can be stressful to highly-identified group members (Haslam & Reicher, 2006). In social identity groups in physical activity contexts, the increased physical effort associated with desire for achievement of identity-related goals could lead to positive evaluations by in-group members but also lead to overuse injury.

In lieu of being able to accomplish a goal, group members can obtain positive evaluations if their behaviours are aligned with other social identity content. The social identity content of these hiking and CrossFit® groups suggest that members do not have to accomplish the goals, or be the best performers, or possess the abilities of elite athletes to be perceived positively. The participants revealed that they can be new to the activity, have low fitness, or possess little ability or experience, but as long as they engage in high effort and do not whine, they can obtain the approval and social support of group members. This finding parallels that of members of a theatre group, showing it is similar for members of physical activity groups (Levine, Prosser, Evans, & Reicher, 2005).

Hierarchical self-categorization further enhanced opportunities for members of both the hiking and CrossFit® social identity groups to obtain in-group status. Rather than being a mere member, they were able to be a member of good standing by, for example, encouraging others. This enacted the camaraderie social identity content, yet also may contribute to other members' overuse injury experience if members respond to verbal encouragement by increasing effort (Moffatt, Chitwood, & Biggerstaff, 1994). Members perceived themselves as able to gain higher status if, for example, they did not whine when they felt low-level overuse injury pain. Overall, the pursuit of self-esteem derived from group membership appeared to be part of the reason underlying group members' attempts to align their

behaviours with social identity content. This also may explain in part why sub-elite participants in physical activities engage in the behaviours that put them at risk for overuse injury.

The findings also supported the role of mental toughness within the theoretical framework of social identity. Mental toughness had been associated with increases in effort to cope with stressors, and effort-despite-pain behaviours (Arthur, Fitzwater, Hardy, Beattie, & Bell, 2015; Kaiseler, Polman & Nicholls, 2009). In the first study, mental toughness was directly related to overuse injury occurrence. High effort may be a default behaviour for some hikers high in mental toughness, but high mental toughness alone would not appear to be a sufficient condition for invoking effort-despite-pain behaviours. Findings from the second study revealed that high social identification may be the impetus that motivates hikers with high mental toughness to engage in effort-despite pain behaviours, thereby incurring more severe overuse injury pain. The latter finding demonstrates an advantage of the current study, in that it addressed the different mechanisms behind overuse injury occurrence and overuse injury severity as recommended by injury researchers (Williams & Andersen, 2007).

Though the intent of this line of research was to identify psychological factors related to overuse injury, an advantage of employing a theoretical application to the study of overuse injury is that it additionally shed light upon the mechanisms underlying the psychological factors. As shown by CrossFit® members, membership in social groups can affect how pain is reported. Prior literature documented the phenomenon of reluctance to verbalize concern about low-level pain in physical activity contexts (Almeida et al., 2012; Crocket, 2014; Ekenman, Hassmen, Koivula, Rolf, & Fellander-Tsai, 2001; Martin Ginis & Leary; 2004; Tranaeus, Johnson, Engstrom, Skillgate, & Werner, 2014). Again, this reluctance is understandable for elite athletes, afraid to lose starting positions or income (Turner et al., 2002). The findings in this thesis extends this by showing that the reluctance of non-elites can be based upon fears of losing group membership or fears of reducing in-group status. Publicity was another mechanism that appeared to be involved in the process of selection of effort. Being viewed or evaluated by others is referred to as publicity (Leary & Kowalski, 1990). Numerous studies have shown that people in sport/exercise contexts tend to exert more effort when their behaviours are public (e.g., Rhea, Landers, Alvar, & Arent, 2003; Worringham & Messick, 1983). The current study replicated this finding and extended it by explaining that the increase in effort may due to an attempt to increase in-group status. Also, the current study revealed that the response of increased effort in public conditions may be contingent upon the nature of the viewer. If the viewer was an in-group member, hikers and

CrossFit® members appeared more apt to increase effort, particularly if the in-group member was a trainer, representing a prototypical member.

As noted, a strength of this thesis is that it adhered to the recommendations of researchers in seeking theory-based psychological factors underlying injury rather than emitting miscellaneous factors (McGlashan & Finch, 2010). In this thesis, the theoretical framework of the social identity approach was chosen, in part, because it had been identified by other researchers as a potential basis for explaining various aspects of injury (Levine & Reicher, 1996; Rees, Haslam, Coffee, & Lavallee, 2015). It can be argued that using a theoretical lens to interpret results has utility in uniting many disparate variables to focus on underlying reasons for behaviours. However, the very lens used to examine an item closely can also limit peripheral vision. Indeed, the social identity approach could yield overly-simplistic interpretations of group membership, failing to account for complex behavioural and individual differences. Next, three examples—salience, individual differences, and discrimination—are used to demonstrate potential weaknesses of applying these theories in physical activity contexts.

Within self-categorization theory, it is acknowledged that one person may possess numerous social identities, and situational factors tend to influence which social identity has prominence, or salience (Levine & Reicher, 1996). The shifting salience may affect behaviours. Consider this example: An individual may have two social identities: a CrossFit® member and a parent. In a situation in which a CrossFit® member is surrounded by other members of a CrossFit® social identity group, a group member may be expected to engage in a certain set of behaviours deemed appropriate in that situation, some of which may result in overuse injury. Yet in that moment, if individuals who are parents consider how injury will affect their ability to provide for their children, the behaviours stemming from the parental social identity may take precedence, though the situational factors would predict otherwise. Study of behaviours stemming from group membership may be inhibited in its ability to account for the multiple social identities, and the fluctuating saliences. That is, when using a social identity theoretical lens to explain behaviours, behaviours could be incorrectly attributed to the social identity group present in the situation rather than another that might have precedence with individuals.

Another possible limitation of this theory pertains to individual differences. Two group members, both high in social identification, and both perceiving the group's social identity content similarly, may behave quite differently. If applying a social identity theoretical lens, the analysis may fail to consider the personal values or abilities that interact with social identity constructs to yield behaviours. The findings in this thesis related to the

dispositional measure of mental toughness illustrate this. As a moderator, this one, individual difference appeared to impact outcomes stemming from social identification. Other individual differences could likewise impact behaviours stemming from social identity constructs such that behaviours are not as predictably explained for group members as may be desired from a theory. Thus, the tenets of social identity approach may result in an over-reliance on social and situation factors without accounting for the effects of dispositional factors.

Finally, it may be that application of the social identity approach is hindered somewhat in that inter-group differences, and intra-group similarities, can be exaggerated. For example, a tenet of social identity theory is that in-group members will favor in-group members whilst discriminating against out-group members (Levine, Prosser, Evans, & Reicher, 2005; Livinston & Haslam, 2008). This discrimination is expected to occur because it enables an in-group member to feel self-esteem based on perceptions of being the member of a group that is superior to another group. Whilst this tenet has support in social identity groups regarding nationality and team sports, this aspect of social identity theory may not be supported in some physical activity contexts. For example, a person who participates in CrossFit® may not discriminate against or belittle in any fashion people who participate in other fitness programs or exercise activities. It may be that the effects of in-group biases and out-group discrimination purported by the social identity approach will not be supported in physical activity contexts.

This thesis provided some evidence that the social identity approach has explanatory power in the study of overuse injury in physical activity contexts, but it is acknowledged that other theoretical approaches and constructs may also effectively address aspects of overuse injury (e.g., action-theory based approach, obsessive passion; Blanka Rip, Fortin, & Vallerand, 2006; Johnson et al., 2014). Additionally, some equivocal results within this thesis require further research for clarification to determine whether social identity constructs underlie behaviours related to overuse injury. Indeed, assessment of support for this proposition may have been obstructed by methodological limitations. As these studies are amongst the first to apply the social identity approach to physical activity contexts, results may have been impacted by the novel methods and measures. Methodological considerations are addressed in the next section.

6.2 Methodological Implications

The second stated purpose of this thesis was to develop the methods and measures needed to identify individuals with susceptibility to overuse injury occurrence and severity. The method developed in this thesis to identify overuse injury occurrence met the needs

outlined by injury researchers, in that the method enabled researchers to examine overuse injury separate from acute injury, and the method did not rely on time-loss and medical assistance inclusion criteria, nor on objective reports (Clarsen, Myklebust, & Bahr, 2013; Roos et al., 2015; Yang et al., 2012). The purpose of the method was to ensure that participants in the early stages of overuse injury were not excluded from study. The number of participants identified to be in the early stages in the second study demonstrated the method's effectiveness in meeting this objective.

Additionally, the studies treated occurrence and severity as two separate phenomena, being they stem from different behaviours (i.e., high effort, and effort-despite-pain, respectively). The need for this was confirmed in this study because the psychological factors which contributed to occurrence differed somewhat from those that contributed to severity. This is illustrated in Table 6.1 in which different social identity content influenced occurrence and severity.

Methodology was also enhanced because multiple measures for assessing severity were employed, including the conventional measure involving time loss. Typically, time loss is employed as a measure of injury severity (i.e., the more days a person takes off due to injury, the more severe the injury is). In the second study, measures of other severity outcomes were used (e.g., functional limitation, pain level, performance decrement). They corresponded highly with the time-loss measure yet it was found that different psychological measures contributed to the different outcomes, allowing a more nuanced understanding of overuse injury severity. For example, if only the time loss measure had been used, the only knowledge gained would be that social identification, moderated by mental toughness, influenced severity. By using the additional functional limitation measure, it is now known that two psychological factors (i.e., behavioural intentions to reduce effort, social identity content emphasizing being sensible) are factors which differentiated hikers who incurred functional limitation from those who did not.

The current thesis drew upon the strengths of both qualitative and quantitative methods. The use of qualitative methods enabled the identification of psychological factors with possible relevance to overuse injury; the use of quantitative methods enabled further confirmation (Morgan, 2007). For example, qualitative analysis of responses regarding a real-world situation encountered by participants to choose higher or lower effort yielded the information that hikers who selected the lower effort valued being sensible. When 'being sensible' was incorporated as a social identity measure in the second study, hikers who did not incur functional limitation rated this social identity content item significantly higher than hikers who did incur functional limitation. In this way, the combination of qualitative and

quantitative methods provided evidence that the social identity content of being sensible may be a protective factor for overuse injury. Similarly, pursuant to qualitative analysis, both hikers and CrossFit® members emphasized that not whining was an important norm, or social identity content, for their social identity groups. When measured quantitatively, it was found the item significantly predicted overuse injury severity and was associated with intentions to reduce effort when pain was felt.

The means of analyzing the qualitative data was also advantageous (i.e., the variable-oriented approach; Long, Readdy, & Raabe, 2013; Miles, Huberman, & Saldana, 2014) as exemplified by the results pertaining to social threats. The first round of coding yielded categorizations of data pertaining to criticisms CrossFit® members had heard about CrossFit® programs (e.g., females will get bulky; price; injury; cult-like; see Table Q4). But the second round of coding, analyzed through the theoretical lens, revealed information pertaining to social threats and polarization which, as shown below, have important practical implications. Of note, qualitative analysis in both the first study and the third study revealed three of the same social identity constructs were relevant in overuse injury processes for hikers and for CrossFit® members (i.e., in-group status, social creativity, social identity content). Altogether, this variable-oriented approach to analyzing qualitative data enabled identification of theory-based psychological factors rather than a list of miscellaneous variables. Incorporating the former into injury-prevention interventions is believed to enhance the success of injury-prevention interventions (McGlashan & Finch, 2010).

The use of mixed methods also contributed to the development of the Test of Intentions to Reduce Effort (TIRE). In the first study, hikers described their experiences with overuse injury pain, including what behaviours they enacted when they felt the low-level onset pain. These behaviours were then incorporated into the quantitative measure, such that before their attempts to hike the Appalachian Trail, hikers in the second study could indicate which behaviours they intended to enact should they feel overuse injury pain. The value of this measure was revealed in that the pre-hike scores significantly predicted severity of overuse injury that occurred during the hikes. Scores on measures of social identity content were also found to correlate with scores of the TIRE, confirming research in other domains that social identity content influences behavioural intentions (e.g., Livingstone & Haslam, 2008). To my knowledge, this is the first time the study of social identity constructs has been examined in relation to intentions in the physical activity domain.

Though a few qualitative studies have led the application of social identity to sport/exercise contexts (e.g., Barker, Evans, Coffee, Slater, & McCarthy, 2014; Fransen et al., 2015), the quantitative measures of social identification and social identity content have rarely

if at all been used in physical activity contexts, so the current thesis allowed for exploration of their utility (Rees, Haslam, Coffee, & Lavallee, 2015). In the first and second studies, the multi-dimensional measure of social identification enabled detection of relationships with overuse injury occurrence and severity. The uni-dimensional measures did not, suggesting that the multi-dimensional one may be best suited for study of impacts of social identification on overuse injury. Likewise, multiple measures of mental toughness were used; scores on all three (i.e., multi-dimensional, uni-dimensional, and single-item) were significant related to overuse injury and high effort, so the more parsimonious ones may be suitable for study of overuse injury. Only two social identity content related to sport were identified in past research (Barker et al., 2014), so the current study aided in identification of numerous social identity content relevant to hikers and CrossFit® members. In addition to these methodological implications, the current thesis also yielded practical implications, as summarized next.

6.3 Practical Implications

The primary purpose of this thesis was to explore theoretical and methodological aspects of overuse injury. As an initial study in this area, there is much caution in attempting to prematurely translate the findings of this thesis into practical applications. Nevertheless, the findings do hint of some future practical implications. If the findings of this thesis are supported by future research, it is envisioned that the practical implications of the findings in this thesis can be considered on the intrapersonal, interpersonal, and cultural levels.
On the intra-personal level, it may be that awareness of the psychological risk factors of overuse injury occurrence and severity would enhance the ability of hikers and CrossFit® members to monitor their own injury-related behaviours stemming from these factors. A knowledge-level intervention may be used to prompt hikers and CrossFit® members to consider their own susceptibility. For example, those who consider their respective group memberships to be of utmost importance, who consider themselves to be high in mental toughness, who highly endorse some of the social identity content items labeled as "contributing factors" in Table 6.1, or score high on the TIRE, should it be validated, may recognize their own susceptibility to overuse injury. Upon learning the significance of these risk factors, they may be more apt to enact injury-prevention behaviours.

The findings of this thesis yielded special consideration of who would be most appropriate at implementing injury-prevention interventions specific to the culture of the context. The results pertaining to social threats and polarization also imply additional considerations in development of injury-prevention interventions. If the interventions were enacted by an out-group member (e.g., researcher; exercise physiology professor), the

interventions may fail given the resistance of highly-identified group members to criticisms and input of out-group members perceived to be less familiar with the group's beliefs and members, or cultural norms, per se (Bourhis & Giles, 1977; Spears, Doosje, & Ellemers, 1997). Though interventions to reduce overuse injury may be constructed by sport/exercise experts, the effectiveness of the interventions may be reduced if the researchers are perceived to be the ones who are implementing the interventions. Likewise, per the social identity approach, a group leader, defined as the designated person in charge (e.g., coach, supervisor, boss), is not necessarily the most effective at influencing group members' behaviours (for review, see Haslam et al., 2011). In social identity groups, prototypical members can be most effective at influencing group members' beliefs, norms, and behaviours (Hogg & Reid, 2006). Therefore, injury-prevention interventions may be most effective when implemented in part by these high-status in-group members. As a caveat, though, interventions which are dependent on collection of pain and injury reports might be more successful and accurate when the collection is made by researchers. As shown in this thesis, group members may not be forthright about low-level pain with group leaders, or medical professionals perceived to give input to group leaders, when a valued group membership or in-group status is at stake.

The findings of this thesis can inform the design of injury-prevention interventions for hikers and CrossFit® members. Measures of social identification, mental toughness, and the TIRE, could be administered to group members. High scores on the components considered to be contributing factors to overuse injury occurrence and severity could then be used to identify group members who are more susceptible to overuse injury, and injury-prevention interventions could be aimed at these susceptible individuals.

The advantage of identifying a full range of social identity content in Table 6.1 becomes clear in terms of designs of interventions on the cultural level. Interventions could be designed such that social identity content designated as contributing factors are de-emphasized, whilst social identity content items designated as protective factors are emphasized, in essence changing the cultural norms of the group. Prototypical members can be involved in the origination and embedding of social identity content in social identity groups (Fransen et al., 2015; Haslam, Reicher, & Platow, 2011; Rees et al., 2015). Therefore, interventions may be designed such that prototypical members are involved in modifying social identity content from those associated with overuse injury (e.g., goal) to those not (e.g., being sensible). Prototypical members can also convey cultural norms by exemplifying injury-reduction behaviours stemming from the social identity content. For example, they could broadcast when they are resting due to an overuse injury symptom, uttering statements to the effect that they would rather be sensible than sorry.

The results pertaining to goal social identity content had additional ramifications for practitioners. Given the emphasis of both AT hikers and CrossFit® members on goals related to performance, appearance, and improvement of both, members may need assistance to determine when to adjust or give up goals (Brandstatter, Herrmann, & Schuler, 2013).

Other contributing factors to overuse injury identified in this thesis may be modifiable in physical activity contexts on the inter-personal level. For example, prototypical members could educate other members about the potential pitfalls of encouragement that emphasizes high effort (e.g., "Keep going!"). Prototypical members can teach and exemplify replacement encouragement cues (e.g., "Keep good form! Be smart!"). Prototypical members could also discourage group members from deriding group members who opt to engage in lower-effort behaviours, reminding members that the selection of lower effort may be needed to prevent overuse injury. Given the findings regarding pain reports, prototypical members may more be able to obtain more accurate pain reports, particularly of low-level overuse injury, by directly soliciting them and by expressing reports of their own pains. These actions are aimed to reduce members' fears of being perceived negatively if they report low-level pain. By doing so, those in the early stages of overuse injury could be identified more quickly so that restorative actions (e.g., rest, reduce effort) may be directed, thereby preventing injuries from becoming more severe.

Whilst the practical implications demonstrate the potential for this line of research, limitations should be considered.

6.4 Limitations and Future Directions

Many of the limitations of this thesis are inherent to any new line of research. Given the novelty of social identity applications to physical activity contexts, and of examining psychological factors specific to overuse injury, much research is needed before the interventions alluded to above could be enacted.

The method of identifying overuse injury occurrence was valuable given it met the recommendations of injury researchers, but it has the aforementioned drawbacks of not being based upon objective data (e.g., medical diagnosis). In the first study, the method was insufficient to allow coding of 9.1% of the participants' pain descriptions as having incurred overuse injury or not. After refinement, 4.7% of pain descriptions of participants in the second study were insufficient for the purpose of coding. Therefore, the method was improved, but further refinement is needed. Additionally, the method of coding injury data prescribed in the protocol is time-intensive for raters, but the advantage is that, with training, a rater can conduct coding even if the rater's background is not in injury or physiology.

Regarding the TIRE, initial steps towards its validation (i.e., factorial, construct, predictive validity) were taken within this thesis, but additional validation and reliability tests are needed (e.g., confirmatory factor analysis, test-retest reliability). Future testing of the TIRE includes correspondence of the behavioural intentions with actual effort-related behaviours. Future research efforts could also be made to make the TIRE applicable to all physical activity contexts rather than specific to behavioural intentions in the hiking context. The measure of functional limitation, intended to assess overuse injury severity outcomes other than time-loss, is also a newly-constructed measure, requiring further assessment of its validity and reliability. Future renditions could assess all four stages of overuse injury (Launay, 2015).

The cross-sectional, retrospective nature of the first study is a limitation to its interpretation, but it was appropriate for the exploratory purposes of this thesis regarding overuse injury occurrence. The grossly unequal group sizes of participants in the second study (i.e., 85% incurred overuse injury; 15% did not) precluded a prospective study of occurrence so a prospective study of overuse injury occurrence would strengthen these findings. The prospective nature of the second study aided assessment of causal links of the psychological factors with overuse injury severity outcomes, but experimental manipulations would further solidify the causal link.

Scores on the measures of social identity constructs and mental toughness in the first two studies were high, as expected in a social identity group whose members intend to hike a 2,000-mile trail. The lack of variance in participants' responses on these measures may have obstructed detection of stronger relationships with overuse injury severity outcomes, as most effect sizes were small to medium (i.e., restricted range effect; Goodwin & Leech, 2006). Studies in groups with more variance on these measures would determine if these findings are generalizable. Yet the results are not to be discounted for their small effect sizes. Psychological factors that can be linked to a full array of overuse injury types (e.g., stress fractures, tendonitis) despite the variety of causes and risk factors is considered meaningful in injury-prevention research (McGlashan & Finch, 2010).

The findings regarding social identity content reflected the complexity of values, norms and beliefs in social identity groups, as members of the same social identity groups can emphasize different ones, resulting in different behaviours and outcomes. This suggests the need to identify social identity content specific to different physical activity contexts. Further testing is needed to determine if the social identity content are associated with actual effort-related behaviours (e.g., alterations of pace and mileage, time on task). The social identity content deemed to be protective factors for potential to prevent overuse injury (Table 6.1) may

be important in injury-prevention interventions. Further testing of their impact on overuse injury outcomes is recommended via quantitative methods. Additionally, experimental manipulations of social identity content are needed to determine how social identity content can best be modified in physical activity contexts, and to ascertain their causal link with overuse injury outcomes.

Though there are limitations to the studies within this thesis, the thesis has served its purpose as a pioneer in this area of research. The thesis adds to the extant literature by identifying theory-based, psychological factors specific to overuse injury pain in physical activity contexts. Given previous research primarily focused on acute injury, exploratory methods were used to elucidate factors unique to the pain experience and causal mechanisms that differentiate overuse injury from acute. The exploratory objective was enhanced by a mixed-method approach, large sample sizes, and study of unique populations perceived to have high injury rates (i.e., hikers, CrossFit® members). The studies herein are amongst the first to apply social identity and self-categorization theories to the domain of sport and exercise psychology, thereby contributing to the development of appropriate measures.

6.5 Concluding Remarks

This research program was motivated by my personal experiences with overuse injury. I had witnessed the struggles of teammates, trainees in military and law enforcement environments, and Appalachian Trail hikers with overuse injury. I watched many of them lose their dreams of success in these various contexts due to this insidious form of injury. When I launched this research program, I was surprised to learn that the psychological factors specific to overuse injury were fairly unknown. However, I was also heartened when I learned of the social identity approach and its potential for explaining the underlying mechanisms of overuse injury. As I became more acquainted with the theory, I recognized its value not only in explaining aspects of overuse injury, but in explaining many behaviours in physical activity contexts. It appeared that the pursuit of self-esteem from membership in social groups could be a culprit in the processes underlying overuse injury occurrence and severity.

Within this thesis, important steps were taken to aid the study of overuse injury psychological factors, and study of the applicability of the social identity approach to physical activity contexts. A method was developed and refined for identifying those with overuse injury pain, ensuring inclusion of those in the early stages of overuse injury. The thesis included initial efforts to validate a measure to identify those with susceptibility to higher overuse injury severity. Social identification and mental toughness were found to be potential indicators of susceptibility, and various social identity content were found to be potential

candidates for modification in future interventions. Importantly, the factors' relationships to aspects of overuse injury could be explained via theoretical constructs. These theory-based explanations may enable the findings to be generalizable to members of social groups in other physical activity contexts. As with any relatively new line of research, the first steps were vital, providing a solid foundation for future research. Ultimately, this thesis may inform the design of interventions to prevent the occurrence of overuse injury, reduce the severity of overuse injury, and decrease the number of dreams obstructed by overuse injury.

REFERENCES

Almeida, S. A., Trone, D. W., Leone, D. M., Shaffer, R. A., Patheal, S. L., & Long, K. (1999). Gender differences in musculoskeletal injury rates: A function of symptom reporting? *Medicine & Science in Sports & Exercise, 31*(12), 1807-1812.

American College of Sports Medicine (2014). *ACSM's guidelines for exercise testing and prescription*. Philadelphia, PA: Wolter Kluwere/Lippincott, Williams & Wilkins.

Appalachian Trail Conservancy. 2,000 milers. Retrieved from http://www.appalachiantrail.org/about-the-trail/2000-milers on 8/3/15.

Arthur, C. A., Fitzwater, J., Hardy, L., Beattie, S., & Bell, J. (2015). Development and validation of a Military Training Mental Toughness Inventory. *Military Psychology, 27*(4), 232-241. doi: 10.1037/mil0000074

Ajzen, I. (2002). Constructing a theory of planned behavior questionnaire: Conceptual and methodological considerations. Retrieved from http://www.people.umass.edu/aizen/pdf/tpb.measurement.pdf

Barker, J. B., Evans, A. L., Coffee, P., Slater, M. J., & McCarthy, P. J. (2014). Consulting on tour: A dual-phase personal-disclosure mutual-sharing intervention and group function in elite youth cricket. *The Sport Psychologist, 28,* 186-197. doi: 10.1123/tsp.2013-0042

Barrett, L. F. (1997). The relationships among momentary emotion experiences, personality descriptions, and retrospective ratings of emotion. *Personality and Social Psychology Bulletin, 23,* 1100-1110. doi: 10.1177/01461672972310010

Bartlett, J. D., Close, G. L., MacLaren, D. P. M., Gregson, W., Drust, B., & Morton, J. P. (2011). High–intensity interval running is perceived to be more enjoyable than moderate-intensity continuous exercise: Implications for exercise adherence. *Journal of Sports Sciences, 29,* 547-553.

Baumeister, R. F., & Tice, D. M. (1990). Anxiety and social exclusion. *Journal of Social and Clinical Psychology, 9*(2), 165-195.

Beattie, T. F., Currie, C. E., Williams, J. M., & Wright, P. (1998). Measures of injury severity in childhood: A critical overview. *Injury Prevention, 4,* 228-231.

Bell, J. J., Hardy, L., & Beattie, S. (2013). Enhancing mental toughness and performance under pressure in elite young cricketers: A 2-year longitudinal intervention. *Sport, Exercise, & Performance Psychology, 2*(4), 281-297. doi: 10.1037/a0033129

Benoit, W. L. (1997). Image repair discourse communication. *Public Relations Review, 23*(2), 177.

Bouleware, D. R. (2004). Gender differences among long-distance backpackers: A prospective study of women Appalachian Trail backpackers. *Wilderness and Environmental Medicine, 15,* 175-180.

Bourhis, R. Y., & Giles, H. (1977). The language of intergroup distinctiveness. In H. Giles (Ed.), *Language, ethnicity and intergroup relations* (pp. 119-135). London: Academic Press.

Brandstetter, V., Herrmann, M., & Schuler, J. (2013). The struggle of giving up personal goals: Affective, physiological, and cognitive consequences of an action crisis. *Personality and Social Psychology Bulletin, 39*(12), 1668-1682. doi: 10.1177/0146167213500151

Brewer, B. W. (1999). Causal attribution dimensions and adjustment to sport injury. *Journal of Personal and Interpersonal Loss, 4,* 215-224.

Brown, R. J., & Ross, G. F. (1982). The battle for acceptance: An investigation into the dynamics of intergroup behaviour. In H. Tajfel (Ed.), *Social identity and intergroup relations* (pp. 15-40). Cambridge, UK: Cambridge University Press.

Bridge, M. W., & Toms, M. R. (2013). The specialising or sampling debate: A retrospective analysis of adolescent sports participation in the UK. *Journal of Sports Sciences, 31,* 87-96.

Bruner, M. W., Bailey, B., & Benson, A. J. (2016). Understanding the influence of organizational culture on exercise adherence: A social identity perspective. *Journal of Sport & Exercise Psychology, 38(Suppl.),* S164.

Bruner, M. W., Dunlop, W. L., & Beauchamp, M. R. (2014). A social identity perspective on group processes in sport and exercise. In M. R. Beauchamp & M. A. Eys (Eds.), *Group dynamics in exercise and sport psychology* (pp. 38-52). Milton Park, Abingdon, Oxon: Routledge.

Bruner, M. W., & Spink, K. S. (2006). Exploring the cohesion/social identity relationship in the physical activity setting. *Journal of Sport & Exercise Psychology, 28(Suppl.),* S40.

Bull, S. J., Shambrook, C. J., James, W., & Brooks, J. E. (2005). Towards an understanding of mental toughness in elite English cricketers. *Journal of Applied Sport Psychology, 17,* 209-227. doi: 10.1080/10413200591010085

Cairns, E. (1982). Intergroup conflict in Northern Ireland. In H. Tajfel (Ed.), *Social identity and intergroup relations* (pp. 277-297). Cambridge, UK: Cambridge University Press.

Callow, N., Hardy, L., Roberts, R., Rogers, C.H., & Woodman, T. (2011). There is an "I" in team: Narcissism and social loafing. *Research Quarterly for Exercise and Sport, 82,* 285-290.

Carter, M. J. (2014). Gender socialization and identity theory. *Social Sciences, 3,* 242-263. doi: 10.3390/socsci3020242

Chan, D. K., & Hagger, M. S. (2012). Theoretical integration and the psychology of sport injury prevention. *Sports Medicine, 42*(9), 725-732.

Chitwood, L. F., Moffatt, R. J., Burke, K., Luchino, P., & Jordan, J. C. (1997). Encouragement during maximal exercise testing of Type A and Type B scorers. *Perceptual and Motor Skills, 84,* 507-512.

Clarsen, B., Myklebus, G., & Bahr, R. (2013). Development and validation of a new method for the registration of overuse injuries in sports injury epidemiology: The Oslo Sports Trauma Research Centre (OSTRC) Overuse Injury Questionnaire. *British Journal of Sports Medicine, 47,* 495-502. doi: 10.1136/bjsports-2012-091524.

Conn, J. M., Annest, J. L., & Gilchrist, J. (2003). Sports and recreation related injury episodes in the US population, 1997–99. *Injury Prevention, 9,* 117–123.

Coulter, T. J., Mallett, C. J., & Gucciardi, D. F. (2010). Understanding mental toughness in Australian soccer: Perceptions of players, parents, and coaches. *Journal of Sports Sciences, 28*(7), 699-716. doi: 10.1080/02640411003734085

Creed, P. A., & Hood, M. (2014). Disengaging from unattainable career goals and reengaging in more achievable ones. *Journal of Career Development, 41*(1), 24-42. doi: 10.1177/0894845312471195

Cresswell, J. W. (2013). *Qualitative inquiry and research design: Choosing among five approaches.* Thousand Oaks, CA: Sage.

Cresswell, J. W., & Miller, D. L. (2000). Determining validity in qualitative inquiry. *Theory into Practice, 39*(3), 124-130.

Crocket, H. 'I'm just going to be silly with this person': Exploring the ethics of humour and irony in ultimate Frisbee. *Qualitative Research in Sport, Exercise and Health,* 1-16. doi: 10.1080/2159676X.2014.981575

CrossFit.com. Affiliate. Retrieved from https://affiliate.crossfit.com/how-to-affiliate on 6/14/17.

CrossFit.com. Affiliate map. Retrieved from https://map.crossfit.com/ on 6/14/17.

Crust, L., & Clough, P. J. (2005). Relationship between mental toughness and physical endurance. *Perceptual and Motor Skills, 100,* 192-194.

Crust, L., Earle, K., Perry, J., Earle, F., Clough, A., & Clough, P. J. (2014). Mental toughness in higher education: Relationships with achievement and progression in first-year university sports students. *Personality and Individual Differences, 69,* 87-91. doi: 10.1016/j.paid.2014.05.016

Crust, L., Swann, C., Allen-Collinson, J., Breckon, J., & Weinberg, R. (2014). A phenomenological exploration of exercise mental toughness: Perceptions of exercise leaders and regular exercisers. *Qualitative Research in Sport, Exercise & Health, 6*(4), 441-461.

Cutcliffe, J. R., & McKenna, H. P. (2004). Expert qualitative researchers and the use of audit trails. *Journal of Advanced Nursing, 45*(2), 126-135.

Dawson, M. C. (2017). CrossFit: Fitness cult or reinventive institution? *International Review for the Sociology of Sport, 52*(3), 361-379. doi: 10.1177/1012690215591793

Diamond, D. (2015, May). Is CrossFit® safe? What 60 Minutes didn't tell you. *Forbes.* Retrieved from https://www.forbes.com/sites/dandiamond/2015/05/11/is-crossfit-good-for-you-what-60-minutes-didnt-say/#3b515ea2508c

DiStefano, C., Zhu, M., & Mindrila, D. (2009). Understanding and using factor scores: Considerations for the applied researcher. *Practical Assessment, Research & Evaluation, 14*(20), 1-11.

Donnelly, P., & Young, K. (1988). The construction and confirmation of identity in sport subcultures. *Sociology of Sport Journal, 5,* 223-240.

Ekenman, I., Hassmen, P., Koivula, N., Rolf, C., & Fellander-Tsai, L. (2001). Stress fractures of the tibia: Can personality traits help us detect the injury-prone athlete? *Scandinavian Journal of Medicine & Science in Sports, 11,* 87-95.

Ekkekakis, P., Parfitt, G., & Petruzzello, S. J. (2011). The pleasure and displeasure people feel when they exercise at different intensities: Decennial update and progress towards a tripartite rationale for exercise intensity prescription. *Sports Medicine, 41*(8), 641-671.

Emerson, R. M., Fretz, R. I., & Shaw, L. L. (2011). *Writing ethnographic field notes*. Chicago, IL: University of Chicago.

Evans, L., & Hardy, L. (1995). Sport injury and grief responses: A review. *Journal of Sport and Exercise Psychology, 17,* 227-245.

Fielding, K. S., McDonald, R., & Louis, W. R. (2008). Theory of planned behaviours, identity, and intentions to engage in environmental activism. *Journal of Environmental Psychology, 28,* 318-326. doi: 10.1016/j.jenvp.2008.03.003

Fransen, K., Haslam, A., Steffens, N. K., Vanbeselaere, N., De Cuyper, B., & Boen, F. (2015). Believing in "us": Exploring leaders' capacity to enhance team confidence and performance by building as sense of shared social identity. *Journal of Experimental Psychology: Applied, 21*(1), 89-100.

Gollwitzer, P. M., Sheeran, P., Michalski, V., & Seifert, A. E. (2009). When intentions go public: Does social reality widen the intention-behavior gap? *Psychological Science, 20*(5), 612-618.

Goodwin, L. D., & Leech, N. L. (2006). Understanding the correlation: Factors that affect the size of *r*. *Journal of Experimental Education, 74*(3), 251-266.

Gucciardi, D. F., & Gordon, S. (2008). Personal construct psychology and the research interview: The example of mental toughness in sport. *Personal Construct Theory & Practice, 5,* 119-130.

Gucciardi, D. F., Hanton, S., Gordon, S., Mallett, C. J., & Temby, P. (2015). The concept of mental toughness: Tests of dimensionality, nomological network, and traitness. *Journal of Personality, 83*(1), 26-44. doi: 10.1111/jopy.12079

Gucciardi, D. F., Jackson, B., Hanton, S., & Reid, M. (2015). Motivational correlates of mentally tough behaviours in tennis. *Journal of Science and Medicine in Sport, 18,* 67-71. doi: 10.1016./j.jsams.2013.11.009

Hagger, M. S., & Chatzisarantis, N. L. D. (2006). Self-identity and the theory of planned behaviours: Between- and within-participants analyses. *British Journal of Social Psychology, 45,* 731-757.

Hardy, C. J., Hall, E. G., & Prestholdt, P. H. (1986). The meditational role of social influence in the perception of exertion. *Journal of Sport Psychology, 8,* 88-104.

Hardy, L., Bell, J., & Beattie, S. (2013). A neuropsychological model of mentally tough behavior. *Journal of Personality, 82*(1), 69-81. doi: 10.1111/jopy.12034

Hardy, J. H., Imose, R. A., & Day, E. A. (2014). Relating trait and domain mental toughness to complex task learning. *Personality and Individual Differences, 68,* 59-64. doi: 10.1016/j.paid.2014.04.011

Haslam, S. A. (2004). Psychology in organizations: The social identity approach. London, UK: Sage.

Haslam, S. A., Jetten, J., & Waghorn, C. (2009). Social identification, stress and citizenship in teams: A five-phase longitudinal study. *Stress and Health, 25,* 21-30. doi: 10.1002/smi.1221

Haslam, S. A., & Reicher, S. (2006). Stressing the group: Social identity and the unfolding dynamics of responses to stress. *Journal of Applied Psychology, 91,* 1037-1052.

Haslam, S. A., Reicher, S. D., & Platow, M. J. (2011). The new psychology of leadership: Identity, influence and power. East Sussex, UK: Psychology Press.

Hawker, G. A., Mian, S., Kendzerska, T., & French, M. (2011). Measures of adult pain. *Arthritis Care & Research, 63*(S11), S240-S252. doi: 10.1002/acr.20543

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis.* New York, NY: The Guilford Press.

Heckhausen, J., & Schulz, R. (1995). A life-span theory of control. *Psychological Review, 102*, 284-304.

Hennick, M. M., Kaiser, B. N., & Marconi, V. C. (2017). Code saturation verus meaning saturation: How many interviews are enough? *Qualitative Health Research, 27*(4), 591-608. doi: 10.1177/1049732316665344

Henson, R.K., & Roberts, K.J. (2006). Use of exploratory factor analysis in published research: Common errors and some comment on improved practice. *Educational and Psychological Measurement, 66*(3), 393‑416. doi: 10.1177/0013164405282485

Herring, S. A., & Nilson, K. L. (1987). Introduction to overuse injuries. *Clinics in Sports Medicine, 6*(2), 225-239.

Hesse-Biber, S. N., & Leavy, P. (2004). *Approaches to qualitative research: A reader on theory and practice.* Oxford, UK: Oxford University Press.

Hjermstad, M. J., Fayers, P. M., Haugen, D F., Caraceni, A., Hanks, G. W., Loge, J. H., Fainsinger, R., Aass, N., & Kaasa, S. (2011). Studies comparing numerical rating scales, verbal rating scales, and visual analogue scales for assessment of pain intensity in adults: A systematic literature review. *Journal of Pain and Symptom Management, 41*(6), 1073-1093.

Hogg, M. A., & Abrams, D. (1988). *Social identification: A social psychology of intergroup relations and group processes*. London: Routledge.

Hogg, M. A., & Reid, S. A. (2006). Social identity, self-categorization, and the communication of group norms. *Communication Theory, 16*, 7-30.

Huberty, C. J., & Morris, J. D. (1989). Multivariate analysis versus multiple univariate analyses. *Psychological Bulletin, 105*(2), 302-308.

Hughes, R., & Coakley, J. J. (1991). Positive deviance among athletes: The implications of overconformity to the sport ethic. *Sociology of Sport Journal, 8*, 307-325.

Johnson, U., Tranaeus, U., & Ivarsson, A. (2014). Current status and future challenges in psychological research of sport injury prediction and prevention: A methodological perspective. *Revista de Psicologia del Deporte, 23*(2), 401-409.

Jones, G., Hanton, S., & Connaughton, D. (2002). What is this thing called mental toughness? An investigation of elite sport performers. *Journal of Applied Sport Psychology, 14,* 205-218. doi: 10.1080/10413200290103509

Jones, G., Hanton, S., & Connaughton, D. (2007). A framework of mental toughness in the world's best performers. *The Sport Psychologist, 21,* 243-264.

Jones, K. R., Vojir, C. P., Hutt, E., & Fink, R. (2007). Determining mild, moderate, and severe pain equivalency across pain-intensity tools in nursing home residents. *Journal of Rehabilitation Research & Development, 44*(2), 305-314.

Jones, J. M., & Jetten, J. (2010). Recovering from strain and enduring pain: Multiple group memberships promote resilience in the face of physical challenges. *Social Psychological and Personality Science, 2*(3), 239-244. doi: 10.1177/1948550610386806

Junge, A. (2000). The influence of psychological factors on sports injuries. *The American Journal of Sports Medicine, 28*(5), S10-S15.

Kaiseler, M., Polman, R., & Nicholls, A. (2009). Mental toughness, stress, stress appraisal, coping, and coping effectiveness in sport. *Personality and Individual Differences, 47*(7), 728-733. doi: 10.1016/j.paid.2009.06.012

Kaiser, H. F., & Rice, J. (1974). Little Jiffy, Mark IV. *Educational and Psychological Measurement, 34,* 111-117.

Karjaluoto, H., & Leppaniemi, M. (2013). Social identity for teenagers: Understanding behavioural intention to participate in virtual world environment. *Journal of Theoretical and Applied Electronic Commerce Research, 8*(1), 1-16. doi: 10.4067/S0718-187620130001000002

Keats, M. R., Emery, C. A., & Finch, C. F. (2012). Are we having fun yet? Fostering adherence to injury preventive exercise recommendations in young athletes. *Sports Medicine, 47*(3), 175-184. doi: 0112-1642/12/0003-0175

Kline, R. (2005). *Principles and practice of structural equation modeling*. New York: The Guilford Press.

Korkmaz, M., Bülent, K., Çatıkkaş, F., & Yücel, A. S. (2014). Financial dimension of sports injuries. *European Journal of Experimental Biology, 4*(4), 38-46.

Larsen, R. J. (1992). Neuroticism and selective encoding and recall of symptoms: Evidence from a combined concurrent-retrospective study. *Journal of Personality and Social Psychology, 62*(3), 480-488.

Launay, F. (2015). Sports-related overuse injuries in children. *Orthopaedics & Traumatology: Surgery & Research, 101,* S139-S147. doi: 10.1016/j.otsr.2014.06.030

Leach, C. W., van Zomeren, M., Zebel, S., Vliek, M. L. W., Pennekamp, S. F., Doosje, B., Ouwerkerk, J. W., & Spears, R. (2008). Group-level self-definition and self-investment: A hierarchical (multicomponent) model of in-group identification. *Journal of Personality and Social Psychology, 95,* 144-165. doi: 10.1037/0022-3514.95.1.144

Leary, M. R. (1992). Self-presentational processes in exercise and sport. *Journal of Sport & Exercise Psychology, 14,* 339-351.

Leary, M. R. (1996). *Self-presentation: Impression management and interpersonal behaviours*. Boulder, CO: Westview Press.

Leary, M. R., & Kowalski, R. M. (1990). Impression management: A literature review and two-component model. *Psychological Bulletin, 107,* 34-47.

Lee, S., Quigley, B. M., Nesler, M. S., Corbett, A. B., & Tedeschi, J. T. (1999). Development of a self-presentation tactics scale. *Personality and Individual Differences, 26,* 701-722.

Levine, M., Prosser, A., Evans, D., & Reicher, S. (2005). Identity and emergency intervention: How social group membership and inclusiveness of group boundaries shape helping behaviours. *Personality and Social Psychology Bulletin, 31,* 443-453. doi: 10.1177/0146167204271651.

Levine, R. M., & Reicher, S. D. (1996). Making sense of symptoms: Self-categorization and the meaning of illness and injury. *British Journal of Social Psychology, 35,* 245-256.

Livingstone, A., & Haslam, S. A. (2008). The importance of social identity content in a setting of chronic social conflict: Understanding intergroup relations in Northern Ireland. *British Journal of Social Psychology, 47,* 1-21. doi: 10.1348/014466607X200419

Long, N., Readdy, T., & Raabe, J. (2014). What motivates firefighters to exercise? A mixed-methods investigation of self-determination theory constructs and exercise behavior. *Sport, Exercise and Performance Psychology, 3*(3), 203-218. doi: 10.1037/spy0000012

MacCullum, R. C., Widaman, K. F., Zhang, S., & Hong, S. (1999). Sample size in factor analysis. *Psychological Methods, 4*(1), 84-99.

Maddison, R., & Prapavessis, H. (2005). A psychological approach to the prediction and prevention of athletic injury. *Journal of Sport & Exercise Psychology, 27,* 289-310.

Madrigal, L., Hamill, S., & Gill, D. L. (2013). Mind over matter: The development of the mental toughness scale (MTS). *The Sport Psychologist, 27,* 62-77.

Maffulli, N., Longo, U. G., Gougoulias, N., Caine, D., & Denaro, V. (2010). Sport injuries: A review of outcomes. *British Medical Bulletin, 97,* 47-80. doi: 10.1093/bmb/ldq026

Mahoney, J. W., Gucciardi, D. F., Ntoumanis, N., & Mallett, C. J. (2014). Mental toughness in sport: Motivational antecedents and associations with performance and psychological health. *Journal of Sport & Exercise Psychology, 36,* 281-292. doi: 10.1123/jsep.2013-0260

Malterud, K. (2001). Qualitative research: Standards, challenges, and guidelines. *Lancet, 358*(9280), 483-488.

Marshall, S. W., & Guskiewicz, K. M. (2003). Sports and recreational injury: The hidden cost of a healthy lifestyle. *Injury Prevention, 9,* 100-102. doi: 10.1136/ip.9.2.100

Martin Ginis, K. A., & Leary, M. R. (2004). Self-presentational processes in health-damaging behavior. *Journal of Applied Sport Psychology, 16,* 59-74.

McGlashan, A. J., & Finch, C. F. (2010). The extent to which behavioural and social sciences theories and models are used in sport injury prevention research. *Sports Medicine, 40*(10), 841-858. doi: 0112-1642/10/0010-0841

Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation.* San Francisco, CA: Jossey-Bass.

Miles, M. B., Huberman, M. A., & Saldana, J. (2014). *Qualitative data analysis: A methods sourcebook*. Thousand Oaks, CA: Sage.

Miller, W. L., & Crabtree, B. F. (2004). Depth interviewing. In S. N. Hesse-Biber & P. Leavy (Eds.), *Approaches to qualitative research: A reader on theory and practice* (pp. 185-202). Oxford, UK: Oxford University Press.

Moffatt, R. J., Chitwood, L .F., & Biggerstaff, K. D. (1994). The influence of verbal encouragement during assessment of maximal oxygen uptake. *The Journal of Sports Medicine and Physical Fitness 34*(1), 45-49.

Montalvo, A. M., Shaefer, H., Rodriguez, B., Li, T., Epnere, K., & Myer, G. D. (2017). Retrospective injury epidemiology and risk factors for injury in CrossFit. *Journal of Sports Science and Medicine, 16,* 53-59.

Moran, A. P., Matthews, J., Kirby, K. (2011). Whatever happened to the third paradigm? Exploring mixed methods research designs in sport and exercise psychology. *Qualitative Research in Sport, Exercise and Health, 3*(3), 362-369. doi: 10.1080/2159676X.2011.60784 3

Morgan, D. L. (2007). Paradigms lost and pragmatism regained: Methodological implications of combining qualitative and quantitative methods. *Journal of Mixed Methods Research, 1*(1), 48-76. doi: 10.1177/2345678906292462

Morgan, D. L. (2014). Pragmatism as a paradigm for social research. *Qualitative Inquiry, 20*(8). 1045-1053. doi: 10.1177/1077800413513733

Nicholls, A. R., Polman, R. C. J., Levy, A. R., & Backhouse, S. H. (2008). Mental toughness, optimism, pessimism, and coping among athletes. *Personality and Individual Differences, 44,* 1182-1192. doi: 10.1016/j.paid.2007.11.011

Nicholls, A. R., Polman, R. C. J., Levy, A. R., & Backhouse, S. H. (2009). Mental toughness in sport: Achievement level, gender, age, experience, and sport type differences. *Personality and Individual Differences, 47,* 73-75.

Nixon, H. (1996). Explaining pain and injury attitude and experiences in sport in terms of gender, race, and sports status factors. *Journal of Sport & Social Issues, 20,* 33-44.

Novelli, D., Drury, J., & Reicher, S. (2010). Come together: Two studies concerning the impact of group relations on 'personal space'. *British Journal of Social Psychology, 49,* 223-236. doi: 10.1348/014466609X449377

Petrie, T. A. (1992). Psychosocial antecedents of athletic injury: The effects of life stress and social support on female collegiate gymnasts. *Behavioural Medicine, 18*(3), 127-138.

Petrie, T. A., Deiters, J., & Harmison, R. J. (2013). Mental toughness, social support, and athletic identity: Moderators of the life stress-injury relationship in collegiate football players. *Sport, Exercise, and Performance Psychology, 3*(1), 13-27.

Petrie, T. A., & Hamson-Utley, J. (2011). Psychosocial antecedents of and responses to athletic injury. In T. Morris & P. C. Terry (Eds.), *The new sport and exercise psychology companion* (pp. 531-551). Morgantown, WV: Fitness Information Technology.

Petrie, T. A., & Perna, F. (2004). Psychology of injury: Theory, research and practice. In T. Morris & J. Summers (Eds.), *Sport psychology: theory, applications and issues* (pp. 547-571). Milton, QLD, Australia: John Wiley & Sons.

Pike, E. C. J. (2004). Risk, pain and injury: "A natural thing in rowing?" In K. Young (Ed.), *Sporting bodies, damaged selves: Sociological studies of sports-related injury* (pp. 151-162). Oxford, UK: Elsevier.

Podlog L., & Eklund, R. C. (2005). Return to sport after serious injury: A retrospective examination of motivation and psychological outcomes. *Journal of Sport Rehabilitation, 14,* 20-34.

Postmes, T., Haslam, A., & Jans, L. (2013). A single-item measure of social identification: Reliability, validity, and utility. *British Journal of Social Psychology, 52,* 597-617. doi: 10.1111/bjso.1200

Poston, W. S., Haddock, C. K., Heinrich, K. M., Jahnke, S. A., Jitnarin, N., & Batchelor, D. B. (2016). Is high-intensity functional training (HIFT)/CrossFit safe for military fitness training? *Military Medicine, 181*(7), 627-637. doi: 10.7205/milmed-d-15-00273

Pronk, N. P., Crouse S. F., Rohack, J. J. (1995). Maximal exercise and acute mood response in women. *Physiology & Behavior, 57*(1), 1-4. doi: 10.1016/0031-9384(94)00195-B

Rees, T., Haslam, S. A., Coffee, P., & Lavallee, D. (2015). A social identity approach to sport psychology: Principles, practices, and prospects. *Sports Medicine, 45,* 1083-1096. doi: 10.1007/s40279-015-0345-4

Rejeski, W. J., & Lowe, C.A. (1980). Nonverbal expression of effort as causally relevant information. *Personality and Social Psychology Bulletin, 6,* 436-440.

Renstrom, P., & Johnson, R. J. (1985). Overuse injuries in sports: A review. *Sports Medicine, 2*(5), 316-333.

Rhea, M. R., Landers, D. M., Alvar, B. A., and Arent, S. M. (2003). The effects of competition and the presences of an audience on weight lifting performance. *Journal of Strength and Conditioning Research, 17*(2), 303-306.

Blanka Rip, B.A., Fortin, S., & Vallerand, R.J., 2006. The relationship between passion and injury in dance students. *Journal of Dance Medicine & Science, 10*(1-2), 14-20.

Rogers, T. J., & Landers, D. M. (2005). Mediating effects of peripheral vision in the life event stress/athletic injury relationship. *Journal of Sport & Exercise Psychology, 27,* 271-288.

Roos, K. G., & Marshall, S. W. (2014). Definition and usage of the term "Overuse Injury" in the US high school and collegiate sport epidemiology literature: A systematic review. *Sports Medicine, 44*(3), 405-421. doi: 10.1007/s40279-013-0124-z

Roos, K. G., Marshall, S. W., Kerr, Z. Y., Golightly, Y. M., Kucera, K. L., Myers, J. B., Rosamond, W. D., & Comstock, R. D. (2015). Epidemiology of overuse injuries in collegiate and high school athletics in the United States. *The American Journal of Sports Medicine, 44*(7), 1790-1797. doi: 10.1177/0363546515580790.

Rossler, R., Donath, L., Verhagen, E., Junge, A., Schweier, T., & Faude, O. (2014). Exercise-based injury prevention in child and adolescent sport: A systematic review and meta-analysis. *Sports Medicine, 44,* 1733-1748. doi: 10.1007/s40279-014-0234-2.

Russell, H. C., & Wiese-Bjornstal, D. M. (2015). Narratives of psychosocial response to microtrauma injury among long-distance runners. *Sports, 3,* 159-177. doi: 10.3390/sports3030159.

Salamon, K. S., Davies, W. H., Fuentes, M. R., Weisman, S. J., & Hainsworth, K. R. (2014). The pain frequency-severity-duration scale as a measure of pain: Preliminary validation in a pediatric chronic pain sample. *Pain Research and Treatment, 2014,* 1-6. doi: 10.1155/2014/653592

Sallis, J. F., Hovell, M. F., Hofstetter, C. R., Elder, J. P., Faucher, P., Spry, V. M., Barrington, E., & Hackley, M. (1990). Lifetime history of relapse from exercise. *Addictive Behaviours, 15,* 573-579.

Schroeder, A. N, Comstock, R. D., Collins, C. L., Everhart, J., Flanigan, D., & Best, T. M (2015). Epidemiology of overuse injuries among high-school athletes in the United States. *The Journal of Pediatrics, 66,* 600-606. doi: 10.1016/j.jpeds.2014.09.037.

Scott, M. B., & Lyman, S. M. (1968). Account. *American Sociological Review, 33*(1), 46-62.

Sheard, M., Golby, J., & van Wersch, A. (2009). Progress toward construct validation of the Sports Mental Toughness Questionnaire (SMTQ). *European Journal of Psychological Assessment, 25,* 186-193. doi: 10.1027/1015-5759.25.3.186

Shephard, R. J. (2003). Can we afford to exercise, given current injury rates? *Injury Prevention, 9,* 99-100. doi: 10.1136/ip.9.2.100

Shuer, M. L., & Dietrich, M. S. (1997). Psychological effects of overuse injury in elite athletes. *Western Journal of Medicine, 166,* 104-109.

Slater, M. J., Barker, J. B., Coffee, P. C., & Jones, M. V. (2014). *Qualitative Research in Sport, Exercise and Health,* 1-18. doi: 10.1080/2159676X.2014.936030

Smith, B., & McGannon, K. R. (2017). Developing rigor in qualitative research: Problems and opportunities within sport and exercise psychology. *International Review of Sport and Exercise Psychology,* 1-21. doi: 10.1080/1750984X.2017.1317357

Smith, R. E., Smoll, F. L., & Ptacek, J. T. (1990). Conjunctive moderator variables in vulnerability and resiliency research: Life stress, social support and coping skills, and adolescent sport injuries. *Journal of Personality and Social Psychology, 58*(2), 360-370.

Sobell, L. C, Toneatto, T, Sobell, M. B., Schuller, R., & Maxwell, M. (1990). A procedure for reducing errors in reports of life events. *Journal of Psychosomatic Research, 34,* 163-170.

Sparkes, A. C. (1998). Validity in qualitative inquiry and the problem of criteria: Implications for sport psychology. *The Sport Psychologist, 12,* 363-386.

Spears, R., Doosje, B., & Ellemers, N. (1997). Self-stereotyping in the face of threats of groups status and distinctiveness: The role of group identification. *Personality and Social Psychology Bulletin, 23*(5), 538-553.

Stephan, Y., Deroche, T., Brewer, B. W., Caudroit, J., & Le Scanff, C. (2009). Predictors of perceived susceptibility to sport-related injury among competitive runners: The role of previous experience, neuroticism, and passion for running. *Applied Psychology: An International Review, 58*(4), 672-687. doi: 10.1111/j.1464-0597.2008.00373.x

Stevens, J. P. (2001). *Applied multivariate statistics for the social sciences.* Psychology Press.

Sullivan, M. J. L., Bishop, S. R., & Pivik, J. (1995). The Pain Catastrophizing Scale: Development and validation. *Psychological Assessment, 7*(4), 524-532. doi: 1040-3590/95

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics.* Boston: Pearson Education.

Tabachnick, B. G., & Fidell, L. S. (2013). *Using multivariate statistics.* Boston: Pearson Education.

Tajfel, H. (1970). Experiments in intergroup discrimination. *Scientific American, 223,* 96-102.

Tajfel, H. (1974). Social identity and intergroup behaviours. *Social Science Information, 13*(21), 65-93.

Tajfel, H. (Ed.). (1978). *Differentiation between social groups: Studies in the social psychology of intergroup relations.* London, UK: Academic Press.

Tajfel, H. (Ed.). (1982). *Social identity and intergroup relations.* Cambridge, UK: Cambridge University Press.

Tedeschi, J.T., & Riess, M. (1981). Identities, the phenomenal self, and laboratory research. In Tedeschi, J.T. (Ed.), *Impression management theory and social psychological research* (pp. 3-22). New York, NY: Academic Press.

Tenenbaum G., Lidor, R., Lavyan, N., Morrow, K., Tonnel, S., & Gershgoren, A. (2005). Dispositional and task-specific social-cognitive determinants of physical effort perseverance. *Journal of Psychology, 139,* 139-157.

Tenforde, A. S., Sayres, L. C., McCurdy, M. L., Collado, H., Sainani, K. L., & Fredericson, M. (2011). Overuse injuries in high school runners: Lifetime prevalence and prevention strategies. *Physical Medicine & Rehabilitation, 3,* 125-131. doi: 10.1016/j.pmrj.2010.09.009

Terry, D. J., Hogg, M. A., & White, K. A. (1999). The theory of planned behavior: Self-identity, social identity and group norms. *British Journal of Social Psychology, 38,* 225-244.

Thorne, B. (1980). You still takin' notes? Fieldwork and problems of informed consent. *Social Problems, 27*(3), 284-297.

Timpka, T., Jacobsson, J., Ekberg, J., Finch, C. F., Bichenbach, J., Edouard, P., Bargoria, V., Branco, P., & Alonso, J. M. (2015). Meta-narrative analysis of sports injury reporting practices based on the Injury Definitions Concept Framework (IDCF): A review of consensus statements and epidemiological studies in athletics (track and field). *Journal of Science and Medicine in Sport.* doi: 10.1016/j.jsams.2014.11.393

Tracy, S. J. (2010). Qualitative quality: Eight "Big-Tent" criteria for excellent qualitative research. *Qualitative Inquiry, 16*(10), 837-851. doi: 10.1177/1077800410383121

Tranaeus, U., Johnson, U., Engstrom, B., Skillgate, E., & Werner, S. (2014). Psychological antecedents of overuse injuries in Swedish elite floorball players. *Athletic Insight, 6*(2), 155-172.

Turner, J. C. (1982). Towards a cognitive redefinition of the social group. In H. Tajfel (Ed.), *Social identity and intergroup relations* (pp. 15-40). Cambridge, UK: Cambridge University Press.

Turner, J. C., Hogg, M. A., Oakes, P. J., Reicher, S. D., & Wetherell, M. S. (1987). *Rediscovering the social group: A self-categorization theory.* Oxford, UK: Basil Blackwell.Turner, A., Barlow, J., & Ilberry, B. (2002). Play hurt, live hurt: Living with and managing osteoarthritis from the perspective of ex-professional footballers. *Journal of Health Psychology, 7*(3), 285-301.

Vaughn, B. K., & Daniel, S. R. (2012). Conceptualizing validity. In G. Tenenbaum, R. C. Eklund, & A. Kamata (Eds.), *Measurement in sport and exercise psychology* (pp. 33-39). Champaign, IL: Human Kinetics.

van Wilgen, C. P., & Verhagen, E.A.L.M. (2012). A qualitative study on overuse injuries: The beliefs of athletes and coaches. *Journal of Science and Medicine in Sport, 15,* 116-121. doi: 10.1016/j.jsams.20111.11.253

von Korff, M., & Dunn, K. M. (2008). Chronic pain reconsidered. *Pain, 138,* 267-276. doi: 10.1016/j.pain.2007.12.010

Wann, D. L., Keenan, B. L., Burnett, S., Martin, J., Page, L., Smith, L., & Lantz, C. (2002). The impact of sport team identification and attributions of ability and effort on spectators' impressions of athletic performance. *North American Journal of Psychology, 4,* 347-354.

Weisenthal, B. M., Beck, C. A., Maloney, M. D., DeHaven, K. E. & Giordano, B. D. (2014). Injury rate and patterns among CrossFit athletes. *Orthopaedic Journal of Sports Medicine, 2*(4), 1-7. doi: 10.1177/2325967114531177

Wiese-Bjornstal, D. M., Smith, A. M., Shaffer, S.M., & Morrey, M.A. (1998). An integrated model of response to sport injury: Psychological and sociological dynamics. *Journal of Applied Sport Psychology, 10,* 46-69.

Wilder, R. P., & Sethi, S. (2004). Overuse injuries: Tendinopathies, stress fractures, compartment syndrome, and shin splints. *Clinics in Sports Medicine, 23,* 56-81. doi: 10.1016/S0278-5919(03)00085-1

Williams, J. M., & Andersen, M. B. (1998). Psychological antecedents of sport injury: Review and critique of the stress and injury model. *Journal of Applied Sport Psychology, 10,* 5-25.

Williams, J. M., & Andersen, M. B. (2007). Psychosocial antecedents of sport injury and interventions for risk reduction. In G. Tenenbaum & R. C. Eklund (Eds.), *Handbook of sport psychology* (pp. 379-399). Hoboken, NJ: John Wiley & Sons.

Williamson, A., & Hoggart, B. (2005). Pain: A review of three commonly used pain rating scales. *Journal of Clinical Nursing, 14,* 798-804.

Worringham, C. J., & Messick, D. M. (1983). Social facilitation of running: An unobtrusive study. *Journal of Social Psychology, 121,* 22-29.

Wrosch, C., Miller, G. E., Scheier, M. F., & Brun De Pontet, S. (2007). Giving up on unattainable goals: Benefits for health? *Personality and Social Psychology Bulletin, 33*(2), 251-265. doi: 10.1177/0146167206294905

Yang, J., Tibbetts, A. S., Covassin, T., Cheng, G., Nayar, S., & Heiden, E. (2012). Epidemiology of overuse and acute injuries among competitive collegiate athletes. *Journal of Athletic Training, 47*(2), 198-204.

APPENDIX A

Study 1 Survey

In deference to spatial considerations, items not pertinent to results within this thesis (e.g., education, income) are not presented. Also, the spacing and formatting presented here does not reflect that of the actual online survey.

Please read the following information. After you have read it, you will be asked if you wish to participate in this study.
Risks and benefits of being in the study:
The study has few risks involved. Some may find the information difficult to disclose, but the likelihood of this harming you in any way is very minimal. No direct benefits are offered to participants. However, study results may be beneficial to the A.T. community.
Compensation:
There is no compensation for participation.
Confidentiality:
The records of this study will be kept private and confidential to the extent permitted by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records. Cookies, personal data stored by your Web browser, are not used in this survey.
Voluntary nature of the study:
Participation in this study is voluntary. If you decide to participate, you are free to not answer any question or withdraw at any time.
Contacts and questions:
You are encouraged to contact any of the following to ask questions or discuss this project:
Researcher: Vista Beasley University of Stirling, School of Sport, Sport Psychology Ph.D program, contact information
Research Supervisor: Dr. Robert Eklund, contact information
School of Sport Research Ethics Committee University of Stirling, contact information

I have read the above information.
I have had the opportunity to discuss the details and/or ask questions with Vista Beasley.
I understand the nature and purpose of the study.
I understand what is proposed to be done.
I understand that I am completely free to withdraw from the study or any part of the study at any time I wish.
I understand and agree that my participation in the study is entirely at my own risk.
I understand that this study is a part of a research project designed to promote knowledge.
I understand this study may be of no benefit to me personally.
I understand this study has been approved by the Sports Studies Ethics Committee. The Sports Studies Ethics Committee may wish to inspect the data collected at any time as part of its monitoring activities.

Do you agree to participate in the study?
__ Yes __ No
Please enter today's date. DD-MM-YYYY: _____
Thank you for agreeing to participate in this study.
Please answer the following questions.
Think about the MOST CHALLENGING ASPECTS of your FIRST thru-hike attempt.
Please describe the most challenging aspects below.

In the next 3 pages, please answer the questions in relation to how you *thought* and *felt* about THE MOST CHALLENGING ASPECTS you described above.
- Try to respond to each item separately in your mind from other items.
- There are no "right" or "wrong" answers, so choose the most accurate answer for you--not what you think "most people" would say or do.
- Do not spend too much time on any one item. Do not think too deeply. We are interested in how you react immediately, so please respond quickly.

For this study, the group "A.T. thru-hikers" includes
- Those who were attempting a thru-hike (2,000+ miles in one year) at the same time as you AND
- Those who have completed a thru-hike
The group "A.T. thru-hikers" includes northbounders, southbounders, and flipfloppers.
The group "A.T. thru-hikers" does not include section hikers and day hikers.
Remembering the MOST CHALLENGING ASPECTS, please answer the questions on this page in relation to how you *thought* and *felt* during your FIRST thru-hike attempt.

Rate your level of agreement with each statement
Response options for this set of items:

Strongly Disagree	1	2	3	4	5	6	7	Strongly Agree

In relation to the MOST CHALLENGING ASPECTS during my FIRST thru-hike attempt,
1. I felt a bond with A.T. thru-hikers.
2. I was glad to be an A.T. thru-hiker.
3. I often thought about the fact that I was an A.T. thru-hiker.
4. I had a lot in common with the average A.T. thru-hiker.
5. A.T. thru-hikers had a lot in common with each other.
6. I felt solidarity with A.T. thru-hikers.
7. I thought that A.T. thru-hikers have a lot to be proud of.
8. The fact that I was an A.T. thru-hiker was an important part of my identity.
9. I was similar to the average A.T. thru-hiker.
10. I felt committed to A.T. thru-hikers.
11. It was pleasant to be an A.T. thru-hiker.
12. Being an A.T. thru-hiker was an important part of how I saw myself.
13. A.T. thru-hikers were very similar to each other.
14. Being an A.T. thru-hiker gave me a good feeling.

Rate your level of agreement with each statement.
Response options for this set of items:

Disagree completely	1	2	3	4	5	6	7	Agree completely

In relation to the MOST CHALLENGING ASPECTS during my first thru-hike attempt:
1. I identified with A.T. thru-hikers.
2. I saw myself as an A.T. thru-hiker.
3. I was pleased to be an A.T. thru-hiker.
4. I felt strong ties with A.T. thru-hikers.

In relation to the MOST CHALLENGING ASPECTS during your FIRST thru-hike attempt:
When you thought of yourself as an A.T. thru- hiker, how important were the following items?

Response options for this set of items:

Not at all important	1	2	3	4	5	6	7	Extremely important

1. Being mentally tough
2. Trying hard
3. Not quitting
4. Keep hiking despite physical pain
5. Making friends
6. Keep hiking despite adversity
7. Exert as much effort as physically possible
8. Completing the trail
9. Building relationships
10. Enjoying the experience
11. Not giving up
12. Having fun

Remembering the MOST CHALLENGING ASPECTS, please answer the questions on this page in relation to how you *thought* and *felt* during your FIRST thru-hike attempt.Rate how true each statement was for you on a scale of 1 (NOT AT ALL true) to 4 (VERY true).
Response options for this set of items:

Not at all true	1	2	3	4	Very true

In relation to the MOST CHALLENGING ASPECTS during my FIRST thru-hike attempt,
1. I could regain my composure if I momentarily lost it.
2. I worried about performing poorly.
3. I was committed to completing the tasks I had to do.
4. I was overcome by self-doubt.
5. I had an unshakeable confidence in my ability.
6. I had what it took to perform well while under pressure.
7. I got angry and frustrated when things did not go my way.
8. I gave up in difficult situations.
9. I got anxious by events I did not expect or could not control.
10. I got distracted easily and lost my concentration.
11. I had qualities that set me apart from other hikers.
12. I took responsibility for setting myself challenging targets.
13. I interpreted potential threats as positive opportunities.
14. Under pressure, I was able to make decisions with confidence and commitment.

Rate how true this statement was for you on a scale of 1 (NOT AT ALL true) to 4 (VERY true).
In relation to the MOST CHALLENGING ASPECTS during my FIRST thru-hike attempt,
1. I was mentally tough.

Not at all true	1	2	3	4	5	6	7	Very true

Please answer the following questions about <u>the first time</u> you ATTEMPTED to thru-hike the A.T.
The date I STARTED my first thru-hike attempt was DD-MM-YYYY
The date I STOPPED my first thru-hike attempt was DD-MM-YYYY

Please read the information below. It describes 3 types of INJURY and OTHER PHYSICAL PROBLEMS. After reviewing the information, you will answer questions about which type(s) you may have experienced during your first thru-hike attempt.
For this study, the 3 types of injury are 1) acute 2) chronic 3) acute injury that became chronic.

ACUTE

- It happens suddenly.
- You usually know exactly what caused it. For example: You fell on a wet rock. You fell while climbing.
- Examples:

Broken leg. Sprained ankle.

CHRONIC

- It usually happens gradually. You may not know exactly when it started.
- You may not know what caused it. It is usually caused by overuse.
- Usually, the pain starts out not too bad, then keeps getting worse and worse.

-Examples:

Back pain
Muscle stiffness/tightness/cramps
Plantar fasciitis
Tendonitis
Shin splints
Stress fractures
Joint pain
Bursitis
IT band pain
Swollen ankles from unknown cause

ACUTE INJURY THAT BECAME CHRONIC

- This starts out as an acute injury: You know when it started, and you know what caused it.
- The injury gets worse and worse. This may be because you kept hiking despite the pain. You didn't get proper treatment. You didn't rest enough.
- Example:

You twist your left ankle in some rocks. You favour your left leg, putting more weight on your right leg. Your right knee starts hurting. You keep hiking, and the pain in your right knee gets worse.

OTHER PHYSICAL PROBLEMS

For this study, "other physical problems" means

- You feel some pain/discomfort in your body.
- Not injury as defined above
- May be gastro-intestinal, infection, or skin
- Examples:

Flu
Blisters
Allergies
Diarrhea
Lyme Disease
West Nile virus
Chafing
Giardia
Dehydration
Abrasions

Now you'll answer questions about each type of INJURY and/or PHYSICAL PROBLEMS you may have experienced *during your first thru-hike attempt*.
Each injury should only be listed as one type. For example, a sprained ankle would only be listed as ACUTE or as ACUTE INJURY THAT BECAME CHRONIC.
Did you experience any ACUTE injuries during your first thru-hike attempt?
Click "More Info" if you need to review the description of ACUTE.
__ Yes __ No
If Yes:
Please list each ACUTE injury you experienced during your first thru-hike attempt. Place an asterick (*) beside the ones which were diagnosed by a medical professional.
Please describe your experience with each ACUTE injury. Include cause(s). If you experienced the same injury prior to starting the A.T., include that information here.
Did you experience any CHRONIC injuries during your first thru-hike attempt?
Click "More Info" if you need to review the description of CHRONIC.
__ Yes __ No
If Yes:
List each CHRONIC injury you experienced during your first thru-hike attempt. Place an asterick (*) beside the ones which were diagnosed by a medical professional.
Please describe your experience with each CHRONIC injury during your first thru-hike attempt. Include possible cause(s). If you experienced the same injury prior to starting the A.T., include that information here.
Did you experience any ACUTE INJURIES THAT BECAME CHRONIC during your first thru-hike attempt?
Click "More Info" if you need to review the description of ACUTE INJURY THAT BECAME CHRONIC.
__ Yes __ No
If Yes:
List each ACUTE INJURY THAT BECAME CHRONIC you experienced during your first thru-hike attempt. Place an asterick (*) beside the ones which were diagnosed by a medical professional.
Please describe your experience with each ACUTE INJURY THAT BECAME CHRONIC during your first thru-hike attempt. Include possible cause(s). If you experienced the same injury prior to starting the A.T., include that information here.

For this study, a thru-hike *attempt* means you started the trail with the intent to hike 2,000 or more miles of the A.T. within a one-year period. A *completion* means you hiked 2,000 or more miles of the A.T. within a one-year period. For example, if you hiked 2,010 miles, aqua-blazed (kayaked) 100 miles in Virginia, and yellow-blazed (skipped) some other miles, between April and October of one year, this would be considered a completed thru-hike.
By this definition, did you complete an A.T. thru-hike the first time you attempted it?
No __ Yes __

In New York, there is a sign on the A.T. near some steep rocks. The words "Easy Way" are on the sign, with an arrow pointing at an alternate route around the rocks. Did you see this sign during your first thru-hike attempt?
__ No __ Yes __ I don't remember this
If yes:
Did you follow the "Easy Way" route?
__ No __ Yes
Please describe your reasons for taking the route you chose, whether it was the easy or hard way.

APPENDIX B

Protocol for Coding Overuse Injury Occurrence

Thank you for agreeing to assist in this project by helping code overuse injury occurrence.

Background & Aim

Please read the following **measure, analytic strategy, and example results** sections to understand the background and aim.

Measure

Participants read information about different types of pain and injury (e.g., acute, chronic). They then responded to this open-ended item: "Please list each pain/injury you experienced during your first thru-hike attempt. Place an asterick (*) beside the ones which were diagnosed by a medical professional". They then responded to this open-ended item about each injury: "Please describe your experience with each injury. Include cause(s). If you experienced the same injury prior to staring the A.T., include that information here."

Overuse injury was dichotomized into a binary variable (overuse injury incurred or not), as recommended by Rogers and Anders (2005). Occurrence was based on causal mechanisms consisting of cumulative trauma or repetitive use/stress, with no single, identifiable event responsible for the pain, as opposed to acute trauma resulting from a specific and identifiable event (Schroeder et al., 2015; Yang et al., 2012), and excluding physical problems not affecting the musculoskeletal system. If causal mechanism did not match these criteria, or was not described by participant, the pain/injury was not categorized as an overuse occurrence, unless the diagnosis indicated a well-known overuse injury (e.g., stress fracture, shin splints).

Analytic strategy

Based on the above conceptualization, the researcher and a research supervisor independently used causation coding (Miles, Huberman, & Saldana, 2014) with a random sample of 50 participants' causal attributions. The two coders agreed on categories for **## of the 50 (kappa = ##; p < .001).** Following discussion of the cases in which there was disagreement, the researcher categorized the remainder of the descriptions.

Example Results

Of the 751 participants, ___% (*n* = ____) described causal mechanisms categorized as having incurred overuse injury.

What you do

You are being presented with 50 responses to the above injury items. These responses were randomly selected from the 751 participants. You are being asked to code each response to indicate whether the person did or did not incur overuse injury. To do so, please follow these steps.

How to do it

Step 1. Please read the following guidance to orient yourself to the definitions and criteria that will be used. You can view the guidance by scrolling below, or by following the hyperlinks. **To follow hyperlinks,** place your cursor on the underlined item, press "Ctrl" key, and simultaneously right-click.

Other physical problems
Single, identifying event
Musculoskeletal system
Pain symptoms
Causal mechanisms
Examples

Step 2. Please access the attached spreadsheet.
Open the worksheet called "Code occurrence".
Each row represents the responses of one participant.
Columns are as follow:

Column A: Case number.
Column B: Blank. [This is where you will place your code.]
Columns C – H are in the participants' own words.
Column C: A list of injury or injuries.
Column D: Description of experience with injuries listed in Column C.
Column E: A list of injury or injuries.
Column F: Description of experience with injuries listed in Column E.
Column G: A list of injury or injuries.
Column H: Description of experience with injuries listed in Column G.
Column I: Blank.

Step 3. Please read each participant's responses in Columns C – H.

Step 4. For each pain/injury item presented in each participant's descriptions, follow the protocol in the **flow chart**. To view the flow chart, scroll below, or follow underlined hyperlink. As an alternative to the flow chart, a list of **questions** is provided below the flow chart which can be used to guide coding. To view the questions, scroll below, or follow underlined hyperlink.

Step 5. Per the protocol, enter a "0", "1", or "2"in Column B for each person.
"0" indicates NO OVERUSE INJURY
"1" indicates OVERUSE INJURY INCURRED
"2" indicates POSSIBLE OVERUSE INJURY, BUT INSUFFICIENT DESCRIPTION
If you wish to make any notes about your decision, please enter them in Column I.

Step 6. Save your excel spreadsheet.

Step 7. Set up meeting to discuss differences in codes marked by different coders.

Guidance

OTHER PHYSICAL PROBLEMS

Many physical problems described by participants do not require subjective judgement by coders. They are excluded by the definition of overuse injury being used because they 1) do not primarily affect the musculoskeletal system, and/or 2) are caused by a single, identifying event, rather than repetitive stress.

When assessing participants' descriptions, you will be directed to the list of **Other Physical Problems.** It is found in the attached spreadsheet, in the worksheet "Other Physical Problems". All items on this list have already been eliminated as overuse injury.

SINGLE, IDENTIFYING EVENT

Overuse injuries are caused by repetitive microtrauma, that is, accumulation of repeated small forces, without a single, identifying event.

If the injury stems from a single, identifying event, the causal mechanism is not considered to be overuse. Thus descriptions of a pain/injury item which include the following are not indicative of overuse injury: falling, tripping, slipping, postholing, stepping wrong, car accident, or single incident of contact with a person or object.

In the case where one can point to a single moment, e.g., "During that day, I tripped on a rock", that causal mechanism would indicate it's not an overuse injury. That moment is a stark, distinct point in time. A day is not a single event, as one cannot point to a moment during that day from which the injury stemmed. For example, "one day I pushed really hard" would not be considered a single, identifying event, but rather, would be potentially indicative of overuse. The repeated small forces of multiple steps throughout that day are the cause, rather than one step. Likewise, "going downhill" would not constitute a single, identifying event unless there was one, single step during the many taken downhill that caused the injury onset.

Some items in "Other physical problems" are designated as having a single, identifying event, though one may not know the exact moment in time it occurred. For example, Lyme's disease is caused by a single event—a tick bite—though one may not know when the tick bit.

MUSCULOSKELETAL SYSTEM

The definition of overuse injury is confined to injury which primarily affects the musculoskeletal system. This includes tendon, ligament, muscle, bone, joint, cartilage, and connective tissue. In contrast are other systems that could be affected, with examples in parentheses:

- integumentary (skin, hair, nails)
- lymphatic (lymph nodes, immune mechanisms)
- circulatory (heart, blood vessels)
- urinary (bladder)
- digestive (gastro-intestinal)
- respiratory (lungs, oxygen usage)
- reproductive (menses, organs)
- nervous (brain, nerve cells)
- endocrine (hormones)
- organs (kidneys, stomach)

PAIN SYMPTOMS

Functional overreaching: In assessing causal mechanisms, you may also need to consider the nature of the pain symptoms to determine whether the pain described is related to functional overreaching, and thus is not indicative of overuse injury.

This distinction is presented by Timpka et al. (2015): "In athletes, improvement in performance is achieved through functional overreaching, i.e., applications of bouts of load to an extent that allows fatigue to be reversed within a pre-planned recovery period. Non-functional overreaching occurs when functions do not improve, feelings of fatigue do not disappear after the recovery period, and clinical, biochemical or immunological signs of systems stress can be observed. The notion of overtraining condition applies to long-standing cases in which performance decrements, symptoms, and signs persist over months or even years" (p. 2).

The symptoms of functional overreaching involving soreness and pain would be expected to follow a pattern in which the initial pain can be low-level or high-level, but regardless, it decreases and dissipates in a relatively short amount of time as one gets stronger or "in shape".

Functional overreaching would be expected to apply mostly to muscular soreness, which may be described in various forms such as pain, stiffness, aches, strains. As an example, consider a description of muscle stiffness. The causal mechanism given may be overuse, or continuous hiking, which matches the causal mechanism of overuse injury. However, it may be muscle stiffness that comes from starting new SRA. The process of going from out-of-shape to getting in shape lends itself to muscular stiffness that indicates strengthening. In this case, it would not be overuse. In other cases, stiffness comes from engaging in a higher volume/intensity of SRA. In this case, it may also be the byproduct of strengthening, with the expectation that the stiffness would be temporary and then subside. However, it could be indicative of overuse injury onset if the pattern is as described below.

The pain symptoms indicating onset of overuse injury occurrence would be expected to follow a different pattern, such as:

- **low-level:** the initial pain may be low-level such that it does not functionally impair ability to engage in SRA, that is, they can keep hiking despite pain, and/or

- **gradual onset:** this pain may increase in severity over time, worsening, possibly eventually to point of functional impairment, so they have to limp while hiking or stop hiking, for example, because knee will not bend, and/or

- **intermittent, transient:** some days the pain is severe, some days it does not seem to hurt at all, for no clear reason; or within a day, it hurts more at some points in the day, sometimes less, and/or

- **persistence:** it nags indefinitely, never seeming to go away but perhaps not getting worse either

Note: These descriptors are culled from Clarsen, Myklebust, & Bahr, 2013; Russell & Wiese-Bjornstal, 2015; Shuer & Dietrich, 1997.

Distinguishing between functional overreaching and overuse injury occurrence: Without sufficient description of the muscle stiffness, coder may be unable to distinguish between stiffness arising from functional overreaching, or stiffness of overuse injury onset.

Altogether, instances of muscular stiffness/soreness/pain may require more details to code as overuse injury occurrence.

If the respondents' description does not enable you to distinguish between functional overreaching or overuse injury, continue to review of causal mechanism.

CAUSAL MECHANISM

Repetitive stress: Causal mechanisms of overuse injury involve repetitive microtrauma, that is, accumulation of repeated small forces. Descriptions would be expected to allude to repetitive stress, overtraining, change in training, or insufficient rest. Examples include:

- Explicit statement of overuse or repetitive stress
- Daily or constant engagement in SRA, e.g., the cause is "hiking every day"
- Excessive engagement in SRA
    - -- frequency, e.g., "I hiked too many days"
    - -- duration, e.g., "I hiked too many miles"
    - -- intensity, e.g., "I hiked too fast or pushed too hard"
- Insufficient rest/recovery

Unknown cause: While some may understand that the pain they are experiencing is related to repetitive stress, overtraining, change in training, or insufficient rest, others may not have that knowledge. Some respondents may provide answers such as "I'm not sure" or "Unknown cause". Not knowing the cause of the overuse injury is often a feature of overuse injury. They may only be able to say "It just started hurting one day, and I'm not sure why." This very ambiguity is often a marker of overuse injury and is a source of distress for some. Without knowing what caused it, they often do not know how to treat it.

The explicit response "I'm not sure" or "Cause is unknown" is different from respondents who simply did not mention the cause in any way, though the open-ended item asked them to include cause in the description of the injury experience. The former indicates lack of knowledge of causal mechanism; the latter is a failure to provide information about the causal mechanism.

With this in mind, there is a distinction between "Causal mechanism known and given and matches that of overuse injury", and "Causal mechanism not known", versus "Causal mechanism not given".

For those who explicitly indicate in some form that causal mechanism is not known:
- If all previous steps, such as pain symptoms, indicate overuse injury, then mark "2 Overuse injury incurred".
- If in your judgement the previous steps leave you unsure as to whether this is or is not overuse injury, then proceed to insufficient description.

Extrinsic/intrinsic factors: Many descriptions refer to pre-existing conditions (e.g., out of shape, prior sport injury), gear (e.g., shoes, backpacks) or terrain (e.g., steep downhills) being the cause of injury. The reason these still get an overuse categorization is because they would not be painful if it were not for engagement in the SRA. For example, though shoes with the wrong arch supports may cause pain, hikers did not feel pain in those shoes until they engaged in the SRA. Intrinsic factors (e.g., biomechanical abnormalities, malalignments, muscle imbalance, inflexibility, weakness, instability) and external factors (e.g., improper technique, equipment, and surfaces) may contribute to overuse injury (Renstrom & Johnson, 1985;

Stephan, Deroche, Brewer, Caudroit, & Le Scanff, 2009; Wilder & Sethi, 2004). However, these factors can be benign until changes in mode of SRA occur, as well as improper changes in frequency, duration, and/or intensity of SRA engagement. For example, one may have a bunion, a bony deformity of the joint at the base of the big toe. With a sedentary life, this may not be problematic, but if one starts backpacking on a daily basis, pain, swelling, and ultimately functional impairment may ensue. As noted by Launay (2015), the combination of general physical inactivity with high engagement in SRA can contribute to overuse injury. Altogether, excessive or improper applications of effort during SRA underlies overuse injury occurrence.

EXAMPLES

Below are example descriptions, followed by the suggested designation, **BOLDED**, to illustrate guidance given above.

Muscular stiffness, caused by overuse, felt at start of hike but it went away in 2 weeks
Functional overreaching; Code 0

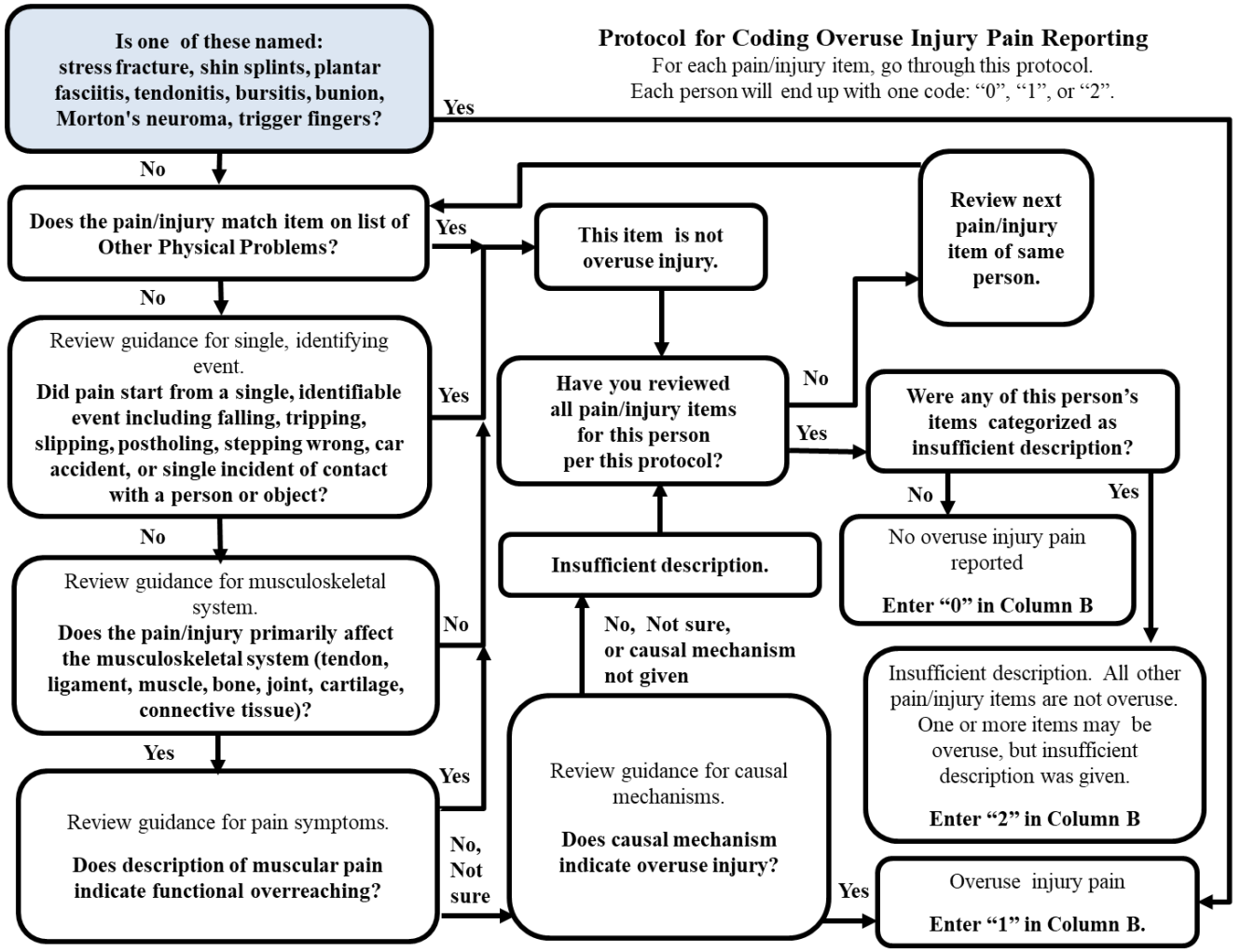
Muscular stiffness, cause unknown, felt at start of hike but it went away in 2 weeks
Functional overreaching; Code 0

Muscular stiffness, I'm not sure of cause
Insufficient description (would need pain symptoms description to code); Code 2

Muscular stiffness, I'm not sure of cause, felt for 300 miles, went away, came back
Overuse injury; Code 1

Muscular stiffness, felt for 300 miles, went away, came back
Insufficient description (no causal mechanism given—do not know if muscle pain started from a fall or repetitive); Code 2

Protocol for Coding Overuse Injury Pain: Flow Chart



Protocol for Coding Overuse Injury Pain: Questions (Page 1)

Go through the following questions in the following order.
If you answer no to a question, move on to the next question.
If you answer yes to a question, the pain/injury is to be coded with the number in the right-hand column.
If you code 1 for overuse injury pain, move on to next participant.
If you code 0, move on to the next pain/injury item of the same person until all of their items are coded, or until an item is coded 1.

Question	Code
Known overuse injury	
Is it stress fractures?	1
Is it shin splints?	1
Is it plantar fasciitis?	1
Is it tendonitis?	1
Is it bursitis?	1
Is it pain from bunion?	1
Is it Morton's neuroma?	1
Is it arthritis?	1
Is it trigger fingers?	1
Musculo-skeletal system	
Does it primarily affect the integumentary system?	0
Does it primarily affect the lymphatic system?	0
Does it primarily affect the circulatory system?	0
Does it primarily affect the respiratory system?	0
Does it primarily affect the urinary system?	0
Does it primarily affect the digestive system?	0
Does it primarily affect the nervous system and/or brain?	0
Does it primarily affect organs?	0
Single, identifying event	
Did the pain result from an animal or insect bite?	0
Did the pain result from a fall?	0
Did the pain result from slipping?	0
Did the pain result from postholing?	0
Did the pain result from stepping wrong?	0
Did the pain result from a car accident?	0
Did the pain result from a single incident of contact with a person?	0
Did the pain result from a single incident of contact with an object?	0
Did the pain result from a single, identifiable event?	0
Did the pain result from a bacterial or viral infection?	0
Functional overreaching	
Is it muscle pain that starts in new SRA, then decreases and dissipates in a relatively short amount of time as one gets stronger or in shape?	0

Protocol for Coding Overuse Injury Pain: Questions (Page 2)

Question	Code
Repetitive stress of SRA combined with intrinsic & extrinsic factors	
Is it non-muscular pain related to being overweight combined with engaging in this SRA?	1
Is it non-muscular pain related to being out of shape / having low levels of physical fitness, combined with engaging in SRA?	1
Is it pain related to a prior injury, that presents now in relation to this SRA?	1
Is it non-muscular pain related to terrain (rocky, steep inclines/declines)?	1
Is it non-muscular pain related to fit, age, or type of shoes/insoles/inserts, combined with engaging in SRA?	1
Is it non-muscular pain related to fit, or type of backpack, combined with engaging in SRA?	1
Overuse injury pain symptoms	
Does pain pattern appear intermittent?	1
Does pain pattern imply gradual onset?	1
Is pain persistent?	1
Repetitive stress	
Is cause of pain explicitly "overuse" or repetitive stress?	1
Is cause of pain related to too many days, too many miles, going too fast, pushing too hard, or carrying something too heavy?	1
Is cause of pain related to constant engagement in SRA, such as hiking every day?	1
Is cause of pain related to not resting enough?	1
Insufficient description	
All else	2

APPENDIX C

Additional Descriptive Statistics (Study 1)

Table C1

Means (Standard Deviations) of Psychological Measures by All Participants, Gender, and Completion Status

			Gender				Completion Status			
	All		Women		Men		Finishers		Non-finishers	
	n = 683		*n* = 195		*n* = 488		*n* = 501		*n* = 182	
Psychological Measures	M	SD	M	SD	M	SD	M	SD	M	SD
SIC Being mentally tough	6.40	(0.91)	6.27	(0.98)	6.44	(0.87)	6.45	(0.87)	6.25	(0.98)
SIC Building relationships	4.88	(1.48)	5.21	(1.48)	4.75	(1.46)	4.91	(1.46)	4.80	(1.53)
SIC Completing the trail	6.17	(1.33)	6.11	(1.37)	6.19	(1.31)	6.48	(1.03)	5.31	(1.63)
SIC Enjoying the experience	6.34	(0.99)	6.39	(0.97)	6.32	(1.00)	6.29	(1.04)	6.47	(0.86)
SIC Exert as much effort…	4.32	(1.77)	4.44	(1.85)	4.28	(1.74)	4.34	(1.71)	4.29	(1.92)
SIC Having fun	6.09	(1.18)	6.18	(1.14)	6.05	(1.19)	6.10	(1.12)	6.06	(1.35)
SIC Keep hiking…pain	5.26	(1.45)	5.22	(1.55)	5.27	(1.40)	5.32	(1.42)	5.08	(1.52)
SIC Making friends	5.01	(1.41)	5.27	(1.37)	4.91	(1.42)	5.02	(1.38)	4.99	(1.51)
SIC Not giving up	6.43	(0.99)	6.44	(0.96)	6.43	(1.00)	6.62	(0.78)	5.92	(1.30)
SIC Not quitting	6.50	(0.92)	6.47	(0.90)	6.51	(0.93)	6.61	(0.80)	6.19	(1.14)
SIC Trying hard	5.91	(1.11)	6.15	(1.11)	5.81	(1.10)	5.89	(1.13)	5.95	(1.07)
Social Id Scale	6.08	(0.92)	6.08	(0.88)	6.08	(0.94)	6.22	(0.79)	5.70	(1.13)
In-group Solidarity	5.78	(1.19)	5.84	(1.19)	5.75	(1.20)	5.91	(1.04)	5.42	(1.48)
In-group Satisfaction	6.26	(0.81)	6.26	(0.86)	6.25	(0.80)	6.35	(0.68)	5.99	(1.07)
In-group Centrality	5.65	(1.38)	5.69	(1.54)	5.64	(1.31)	5.81	(1.23)	5.22	(1.66)
In-group Self-stereotype	4.43	(1.42)	4.28	(1.42)	4.49	(1.42)	4.54	(1.37)	4.13	(1.52)
SMTQ Confidence	3.07	(0.51)	2.88	(0.54)	3.14	(0.48)	3.13	(0.48)	2.90	(0.55)
Single-item Mental Toughness	5.88	(1.25)	5.58	(1.37)	6.00	(1.18)	6.15	(0.92)	5.12	(1.66)

Table C2 (Page 1)

Means and Standard Deviations of Psychological Measures of Overuse Injury Pain x Completion Status x Gender Groups for a. Women and b. Men

a. Women

	With Overuse Pain				Without Overuse Pain			
	Finishers *n* = 84		Non-finishers *n* = 46		Finishers *n* = 45		Non-finishers *n* = 20	
Psychological Measures	M	SD	M	SD	M	SD	M	SD
SIC Being mentally tough	6.40	(0.91)	6.13	(1.11)	6.16	(1.02)	6.30	(0.80)
SIC Building relationships	5.36	(1.44)	4.87	(1.63)	5.36	(1.32)	5.05	(1.54)
SIC Completing the trail	6.61	(0.74)	5.50	(1.60)	6.40	(1.10)	4.80	(1.94)
SIC Enjoying the experience	6.37	(0.99)	6.26	(1.04)	6.42	(0.99)	6.70	(0.57)
SIC Exert as much effort…	4.52	(1.79)	4.46	(2.11)	4.36	(1.67)	4.20	(1.96)
SIC Having fun	6.17	(1.04)	5.93	(1.47)	6.27	(1.07)	6.65	(0.67)
SIC Keep hiking…pain	5.38	(1.52)	5.37	(1.54)	4.93	(1.63)	4.80	(1.51)
SIC Making friends	5.39	(1.30)	4.91	(1.46)	5.36	(1.21)	5.35	(1.69)
SIC Not giving up	6.75	(0.53)	6.17	(1.14)	6.51	(0.82)	5.55	(1.47)
SIC Not quitting	6.68	(0.62)	6.15	(1.21)	6.53	(0.79)	6.15	(1.04)
SIC Trying hard	6.17	(1.16)	6.17	(1.04)	6.07	(1.18)	6.20	(1.01)
Social Id Scale	6.34	(0.66)	5.67	(1.08)	6.17	(0.74)	5.78	(1.05)
In-group Solidarity	6.10	(0.90)	5.25	(1.56)	5.95	(1.17)	5.90	(0.94)
In-group Satisfaction	6.43	(0.63)	5.88	(0.94)	6.39	(0.83)	6.15	(1.24)
In-group Centrality	6.06	(1.31)	5.23	(1.75)	5.80	(1.38)	4.95	(1.80)
In-group Self-stereotype	4.36	(1.36)	3.75	(1.42)	4.49	(1.43)	4.73	(1.40)
SMTQ Confidence	3.03	(0.52)	2.68	(0.50)	2.91	(0.53)	2.68	(0.58)
SIMT	5.92	(1.08)	5.09	(1.72)	5.93	(0.89)	4.55	(1.67)

Table C2 (Page 2)

b. Men

	With Overuse Pain				Without Overuse Pain			
	Finishers *n* = 238		Non-finishers *n* = 66		Finishers *n* = 134		Non-finishers *n* = 50	
Psychological Measures	M	SD	M	SD	M	SD	M	SD
SIC Being mentally tough	6.58	(0.73)	6.27	(0.94)	6.34	(0.98)	6.30	(0.99)
SIC Building relationships	4.88	(1.37)	4.97	(1.51)	4.52	(1.55)	4.40	(1.43)
SIC Completing the trail	6.47	(1.09)	5.02	(1.56)	6.44	(1.06)	5.72	(1.53)
SIC Enjoying the experience	6.19	(1.11)	6.38	(0.92)	6.38	(0.94)	6.68	(0.59)
SIC Exert as much effort…	4.34	(1.63)	4.38	(1.80)	4.22	(1.82)	4.04	(1.93)
SIC Having fun	6.02	(1.15)	5.88	(1.53)	6.13	(1.12)	6.18	(1.10)
SIC Keep hiking…pain	5.46	(1.31)	5.06	(1.52)	5.16	(1.43)	4.96	(1.51)
SIC Making friends	4.99	(1.32)	5.18	(1.45)	4.72	(1.51)	4.66	(1.55)
SIC Not giving up	6.63	(0.78)	5.64	(1.45)	6.56	(0.88)	6.20	(1.03)
SIC Not quitting	6.66	(0.77)	5.98	(1.22)	6.51	(0.94)	6.50	(0.93)
SIC Trying hard	5.80	(1.00)	5.64	(1.12)	5.83	(1.28)	6.04	(0.99)
Social Id Scale	6.22	(0.78)	5.64	(1.21)	6.15	(0.90)	5.78	(1.13)
In-group Solidarity	5.90	(1.01)	5.46	(1.48)	5.79	(1.14)	5.34	(1.58)
In-group Satisfaction	6.34	(0.63)	5.87	(1.22)	6.31	(0.72)	6.19	(0.88)
In-group Centrality	5.82	(1.08)	5.27	(1.56)	5.64	(1.34)	5.24	(1.68)
In-group Self-stereotype	4.61	(1.34)	4.20	(1.49)	4.56	(1.43)	4.13	(1.63)
SMTQ Confidence	3.18	(0.46)	3.00	(0.58)	3.19	(0.45)	3.04	(0.47)
SIMT	6.27	(0.84)	5.06	(1.74)	6.16	(0.94)	5.46	(1.46)

Note. SIC = Social Identity Content; SMTQ = Sport Mental Toughness Questionnaire; SIMT = Single-item Mental Toughness.

APPENDIX D

Visual Summaries of Qualitative Data (Study 1)

Table D1

Challenge Types and Reasons for Route Selection Derived from A Priori Theoretical Analysis with Social Identity Approach

a. Challenge types

Category	Sub-category	%	*n*	Sample descriptors
Others		35.8	269	
	Out-group members	13.7	103	friends; family; missing them; pressure to return home
	In-group members	22.1	166	different speed, ability; disagreements over mileage
Status (finisher)		11.6	87	
	Time constraints	5.9	44	finish before winter weather; events in personal life
	Thoughts of quitting	5.7	43	thoughts of quitting; fear of failure; thought of defeat

b. Reasons for taking the higher-effort route (*n* = 274)

Category	Sub-category	%	*n*	Sample descriptors
Social identity content	Morality	47.1	129	purist; the right way; white blazes; no shortcuts
	Enjoyment	22.3	61	fun; the experience; scenery; exciting
	Necessity	19.0	52	weather fine; physically able; no need to take easy way
	Challenge	17.2	47	challenge
In-group members	Presence	6.9	19	friends wanted to go the hard way
Status	Reduce others	2.6	7	weak; lame; pejoratives
	Increase own			accomplishment

c. Reasons for taking lower-effort route (*n* = 58)

Category	Sub-category	%	*n*	Sample descriptors
Status	Sad tale	31	18	hot; tired; already doing "hard" in other forms
	Biological element	26	15	couldn't; age; height; injury
	Hazardous condition	24	14	weather (storms, rain, black ice); slick rocks
Social creativity	Intelligence	26	15	intelligence; I have a brain
	Practicality			time; energy conservation; no need to take hard way
	Non-conformity			rebels; walk to own rhythm
	Self-compassion			being kind to self
In-group members	Presence	10.3	6	took easy way with/because of others
	Lack of presence	3.4	2	would have taken hard way if others had been present

Table D2

Categorizations of Challenge Types with Sample Descriptors

Category	%	*n*	Sample In Vivo Descriptors
Psychological	38.7	291	
Monotony	9.1	68	boredom, tedium, repetition, mundane, day after day
Mental	8.4	63	explicit: mental, psychological, emotional, moods
Missing home	4.9	37	leaving normal life behind, comforts of home, parties, girls
Inexperience	4.7	35	unknown, unfamiliarity, inexperience, unprepared
Homesick	3.9	29	events/issues at home
Motivation	3.7	28	losing interest/desire/enthusiasm, staying committed
Before starting	2.1	16	getting everything in order, courage/deciding to do it
Mornings	1.3	10	getting up,putting on cold/wet shoes/socks/clothes
Self-doubt	0.7	5	
Others	35.8	269	
Home relationships	13.7	103	them not wanting you gone, them thinking you're not safe
Lack of others	12.3	92	isolation, friends quitting, losing hiker family
Hiking partner(s)	5.5	41	different speed or ability, disagreements over mileage
Other hikers	4.4	33	negative comments, crowded, unwanted male attention
Environmental	25.3	190	
Weather, Cold	19.6	147	wet, cold
Terrain	8.4	63	steep downhills, crossing waterways, climbing
Weather, Hot	5.7	43	heat, humidity
Weather, General	4.7	35	explicit, no further detail
Bugs	4.0	30	mosquitos
Water sources	1.3	10	finding, treating
Hygeine	1.2	9	lack of showers/cleanliness, dealing with grime and filth
Physical health	27.7	208	
Pain & Injury	18.9	142	stiffness, discomfort, bad knees, foot pain
Physical problems	8.3	62	blisters, norovirus, Lyme, flu, diabetes, giardia
Fear	0.5	4	fear of injury/illness
Physical exertion	27.0	203	
During hike	7.3	55	physical demand, wear and tear on the body
Pre-hike conditionir	5.7	43	being overweight/out-of-shape, getting my trail legs
Fatigue	4.0	30	fatigue, exhaustion, tiredness, worn out
Pack weight	4.5	34	too heavy, too many items, packing correctly, reducing
Pace	2.9	22	too slow, too fast
Mileage	2.5	19	mileage

Table D2 (continued)

Category	%	*n*	Sample In Vivo Descriptors
Logistics	15.0	113	
Finances	6.4	48	finances, money, budget, unemployment, quit job
Travel	5.3	40	resupply, coordinating trips to town, getting hitches, lost
Equipment	3.3	25	optimizing, handling damaged gear returns/replacements
Outcome	11.5	86	
Time constraints	5.7	43	finish before park where final peak is located closed
Thoughts of quitting	5.2	39	temptations to quit, struggle to keep going, fear of failure
Quitting	0.5	4	not finishing, deciding to stop
Food and Sleep	8.5	64	
Food	7.6	57	hunger, weight loss, nutrition, boredom, vegetarian
Sleep	0.9	7	apnea, insomnia, lack, couldn't sleep, loud snorers
Miscellaneous	4.8	36	fear of bears/criminals/dark/lunatics/lightning

APPENDIX E

Study 2 Pre-hike and Post-hike Surveys

In deference to spatial considerations, items not pertinent to results within this thesis (e.g., education, income) are not presented. Also, the spacing and formatting presented here does not reflect that of the actual online survey.

Study 2 Pre-hike Survey

Information Sheet and Informed Consent

Please read the following information. After you have read it, you will be asked if you wish to participate in this study.

Risks and benefits of being in the study:

The study has few risks involved. Some may find the information difficult to disclose, but the likelihood of this harming you in any way is very minimal. No direct benefits are offered to participants. However, study results may be beneficial to the A.T. community.

Compensation:

There is no compensation for participation.

Confidentiality:

The records of this study will be kept private and confidential to the extent permitted by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely and only researchers will have access to the records. Cookies, personal data stored by your Web browser, are not used in this survey.

Voluntary nature of the study:

Participation in this study is voluntary. If you decide to participate, you are free to not answer any question or withdraw at any time, though some questions do require answers to continue participation.

Contacts and questions:

You are encouraged to contact any of the following to ask questions or discuss this project:

Researcher: Vista Beasley

University of Stirling, School of Sport, Sport Psychology Ph.D program, contact information

Research Supervisor: Dr. Robert Eklund, contact information

Ethics Committee University of Stirling School of Sport Research, contact information

CONSENT FORM

I have read the above information.

I have had the opportunity to discuss the details and/or ask questions with Vista Beasley.

I understand the nature and purpose of the study.

I understand what is proposed to be done.

I understand that I am completely free to withdraw from the study or any part of the study at any time I wish.

I understand and agree that my participation in the study is entirely at my own risk.

I understand that this study is a part of a research project designed to promote knowledge.

I understand this study may be of no benefit to me personally.

I understand this study has been approved by the Sports Studies Ethics Committee. The Sports Studies Ethics Committee may wish to inspect the data collected at any time as part of its monitoring activities.

Do you agree to participate in the study?

__ Yes __ No

Please enter today's date, with the format mm/dd/yyyy.

Use of Email Address:
We are asking you to provide your email address. Without the email address, we are unable to include you in the study because the email address is needed to send you the Final Survey, and to connect your First Survey to your Final Survey.
If you provide it, the researcher will use it only for the following purposes:

- to send you links to the Final Survey, and reminders
- to notify you when the study is complete
- to send a summary of the results of this study to you
- to see if you are willing to participate in related studies by this researcher

Your email address will be kept confidential. It will not be provided to any other organizations or researchers unless required by law or University of Stirling's Research Ethics Committee. Your response to emails from the researcher is voluntary and not required.
Please provide your email address here if you consent to being contacted as described above.

Thank you for agreeing to participate in this study.
Please answer the following questions.
For the following question about START DATE:
*If exact date is unknown, please estimate.
I intend to START my A.T. thru-hike on this date:

As you answer questions on the following pages:
- Try to respond to each item separately in your mind from other items.
- There are no "right" or "wrong" answers, so choose the most accurate answer for you—not what you think "most people" would say or do.
- Do not spend too much time on any one item. Do not think too deeply. We are interested in how you react immediately, so please respond quickly.

Below are questions related to the group "A.T. thru-hikers". For this study, the group "A.T. thru-hikers" includes those starting with the intent of completing a thru-hike (2,000+ miles in one year) in 2016.
This group does NOT include day hikers or section hikers.
This group DOES include northbounders, southbounders, and flipfloppers.
For example, if you meet a person in a trail town, they may ask if you are a thru-hiker. As a member of this group, A.T. thru-hikers, you would say "yes" even though you have not yet completed a thru-hike. You answer "yes" to indicate you are trying to do a thru-hike.
Please answer the questions in relation to how you currently think and feel about this group, A.T. thru-hikers.
Please rate your level of agreement with the following statements from 1 (Strongly Disagree) to 7 (Strongly Agree).
Response options for this set of items:

Strongly Disagree	1	2	3	4	5	6	7	Strongly Agree

1. I feel a bond with A.T. thru-hikers.
2. I am glad to be an A.T. thru-hiker.
3. I often think about the fact that I am an A.T. thru-hiker.
4. I have a lot in common with the average A.T. thru-hiker.
5. A.T. thru-hikers have a lot in common with each other.
6. I feel solidarity with A.T. thru-hikers.
7. I think that A.T. thru-hikers have a lot to be proud of.
8. The fact that I am an A.T. thru-hiker is an important part of my identity.
9. I am similar to the average A.T. thru-hiker.
10. I feel committed to A.T. thru-hikers.

11. It is pleasant to be an A.T. thru-hiker.
12. Being an A.T. thru-hiker is an important part of how I saw myself.
13. A.T. thru-hikers are very similar to each other.
14. Being an A.T. thru-hiker gives me a good feeling.

Please rate your level of agreement with each statement from 1 (Disagree Completely) to 7 (Agree Completely).
Response options for this set of items:

Disagree completely	1	2	3	4	5	6	7	Agree completely

1. I identify with A.T. thru-hikers.
2. I see myself as an A.T. thru-hiker.
3. I am pleased to be an A.T. thru-hiker.
4. I feel strong ties with A.T. thru-hikers.

When you think of yourself as an A.T. thru-hiker, how important are the following items? Please rate each item's level of importance from 1 (not at all important) to 7 (extremely important). Response options for this set of items:

Not at all important	1	2	3	4	5	6	7	Extremely important

1. Being mentally tough
2. Trying hard
3. Making friends
4. Completing the thru-hike (2,000 or more miles)
5. Enjoying the experience
6. Not whining
7. Being sensible
8. Being a whit-blaze purist*

* In A.T. lingo, a purist is one who attempts to follow all the white blazes. They might only take a blue-blazed trail if the official, white-blazed trail is not safe because of flooding or bad weather. They might not skip any miles by yellow-blazing (getting a ride to a place farther on the trail). They might not aqua-blaze (taking a route on water, such as in the Shenandoahs) rather than hiking on the white-blazed trail. Some people will extend the purist definition to include no slackpacking, that is, a purist carries a pack the whole way.

The following questions about PAIN refer to
- ache, stiffness, swelling, instability/giving way, locking, or other complaints
- in a joint, bone, tendon, ligament, and / or muscle

This type of pain may be caused by hiking too fast or too hard without rest. It may be called a chronic injury or overuse injury. It may begin as a small, nagging ache or pain. Sometimes the pain goes away on its own. Sometimes it just keeps hurting. Sometimes the pain gets worse gradually, especially if you don't rest enough or treat it early. It may come and go, feeling ok on some days, and worse on others.
Examples of this type of pain are:
- Shin splints
- Arthritis
- Foot or knee pain, with no specific cause
- Back pain, with no specific cause
- Achilles tendonitis
- Stress fracture
- IT band
- Plantar fasciitis

The following questions about pain are NOT referring to pain caused by falling, slipping, tripping, or sudden contact with objects (like running into a tree branch, rock, or table). So this pain does NOT include broken bones, twisted ankles, cuts, or concussions.
The following questions about pain do NOT refer to the pain of temporary discomfort, such as breathing heavy and feeling tired while hiking uphill.
The following questions about pain do NOT refer to infections and illnesses, such as giardia, colds, or Lyme's disease.
The following questions about pain do NOT refer to pain affecting parts of your body other than joint, bone, tendon, ligament, and / or muscle. For example, the pain does NOT refer to blisters, which affects skin.
The following questions about pain do NOT refer to the pain of getting into shape, involving muscular pain when you first start hiking.

For the following questions, pain can be rated from 0 (none) to 10 (worst pain imaginable). Listed below, on the left, are 8 actions. Please rate the MINIMUM amount of pain (0 = none, 10 = worst pain imaginable) you would have to feel in a joint, bone, tendon, ligament, and / or muscle before you would take each action during your thru-hike.

I intend to take this action if I feel *at least* this amount of pain (0 = none - 10 = worst pain imaginable).
Response options for this set of items:

0	1	2	3	4	5	6	7	8	9	10
None										Worst pain imaginable

hike fewer miles in a day
hike a slower pace
take more rest breaks
take an unplanned zero (a day off with no hiking)
take over-the-counter pain relievers (ibuprofen, Tylenol, etc.)
quit my thru-hike
get help from a medical professional

Imagine that *during your thru-hike* you feel pain which is level 4 on a scale of 0 (no pain) to 10 (worst pain imaginable). You are able to walk. You feel this pain every day that you continue your thru-hike. The pain is in your lower body (foot, ankle, knee, or leg), in a joint, bone, tendon, ligament, and / or muscle. The pain is in the same location of your body (such as knee joint). Listed below, on the left, are the same 8 actions. This time, please rate how likely you are to take each action *due to this LEVEL 4 PAIN*. Likelihood can be rated from 1 (Not at all LIKELY) to 10 (Extremely LIKELY).
Rate how likely you are to take each action from 1 (Not at all LIKELY) to 10 (Extremely LIKELY) *due to this LEVEL 4 PAIN*.
Response options for this set of items:

1	2	3	4	5	6	7	8	9	10
Not at all likely									Extremely likely

hike fewer miles in a day
hike a slower pace
take more rest breaks
take an unplanned zero (a day off with no hiking)
take over-the-counter pain relievers (ibuprofen, Tylenol, etc.)
quit my thru-hike
get help from a medical professional

Study 2 Post-hike Survey

What is your email address? ***IMPORTANT: Please use the same email address you used in the FIRST survey. We are pairing your answers from the FIRST survey to answers in this survey using email addresses. If you have a different email address now, please list both.***

I STARTED my 2016 A.T. thru-hike on this date:

As you answer questions on the following pages:
- Try to respond to each item separately in your mind from other items.
- There are no "right" or "wrong" answers, so choose the most accurate answer for you—not what you think "most people" would say or do.
- Do not spend too much time on any one item. Do not think too deeply. We are interested in how you react immediately, so please respond quickly.

The following questions will be about "OVERUSE PAIN".
For this study, OVERUSE pain refers to:
- ache, stiffness, swelling, instability/giving way, locking, or other complaints
- in a joint, bone, tendon, ligament, and / or muscle

Overuse pain may be caused by hiking too fast or too hard without rest. It may be called a chronic injury. It may begin as a small, nagging ache or pain. Sometimes the pain goes away on its own. Sometimes it just keeps hurting. Sometimes the pain gets worse gradually, especially if you don't rest enough or treat it early. It may come and go, feeling ok on some days, and worse on others.
Examples of OVERUSE PAIN are:
- Shin splints
- Arthritis
- Foot or Knee pain, with no specific cause
- Back pain, with no specific cause
- Achilles tendonitis
- Stress fracture
- IT band
- Plantar fasciitis

The following questions are about OVERUSE PAIN you felt during your thru-hike attempt.
The following questions are NOT referring to pain caused by falling, slipping, tripping, or sudden contact with objects (like running into a tree branch, rock, or table). So overuse pain does NOT include broken bones, twisted ankles, cuts, or concussions.
The following questions about pain do NOT refer to the pain of temporary discomfort, such as breathing heavy and feeling tired while hiking uphill.
The following questions about pain do NOT refer to infections and illnesses, such as giardia, colds, or Lyme's disease.
The following questions about pain do NOT refer to pain affecting parts of your body other than joint, bone, tendon, ligament, and / or muscle. For example, overuse pain does NOT refer to blisters, which affects skin.
The following questions about pain do NOT refer to the pain of getting into shape, involving muscular pain when you first start hiking.
Below, you are asked about OVERUSE pain that you felt during your 2016 thru-hike attempt. If you're not sure if it was overuse pain, go ahead and include it.
Space is provided for 5 different overuse pains.
For example, these would count as 5 different overuse pains:
1. Back pain, lower back
2. Shin splints, right leg
3. Plantar fasciitis (foot pain), both feet
4. Tendonitis, left ankle

5. IT band, left knee
If you had more than 5 overuse pains, use the 5 that hurt the most.
Please describe one overuse pain at a time. For each pain, you will answer two questions.
Please give as much information as you can. The more information you provide, the more we can learn for the sake of future thru-hikers.

During your thru-hike attempt: Did you feel OVERUSE pain as described above?
_Yes _No
Pain # 1. Please describe your first overuse pain and its location. Example: Back pain, lower back
Pain # 1. Please describe how the pain started, and what you think CAUSED the pain. If you experienced the pain prior to starting the A.T., include that information here.
Did you experience another overuse pain during your thru-hike attempt?
_Yes _ No
[Those who answer yes were routed through the same series of questions for pain #2, #3, #4, and #4. Those who answer no were routed to the next set of items.]

How much did it hurt?
For your MOST painful overuse pain: Rate the level of pain you felt, from 0 (none) to 10 (worst pain imaginable). Please select exactly 1 answer.
Response options for this set of items:

0	1	2	3	4	5	6	7	8	9	10
None										Worst pain imaginable

Which one of the following best describes your experience with your MOST painful overuse pain? Please select exactly 1 answer.
A. I did not feel the pain while hiking. The pain usually started sometime after I stopped hiking, but did seem to be related to the hiking.
B. I felt the pain sometimes while I was hiking, but I was able to keep hiking. I did not have to change my hiking in any way.
C. I felt the pain while I was hiking. I had to decrease my hiking, or stop hiking, because of the pain.
D. I felt the pain any time I moved. I felt the pain while hiking, AND even when I was not hiking.

For the next question: Medical professionals include doctors, physicians, chiropractors, physical therapists.
During your thru-hike attempt: Did you go to a medical professional because of overuse pain?
No
Yes
No, but I went to a massage therapist
Other (please specify)

During your thru-hike attempt: About how many total DAYS did you feel overuse pain? Only include days within the dates of your thru-hike attempt. For example, if tendonitis started on Day 100, and you finished your thru-hike on Day 136, you would answer 36 days, even if the pain continued for months after you finished.

About how many unplanned ZEROS did you take BECAUSE of overuse pain? A Zero is a day in which you hiked zero miles.

What DATE did you STOP your 2016 thru-hike attempt? If you completed the trail, please enter the date you completed it. If you did not complete the trail, please enter the date you left the AT, knowing you were not going to complete a thru-hike this year.

Do you know the approximate number of miles you hiked on the AT, out of 2,190 miles?
If yes: The number of miles I hiked in my 2016 thru-hike attempt was __.
If no: Please provide as much information as you can to help the researcher calculate the number of miles. For example, "I hiked north from Springer Mountain to Harper's Ferry, West Virginia. Then I flip-flopped, starting at Mt. Katahdin, going south. I stopped hiking near Norwich, Vermont.

For this study, *completion* means you hiked 2,000 or more miles of the A.T. within a one-year period. For example, if you hiked 2,010 miles, aqua-blazed (kayaked) 100 miles in Virginia, and yellow-blazed (skipped) some other miles, between March and August this year, this would be considered a completed thru-hike. By this definition, did you complete your 2016 A.T. thru-hike?
_No _ Yes

APPENDIX F

Graphs of Simple Slopes (Study 2)

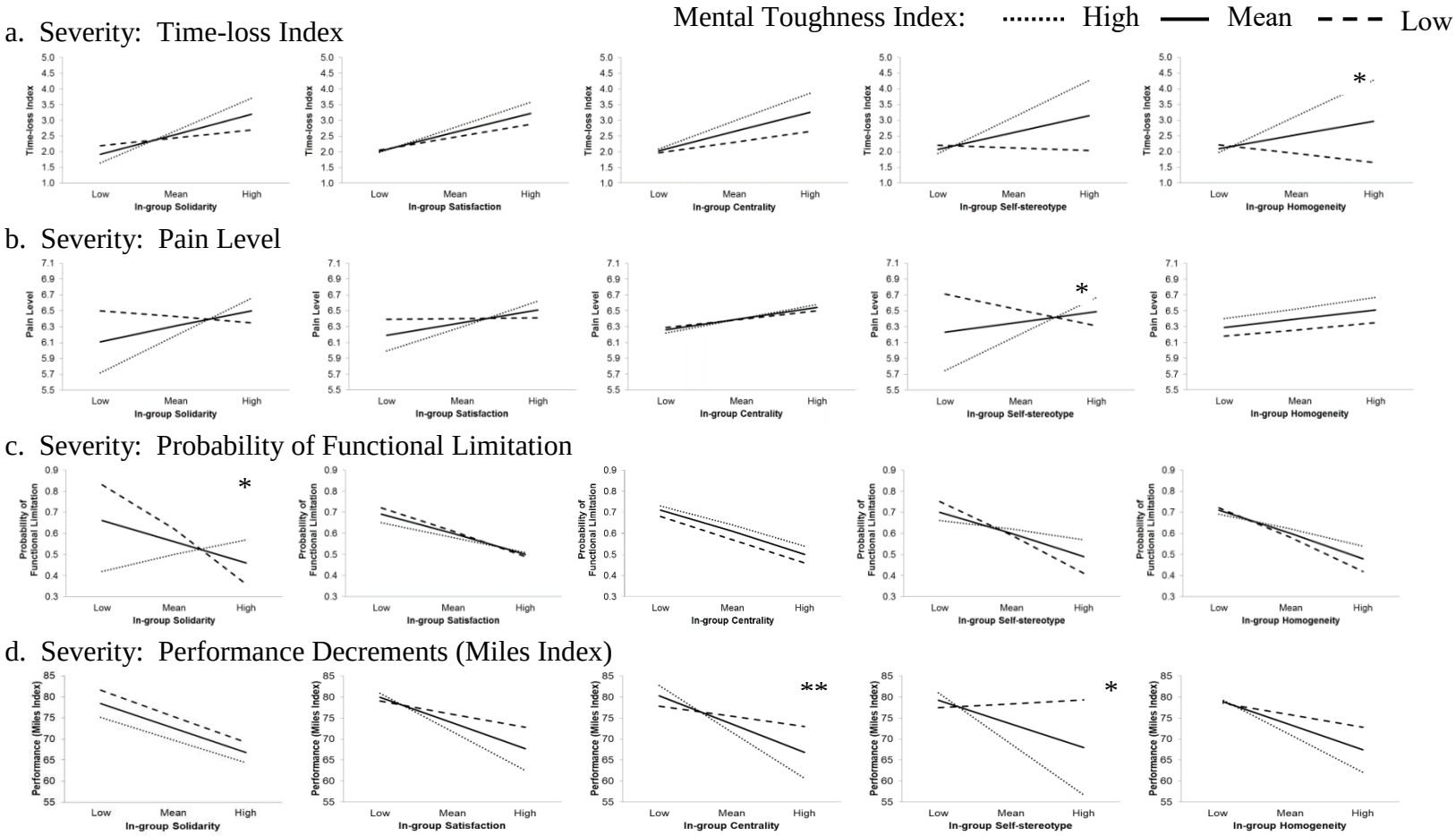


Figure F. Graphical representations of simple slope analyses with social identification in-group identification sub-scales as predictors (horizontal axis), mental toughness as moderator, and overuse injury pain severity as outcomes (vertical axis).

*$p < .05$, **$p = .06$

APPENDIX G

Informed Consent Gym Owner (Study 3)

INFORMATION SHEET

This research study will explore psychological factors related to participation in high-intensity, group physical training programs such as those found in military, law enforcement, and CrossFit® settings. Your CrossFit® gyms were selected as possible venues to conduct this study.

This study is being conducted by Vista Beasley, a former CrossFitter, as part of a Ph.D program in Sport Psychology, approved by the University of Stirling.

Psychological factors I am studying include, but are not limited to, social identity, mental toughness, pain/injury experiences, effort, self-presentation concern (worry about how others evaluate/perceive you), shame/pride, and passion. Others may become apparent during this study.

Please read the following information and ask any questions you may have. After you have read it, you will be asked if you will permit this study to be conducted at the premises of your CrossFit® gyms.

Procedures:

If you agree to allow me to conduct this study at your gyms, I would do the following things:

- **Observations:** I would observe members and trainers during sessions over an estimated two-month period. I may take notes to document what I see and utterances I hear. I may engage in brief, informal conversation with members/trainers prior to and after sessions, but not during sessions due to safety concerns. I would attend sessions randomly, with no advance notice, yet balance my observations over the days and time slots. In addition, if you grant permission, I would observe competitive athlete training sessions; Foundations classes; staff meetings and/or training sessions.

- **Interviews:** In addition to observations, members, trainers, gym owners, and medical staff may be asked to participate in one or two interviews which take approximately an hour each and will be conducted outside of the gym. I will seek interviewees with a full range of characteristics including membership duration (new vs. longtime members); performance (meets/does not meet WOD prescriptions); competitive status (attends workouts vs. competitions); injury experience (none; acute; overuse; returned from); age; athletic backgrounds; trainers; medical staff. I may ask your assistance in soliciting interviewees via your gym's websites, and/or emails to members.

- **Archives analysis:** If you allow, I will access data archives and online materials that may be relevant to this study.

To maintain my role as an independent researcher, my activities related to data collection, analyses, or research dissemination cannot be directed by gym owners, but input is welcome.

Risks and benefits of being in the study:

The study has few risks involved. Some members at your gyms might feel self-conscious about being observed. I recommend a notice be posted to explain my presence at the gym; I have drafted a sample notice for your consideration. Interviewees may find some information difficult to disclose, but the likelihood of this harming them in any way is very minimal.

No direct benefits are offered to you, nor to those I observe, nor to those I interview. However, study results may increase understanding of how psychological factors affect well-being and behaviours in the training environment. On a wider scale, this could help establish recommendations for enhancing healthy adoption and adherence in high-intensity programs.

Compensation:

There is no compensation for participation.

Confidentiality:

The records of this study will be kept private and confidential to the extent permitted by law. In any sort of report we might publish, we will make every effort to not include information that will make it possible to identify you, your gyms, gym members, or trainers. If there is any information that is unique to your gym, making it easily recognizable (e.g., 2 owners, operating since 2013), please inform me.

Researchers will additionally protect the anonymity and confidentiality of members who are observed and participate in the interviews. We cannot inform you, the trainers, or members, of the identities of trainers or members who participate in the interviews. We cannot release to you, the trainers, or members, any specific information resulting from these interviews that would identify the interviewees. Gym owners, trainers, and members can only view the reports resulting from this study, as approved by my supervisor, ethics committee, and, if applicable, publishers, but cannot view the notes and recordings that may make participants identifiable. Results will not include factors identifying individuals, individual contributions, or any form of evaluation of individual performance.

Research records will be stored securely and only researchers will have access to the records. Physical records (e.g., notes) will be stored in locked areas; digital records will be stored in password-protected computers.

Voluntary nature of the study:

Participation in this study is voluntary. If you grant permission for this study to be conducted at your gyms' premises, you are free to withdraw permission at any time, either in whole, or for specific components of the study.

Contacts and questions:

You are encouraged to contact me, my supervisor, Dr. Bob Eklund, or my University's Ethics Committee, to ask questions or discuss this project.

Contacts and questions:

You are encouraged to contact any of the following to ask questions or discuss this project:

Researcher: Vista Beasley
University of Stirling, School of Sport
Sport Psychology Ph.D program
Contact information

Research Supervisor: Dr. Robert Eklund
Contact information

Ethics Committee
University of Stirling School of Sport Research:
Contact information

APPENDIX H

Notification of Study on Gym Premises (Study 3)

NOTICE:

Research study being conducted on CrossFit® gym premises

December 15, 2014 – February 12, 2015

My name is **Vista** Beasley. I am a **Ph.d student in sport psychology** at University of Stirling (Scotland). I have a Masters in Sport Psychology from F.S.U. I am a **former CrossFitter**.

If you see me around the gym and wonder **what I'm doing**:

I'm doing a research study about **psychological factors of CrossFit® participation.** This has rarely been formally studied, so the findings may be valuable to our CrossFit® community.

The **owners** of this gym have given me **permission to observe** CrossFit® sessions on these premises from December 15, 2014 - February 12, 2015.

- I will be taking **notes** to remind myself of what I observe.
- All members will remain **anonymous** in my observations and my study.
- I am not evaluating physical ability.
- You are welcome to talk with me or ask questions when you see me.

If you have any immediate questions or concerns about my presence, please notify your trainer if you do not wish to discuss them with me.

You can also contact:

This study is approved by University of Stirling **Sport Psychology** program for a Ph.D research project.

Gym owner: xxxxxx
Email: xxxxxxxx; Phone: (xxx) xxx-xxxx

Researcher: Vista Beasley
Email: xxxxxxxx; Phone: (xxx) xxx-xxxx

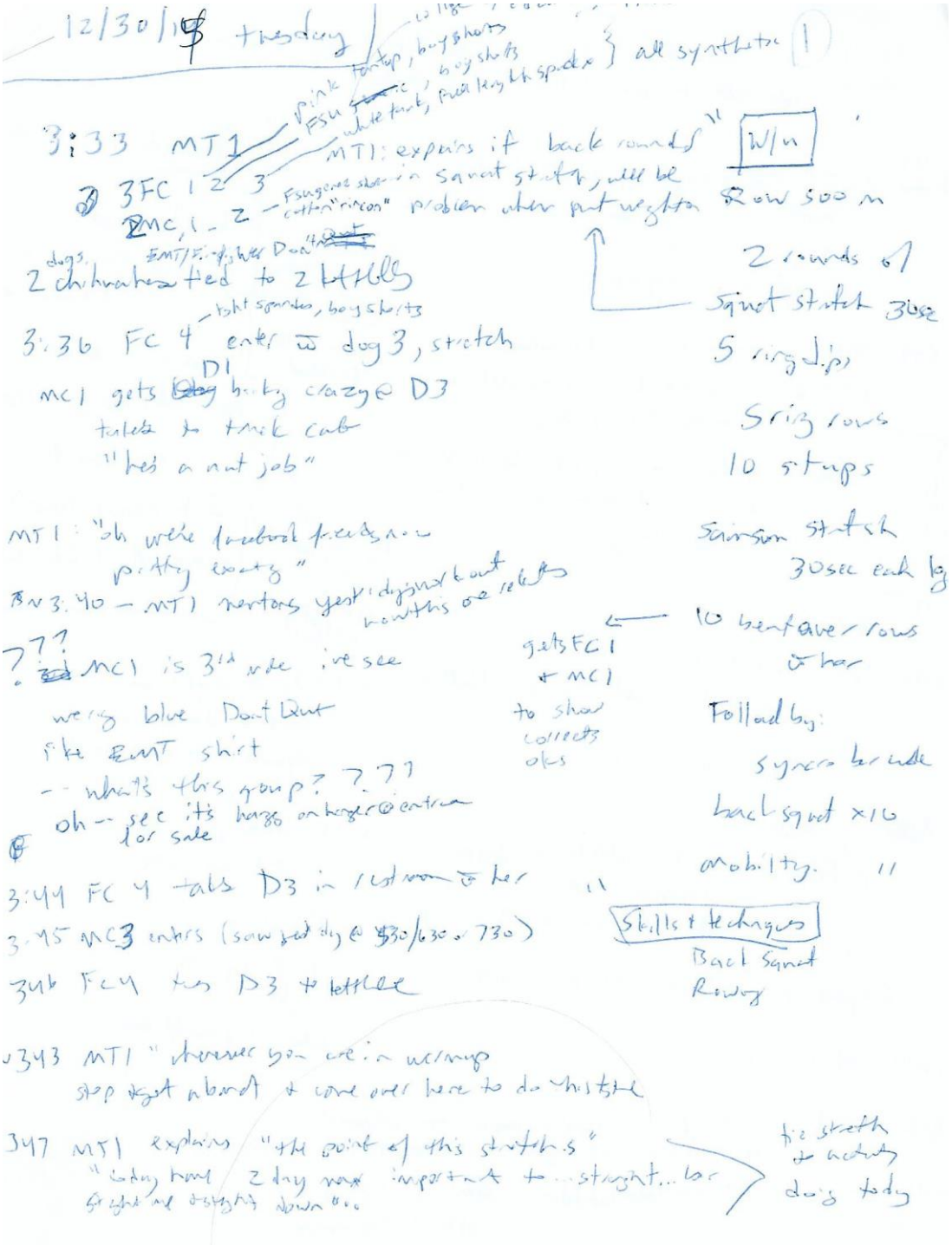
Research Supervisor: Dr. Robert Eklund
Email: xxxxxxxx; Phone: (xxx) xxx-xxxx

Ethics Committee University of Stirling School of Sport Research:
Email: xxxxxxxx; Phone: (xxx) xxx-xxxx

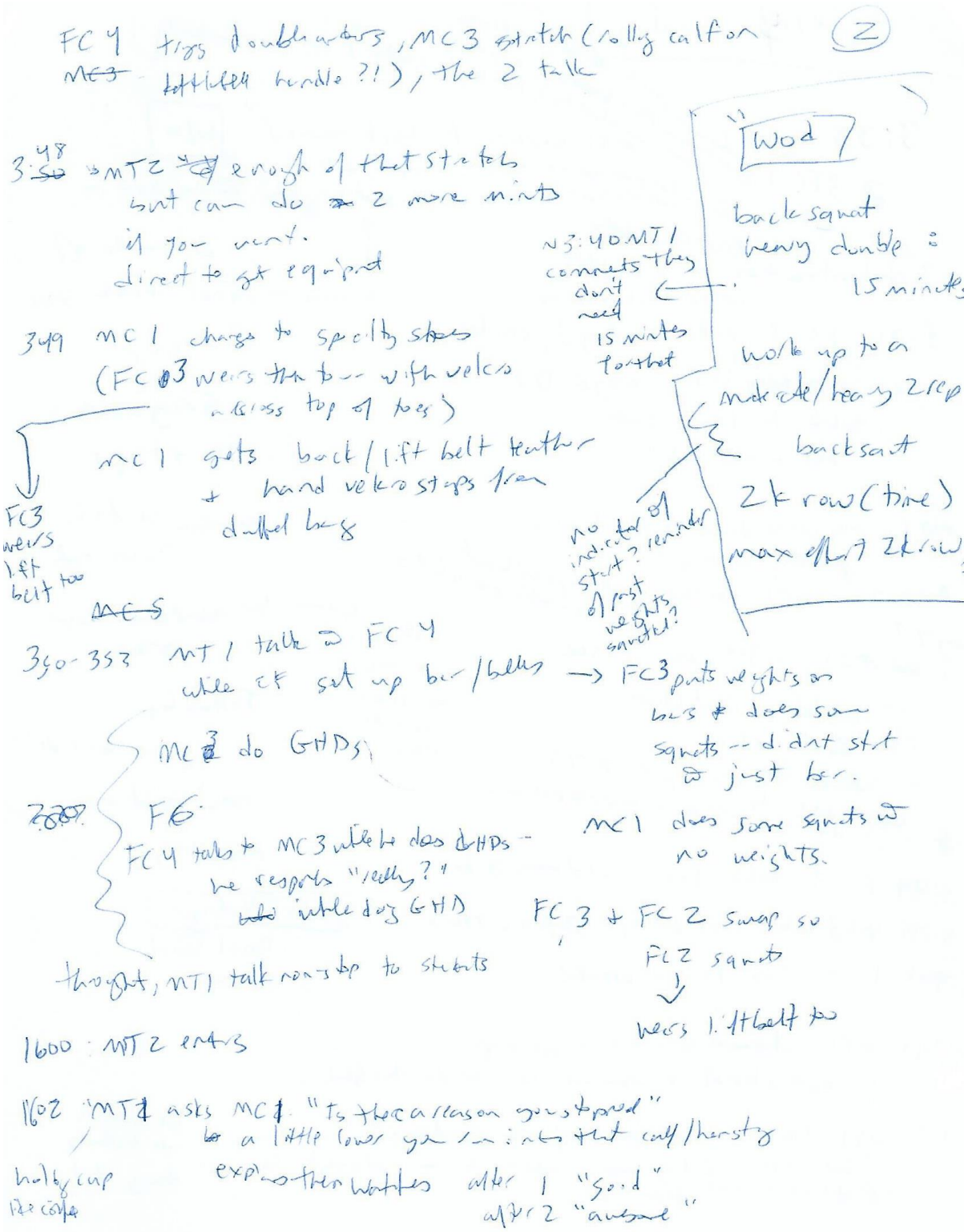
APPENDIX I

Sample Jottings / Field Notes (Study 3)

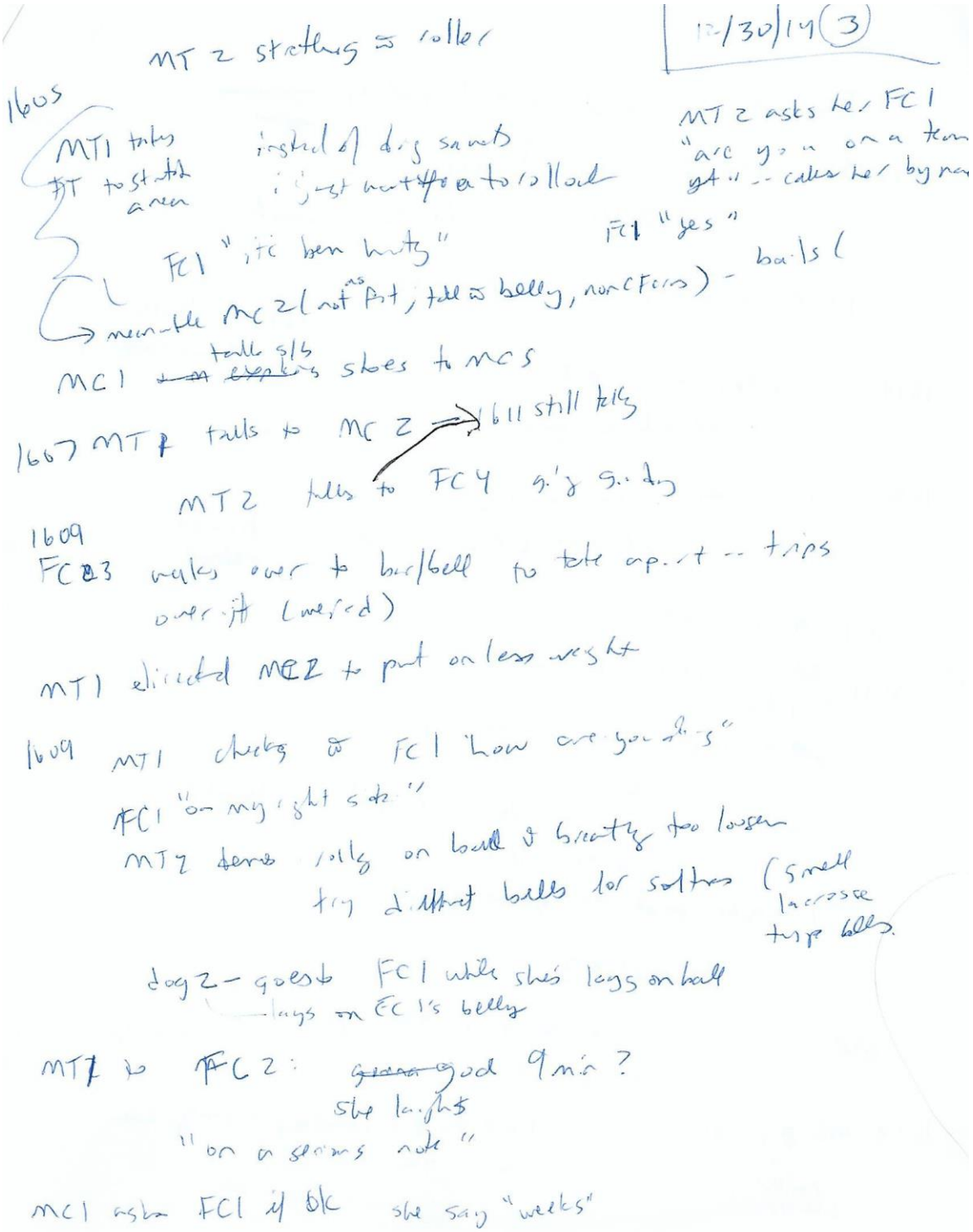
Sample Jotting 12/30/14 Page 1



Sample Jotting 12/30/14 Page 2



Sample Jotting 12/30/14 Page 3



(4)

FC 3 to MC1/MC3: was bled's yestrday ~~Cath velcro~~ ~~wraps~~

1613 MT1 asks FC 1 if okay
tells her "on the row i went "

FC 3 nortaly to MT2 + FC5
1613 -- think i know MC 1

1614: MT1 to MC3
"let me show you"

1615 FC goes to row machine
MT1 directs all to set up rowers "turn on... select."

MT1: "any questions"?
1617 MT1 Start: turns up music
3 2 1 Go
"nice guys use those legs"
MT2: "tired"
MT1: "can't be tired got — tonight"
→ back to roller

MT1 stands beside MC gives guidance

MT talk to MC 3

~~MT~~ 1:39: MT1 back to MC1, then go to each rower
then take photos

~1624 MC 4 enter -- joins MT2 + MC3 in stretching area
roller achilles — roller on lacross ball

Sample Jotting 12/30/14 Page 5

12/30/14 (5)

5:23 MC1 clock starts
MT1 verbally encourages to FC 3
↳ continues w/ ☺
7: FC 3 stop
7:05 MC 1 stop
7:18 MC 2 stop

7:28 MT to FC2
"come on" claps hands
loot ~~Hbt~~
counts strokes
8:02 FC2 stops "told you you could do it"

MT1 goes over to FC1:
825 FC stops

MT1 "great job guys" reminds em to input 2 squat max
↳ talks to FC 2:
"you can definitely get more power out of it"
MT1 "coffee - more of it all the time"

~~FC~~ MT2 to FC4: you're a dog, is sitting on my shoe
FC4 goes for jog w/ dog - (gone < 1 min jog)

Sample Jotting 12/30/14 Page 6

(6)

d. I was
mult workout tomorrow (new years eve so ↓ hours)

FC3: "getting off work early just to do it"

.. depends on what is"

MT 1: be sure to sign up for ~~next~~ ~~to~~ 230 or be cancelled

430 MC3: puts on braces on L knee + specialty shoes

discuss thin, can running

FC3 asks how much "185" but mystery how do that but only 20s"

MC3 "nice" / My bench is 100 .. express surprise "but, don't work on it"

FC2 "don't know how much whats yours 115 ← FC2

FC2 gotta go to work ' impressed but youll improve bench by 20 lbs in 1 time

432 FC3 + MT1 → discuss new years eve from not doing!"

FC3 says she'll try it.

play video games late she gets mad not go out

MT1 direct new class to corners

no one in 430 class stretches after no cooldown FC3 sits on bench

430 class — haven't stayed up for

5 . MC2 —

Sample Field Note 12/30/14, Page 1

12/30/2014, Tuesday, Class: 1530 – 1630, Gym: 1

3:33 MT1, 3F, 2M

FM7 pink tank top, boy short
FM8 local university college of education cotton, boy shorts
FM9 white tank top, full length spandex
MM14 blue CrossFit® shirt
MM15 cotton Puerto Rico Rincon

Warmup
Row 500m
2 rounds of
Squat stretch 30 sec
5 ring dips 5 ring rows
10 stitups
Samson stretch 30 sec each leg
10 bentover rows with bar
Followed by:
Synchro bar work
Back squat x 10
Mobility
Skills and techniques
Back squat
Rowing

Two chihuahas Dog2 and Dog3 are tied to kettlebells. Rowing machines are set up in the middle of the workout area.
Attendees are doing squat stretches. MT1 explains if back is rounded in squat stretch that will be a problem when put weights on. As they do the bentover rows (with bars, no weights), he gets everyone to watch FM7 and MM14, gets them to do again, corrects, then approves.
3:36: FM10 (spandex tank top, boy shorts) enters with Dog4 and stretches. Dog4 stays near her without being leashed. Dog2 barks at Dog4. MM14 stops working out to get Dog2, saying he's going to put him in the truck cab because "He's a nut job". In the distance MT1 tells one of the FM "Oh we're Facebook friends now, pretty exciting".
3:40 MT1 mentions yesterday's workout, relating it to something they're doing today.
3:44 FM10 takes Dog3 in restroom with her, then ties Dog3 to a kettlebell.
3:45 MM16 enters (was there yesterday, think he was in session before the ones I watched 4:30).
~3:43 MT1 directs class "Whereever you are in your warmup", stop and get abmat and come over here to do wall stretches.
3:47 MT1 explains "The point of this stretch is…". Today we have the 2-rep max…important to…straight…bar…straight up and straight down." *I found it interesting that he tied the stretching to the activity they were going to do.* FM7 was trying to do doubleunders, talking to MM16 who is rolling calf on kettlebell handle.
3:48 MT1 tells class they've done enough of that stretch but can do 2 more minutes "if you want" and directs them to get equipment.

Sample Field Note 12/30/14, Page 2

The screen displays:
WOD
Back squat heavy double: 15 minutes
Work up to a moderate/heavy 2 rep backsquat
2k row (time
Max effort 2k row

I wondered how they would know what weights to start at for the backsquat. Would they be reminded of past weights squatted?
MT1 comments that they won't need 15 minutes.
3:49 MM14 changes into some sort of specialty shoes, with 2 velcro straps covering base of toes and below ankle. He takes weightlifting belt and Velcro straps (for hands) out of duffle bag. FM9 wears those kinds of shoes too, and also puts on a weightlifting belt.
3:50: MM14 talks with FM10. FM9 puts weights on bars and does some back squats—didn't start with just bar. MM16 does GHDs; FM10 talks to him while he does them. He responds "Really?" while doing a GHD. MM14 does some back squats with bar with no weights. Throughout preparing for back squats (positioning pegs, placing bars on pegs, loading some weight), MT1 converses with class.
1600 MT4 enters.
1602 MT1 asks MM14 (who is doing back squats) "Is there a reason you stopped?". I don't hear MM14's response but then hear MT1 saying "a little lower you run into that calf, hamstring…". MT1 watches MM15 do two backsquats. After first one MT1 says "good". After second one MT1 says "awesome". While observing/talking, MT1 holds what looks like coffee cup. FM8 and FM9 take turns using the same bar/weights. FM8 also wears a weightlifting belt. MT2 is in stretching area on a foam roller.
1605 MT1 takes FM7 to stretching area, saying "Instead of doing squats, I just want you to roll…" I hear FM7 say "It's been hurting". As FM7 approaches stretching area, MT2 says her name and asks "Are you on a team yet?". FM7 answers yes. Meanwhile, MM15 (not as fit; tall with a bit of belly protruding) has to bail on his back squat (i.e., as he attempts to push up, he can't, so he throws bar and weights from his shoulders onto ground behind him). MM14 and MM16 discuss shoes. MT1 goes over and talks to MM15. MT2 and FM7 talk > 5 minutes. FM9 walks over to her bar/weights which are on the floor; as she gets to it, she somehow trips over the weight (which is attached to bar). She begins disassembling it. MM15 puts a less-heavy weight on his bar. MT1 goes over to stretching area and asks FM7 "How are you doing". Her response indicates the problem is on her right side. MT1 demonstrates rolling on ball (small, lacrosse type), while lying on floor with ball under back. He explains something about breathing to loosen and trying different balls for softness. FM7 lies on floor and begins rolling on ball. Dog2 (belongs to MM14) goes over to FM7 and lies down on her stomach; she pets while rolling. The class is preparing for the row portion. MT1 says to FM8 "9 minutes?" She laughs. MT1 says "On a serious note…." And begins explaining something (can't hear what). MM16 asks FM7 if she's ok. Her response indicates she's been having this problem for "weeks". FM9 is talking to MM14 and MM16, saying "it was bleeding yesterday".
1613 MT1 asks FM7 if she's ok. He tells her "On the row I want…"
FM9 now talking to MT2 and FM8; they laugh.
1614 MT1 says to MM16 (not in class) "let me show you" and demonstrates something with a kettlebell.
1615 FM10 goes to row machine. MT1 directs class to set up rowers (for 2k) explaining which buttons to press "Turn on…Select…". MT1 asks "any questions?".
At this point, I see Dog4 has walked outside.

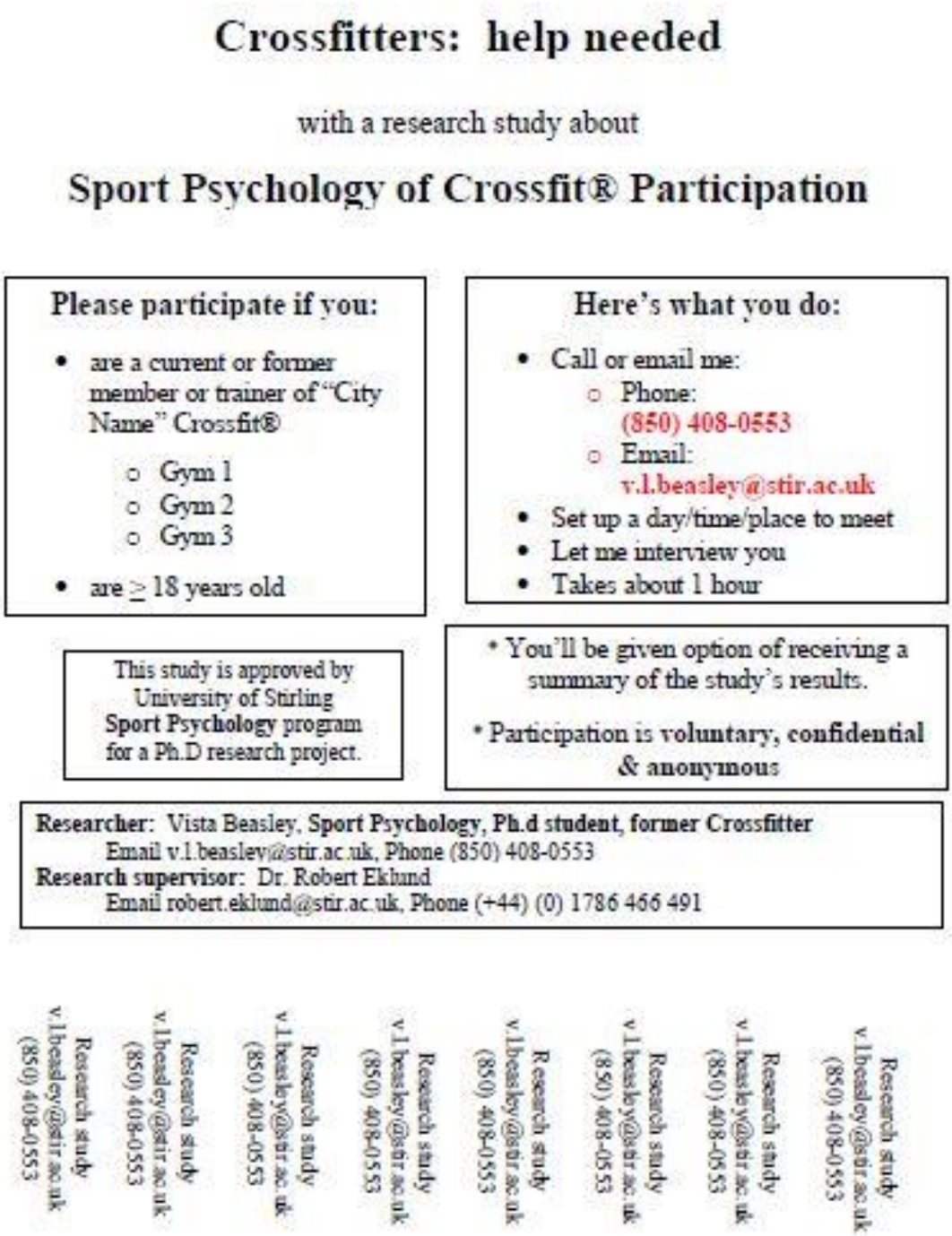
Sample Field Note 12/30/14, Page 3

1617 MT1 start ("3, 2, 1, go") and turns up volume of music with fast beat.
MT1 says "Nice, guys, use those legs". MT2 says to MT1 "Tired." MT1 says "Can't be tired. Got…tonight." MT2 goes back to foam roller.
MT1 stands beside MM14 (on rower); I see he's speaking to him (can't hear). MT1 then talks to MM16 (not in class).
~1:39 into row: MT1 goes back to MM14, then goes to each attendee on each rowing machine then takes photos.
1624 MM17 (~6'5", slim) enters, joins MT2 (foam roller) and MM16 (rolling leg on lacrosse ball) in stretching area. MM17 uses foam roller on Achilles area.
5:23 into row: MM14 clearly straining (face grimaces). MT1 gives continuous verbal encouragement to FM9.
FM9 finishes first, then MM14, then MM15. MT1 goes to FM8 and says "Come on" and claps hands. He counts strokes out loud. When she stops, he says "I told you you could do it" (she's the one he'd asked if she was going to do 9 minutes).
MT1 goes over to last one still rowing, FM7 (one who had to stop squats and roll) and stays by her side til she finishes.
MT1 says "Great job guys". He reminds them to input the 2 squat max. He tells FM8 "You can definitely get more power out of it" (talking about her stroke). MT1 makes a comments "Coffee. More of it, all the time."
MT2 is sitting on bench beside me now, changing shoes, talking with FM10. He tells her: "Your dog is sitting on my shoe." FM10 says she's taking dog to jog with her. Dog4 and FM10 walk out rear door of building. Less than one minute later they return.
FM8 sits beside me on bench. FM9 is on bench next to us. The two talk about new years plans. The gym is having different hours on New Years eve (not having evening sessions), so FM9 said she was "Getting off work early just to do it". FM8 indicated going for her "depends on what it is" (meaning if she liked the workout activities, she would go). MT1 said aloud in general "Be sure to sign up for 230 or it will be cancelled" (ie if enough people didn't sign up for New Years eve class, they'd close early.)
430 MM16 puts on brace on left knee and specialty shoes and discusses with FM9 that he likes some piece of equipment because it's "thin, can run in it".
MM16 asks FM9 about the weight of her back squat today . She says "185". He says "nice". FM9 says "but it's a mystery how I can do that but only do" indicating a much lower weight on some other lifting activity. FM8 asks her how much her bench is. She says 100. FM8 expresses surprise. FM9 says "But I don't work on it". FM9 asks FM8 what she benchpresses. FM8 says "115". FM8 then said that FM9 should try lifting without knowing what weights are on. She improved her bench by 20 pounds in 1 time from not knowing. I commented I thought that was interesting. FM9 said she was going to try it. FM8 had to go to work. FM9 and MT1 discuss New Years eve. MT1 said "she" (unknown) gets mad when he plays video games late instead of them going out. FM9 laughs saying it's been years since she stayed up all the way to midnight.
I don't see anyone from 3:30 class stretching after workout—no cooldown after 2k max row.

Tuesday, 12/30/14 observations typed up next day, Wednesday, 12/31/14, 12pm – 2:52pm.

APPENDIX J

Recruitment Flyer for Interviews (Study 3)



APPENDIX K

Interview Guide (Study 3, Page 1)

A. Thank you for giving up the time needed to help with this study.

B. Why you were selected (Participant credentials / point of view):
- Member vs instructor vs owner
- Gender
- Competitor vs non-competitor
- Age
- Participation duration (new to it, done long time)
- Identified as mentally tough in this context
- Improved
- Identified as impressive in regards to non-performance-based characteristics
- High performance
- Quit program
- Injury experience
- Observed using poor form or non-compliance with injury prevention recommendations
- Other:

C. Review informed consent form

D. Demographics:
- Gender:
- Role: Member (Past, Current), Trainer, Owner, Medical Staff
- Email address / Phone #:
- Age:
- How long participated / When did you start CrossFit®:
- How often do you participate in CrossFit®?
- How long (time / miles) does it take you to get to CrossFit® gym?

E. Questions:

1. Please tell me your personal history in regards to sport and exercise, and how you came to be involved in CrossFit®.
[POSITIVE DISTINCTIVENESS]
- You could do other exercise programs. What made you choose CF instead of other types of physical training?
- What made you want to try CrossFit®?
- How did you hear of it?
- What reactions did others give about your decision to start CrossFit®?

Interview Guide (Study 3; Page 2)

2. What do you like about CrossFit®, and what do you dislike about CrossFit®?
[POSITIVE DISTINCTIVENESS]

- How is that different from what you like/dislike about other exercise activity you've been involved in?
- What has made you continue being involved in CrossFit® (What made you decide to quit?)
  How is that different from people who try CrossFit® but decide to quit?
- When deciding whether to quit or keep going, what moments, if any, were key, leading up to that decision? What happened and what were your thoughts?
- Based on ___, CrossFit® seems to be important to you. If it is, what makes being a CrossFit®ter important to you? [If being a CrossFit®ter is not important to you, we can discuss reasons for participation despite its unimportance.]
- In other programs you could get the same benefits like fitness. What specifically about CrossFit® makes you use it for exercise rather than other exercise programs?

3. How would you describe CrossFit®ters to someone who is not involved in CrossFit®?
[IN-GROUP HOMOGENEITY]

- What, if anything, do you have in common with other CrossFit®ters?
- How is that different from what you have in common generally with people in other exercise programs or people who stay in shape in general?
- How is that different from CrossFit®ters at the other gyms in *city name*?

4. What, if any, criticisms have you heard about CrossFit®ters?
[SOCIAL THREATS]

- If none: Examples of criticisms I've seen in articles I've read about CrossFit® imply that it's a cult, or that it's dangerous.
- How do you respond to those criticisms?
- Despite them, what makes you remain committed to being a CrossFit®ter?

5. Who at your CrossFit® gym impresses you most? Please describe that person.
[PROTOTOTYPICAL GROUP MEMBERS; SOURCES OF IN-GROUP STATUS]

- What about them impresses you? What do they do that impresses you?
- If you want to be perceived favorably by other CrossFit®ters, what do you need to do during a WOD? Please describe something you can actually do, not an ideal.
- What makes you think this is what is needed to be perceived favorably?
- If numerous cited: What is the one thing you could do to gain the most approval?
- If you want to be perceived favorably by the *CrossFit® trainers*, what do you need to do during a WOD?
- How does whether or not you can meet the prescribed weights in the WODs figure into this?
- How does whether or not you participate in competitions figure into this?

6. Imagine that CrossFit® shirts had to be earned. You couldn't just buy one. You couldn't just be a member of CrossFit® gym. What do you think would be the criteria to be allowed to own and wear the shirt?
[SOURCES OF IN-GROUP STATUS]

- What's something you have to *do* to earn it?
- I'm wondering if you have ever been praised in regard to a WOD. If so, what are things you've been praised for about what you did during a WOD? By a trainer? By other CrossFit®ters? By non-CrossFit®ters? Are these actions worthy of a shirt? Why or why not?

7. How does pain figure into CrossFit® participation?
[PAIN REPORTS]

- If you have any personal experiences, please describe them, and also feel free to describe your observations of others' experiences with pain.
- When you started CrossFit®, if you experienced pain, what was the pain you experienced like, and how did you cope with it?
- In regards to pain during CrossFit® workouts, how did you decide whether to stop or keep going?
- When you're doing an AMRAP that you've done before, you know what your past number of repetitions was. So imagine the situation where you are now at the number you got last time. If you get one more repetition, you'll beat your max. Assuming you have to strain to get one more repetition: how do you know whether to keep trying or to stop?
- When you're doing a WOD, at what point, if any, do you take a rest break?
- There is pain and fatigue that comes with hard exercise, but there's the pain that may indicate the onset of injury. How do you distinguish between the two in relation to your CrossFit® participation?
- If you stopped in a WOD due to pain, how do you think your trainer and classmates perceived you?
- When observing, I often hear CrossFit® members talking about how sore they are. It almost sounds like they're proud of that. What is your take on this**?**
- Two CrossFit®ters do a WOD. Immediately afterwards, one is lying on the ground, breathing heavily, apparently unable to move. The other remains standing, walks around to other people, talking and joking. How do you explain the difference?

8. What is your take on the occurrence of injury in relation to CrossFit®?
[Injury]

- If you've had any experiences with injury related to CrossFit® participation, please describe those experiences. You can also discuss examples you've heard of others' injury experiences with CrossFit®.
- What is the longest amount of time you've missed CrossFit®® workouts because of pain or injury? In general, how much have you missed because of pain or injury?
- What, if anything, do you think is done in the CrossFit®® environment to prevent injury?
- What have been your observations regarding form? How do you explain the use of poor form? How do you think other members and the trainers should respond when they see poor form?
- Imagine today's WOD is an AMRAP. The person you're counting reps for does 20. The last two were very poor form. Should 18 be recorded on their daily results, or should 20? What is your reason for the number you select?
- If you have expressed concern about injury to other CrossFit®® class members, how did they respond? If you haven't expressed concern about injury to other CrossFit® class members, how do you think they would respond if you did?
- If you have gone to CrossFit® trainers expressing concern about injury, how did they respond? If you haven't expressed concern about injury to CrossFit® trainers expressing concern about injury, how do you think they would respond if you did? What would they say/do? How would they treat you afterwards?
- Some CrossFit® athletes who have experienced chronic or overuse injury might think it was their own fault. Some might think CrossFit®—whether the trainers, or atmosphere, or gym—didn't do enough to prevent or help with injury. What are your thoughts on this?

G. Thinking over everything we've talked about, are there any questions you want to ask? Are there any comments you want to make about anything we've discussed? If you think of anything after we leave, you're welcome to call or email with any more thoughts you have that you think would help with this study.

H. Who do you think I should talk to to learn more about the topics we covered today?

I. Next: I'll transcribe the interview and email the transcript to you. You can look it over and tell me if you agree with your statements or wish to add anything or clarify what you said.

J. As study progresses, I may develop more questions. Would you be willing to participate in another interview if needed?

K. I cannot limit or restrict you in any way. I request that you not discuss the content of this interview in depth with other CrossFit® members until after the interview portion of this study is over. This way, other members can be interviewed without being biased by what they hear from you. If you provided your email address, I will email you to let you know when the interview portion is over so you'd know you're free to discuss this interview with others without affecting the study.

L. Thank you for helping with this study.

APPENDIX L

Informed Consent Interviewees (Study 3)

INFORMATION SHEET

You are invited to be in a research study to identify psychological factors related to those involved in CrossFit® programs. This study is being conducted by Vista Beasley, a former CrossFitter, as part of a Ph.D program in Sport Psychology, approved by the University of Stirling. Psychological factors I am studying include, but are not limited to, social identity, mental toughness, pain/injury experiences, effort, evaluation concerns, shame/pride, and passion. Others may become apparent during this study.

You were selected as a possible participant because you are or have been involved in a high-intensity, group exercise environment, CrossFit®. You are invited to participate if:

- You are a current or former member or trainer at CrossFit® gyms owned by _____.

- You are 18 years old or older

After you have read it, you will be asked if you wish to participate in this study.

What participation involves:

If you agree to participate, you would be interviewed in person by researcher Vista Beasley. Questions will be asked about your CrossFit® membership such as ability, attendance, and other aspects. The interview is estimated to last approximately 60 minutes, and will occur at a public location convenient to you.

If needed, a second interview may be requested based on questions that arise from observations that occur after your first interview.

If you permit the interview to be recorded, the interview(s) will be transcribed. The transcript will be provided to you. You can review the transcript to correct errors, provide more information, and ensure it reflects what you intended to convey.

Risks and benefits of being in the study:

The study has few risks involved. Some may find the information difficult to disclose, but the likelihood of this harming you in any way is very minimal. No direct benefits are offered to participants. However, study results may be beneficial to the CrossFit® community and help establish recommendation for those involved in high-intensity physical training programs.

Compensation:

There is no compensation for participation.

Confidentiality:

The records of this study will be kept private and confidential to the extent permitted by law. In any sort of report we might publish, we will not include any information that will make it possible to identify a subject. Research records will be stored securely in locked areas and password-protected computers, and only researchers will have access to the records. ***Researchers do not inform gym owners, trainers, or other CrossFit® members of your participation.***

Voluntary nature of the study:

Participation in this study is voluntary. If you decide to participate, you are free to not answer any question or withdraw at any time.

Recording:

If you permit, interviews will be recorded. Recordings are solely for the purpose to allow transcription of interviews so that study of words can be conducted more precisely. Recordings are confidential and voluntary per above information.

- -

Contacts and questions:

You are encouraged to contact any of the following to ask questions or discuss this project:

Researcher: Vista Beasley
University of Stirling, School of Sport, Sport Psychology Ph.D program
Contact information

Research Supervisor: Dr. Robert Eklund
Contact information

Ethics Committee
University of Stirling School of Sport Research Ethics Committee:
Contact information

CONSENT FORM

I have read the above information.

I have had the opportunity to discuss the details and/or ask questions with Vista Beasley.

I have been given contact information for the researchers and Ethics Committee.

I understand the nature and purpose of the study.

I understand what is proposed to be done.

I understand that I am completely free to withdraw from the study or any part of the study at any time I wish.

I understand and agree that my participation in the study is entirely at my own risk.

I understand that this study is a part of a research project designed to promote knowledge.

I understand this study may be of no benefit to me personally.

I do___ do not ____ permit this interview to be recorded. I understand recordings are voluntary and confidential.

I understand this study has been approved by the Sports Studies Ethics Committee. The Sports Studies Ethics Committee may wish to inspect the data collected at any time as part of its monitoring activities.

Do you agree to participate in the study?
__ Yes __ No

Please enter today's date. MM-DD-YYYY: _____

Print name here: _____

Sign name here: _____

APPENDIX M

Members' Perceptions of Injury in CrossFit® Context

Causal Attributions, Behavioural Responses to Injury, Factors Influencing Behavioural Responses, and Effects of Injury in CrossFit® Context

Category	Sample Descriptors
Comply with trainers	*I like that sort of mentality of just gut through it and whatever, but...it's just like, "Okay, I keep going, and I keep doing what they're [trainers] saying, but yet I keep injuring myself."* (MM43)
Do more than prescribed workout	*Then they'll talk to their friends about, "What do you want to do next?". That is where we start getting down the path of overuse, too much all the time. They start deciding what they want to do after that workout. They don't know what's tomorrow. They don't know what day after tomorrow entails. They don't know what the day after the day after tomorrow entails. They have no idea what we have in store for them the rest of the week, but they decide to do something [extra workouts] on their own.* (MT1)
Exerting high effort despite novice status	*Definitely, the pushing way too hard. Coming to this [new], the next thing you know, you're being told to do this astronomical number of pull-ups and kettlebell swings and stuff that really put a ton of stress on your joints. You know you're going to get injured if you try and do what you're asked to do at that point in the game.* (MM34)
Fail to comply with trainers' guidance	*Chances are, if you ask me about that client, I might be able to say...They were walking down that road and I might have tried to pull them off that road before by sitting them down and being like, "Hey man, every time we have dead lifts, I have to remind you every single dead lift that your back is not even close to flat. We've done drills to strengthen your back. We've taught you. You can do it. You can keep your back flat. You're just choosing not to. What that'll lead to is an injury down the road."* (MT1)
Fail to give trainer input	*Shame on her for continuing to do something that she knew was too heavy and not telling the trainer no.* (FM31)

Members' Perceptions of Injury in CrossFit® Context (Page 2)

Category	Sample Descriptors
Lack self-regulation	*For people that have a hard time self regulating...if you're 20, you've never had a major injury, and you're just going to go full speed through this stuff, and there you can get really high injury rates.* (MM42)
Pre-existing physical factors	*It's not that CrossFit is hurting you. You probably had problems that you needed to take care of before, which I did. I had back problems, which I wasn't doing properly or taking care of properly. Like I should have gone to physical therapy probably, which I didn't know until I started CrossFit.* (FM2)
Push too much	*These are adults. They've had 20-some years to become familiar with their body and their ability to do these different things, so if they push themselves recklessly and get hurt, it's their fault. You know, if they jump into a workout they've never done before and try and do a lot of weight, that's their fault. Ultimately you have adults choosing to attempt something, but... I've never seen a trainer pressure someone to lift a weight heavier than they feel comfortable.* (MM42)
Willingness to risk injury	*They incur risk by pushing themselves, by coming into this environment, right? But they should understand that it's something you get over, you rehabilitate, you get stronger, and anybody who says I am so unwilling to try this, that I could get hurt, shouldn't try it...when we try to do new things there are extra risks involved and extra injuries as a result.* (GO1)

Members' Perceptions of Injury in CrossFit® Context (Page 3)

Causal Attributions: Features of Trainers

Category	Sample Descriptors
Encourage members to go harder	*You want to push yourself, and then maybe you feel this pressure from the trainer to go a little bit harder than maybe you think you should.* (MM43)
Fail to monitor members	*But I also know from personal experience and from word of mouth that there are gyms where trainers don't pay attention as often which makes me mad and upset because these are intricate movements and you can easily injure yourself. So I feel that you really need to be paying attention if you're a coach.* (FM24)
Fail to customize guidance based on features of members	*Shame on the trainer for not knowing the individual enough to know when too much is too much. If you know someone, if you know that they're super, super, super-competitive, you know that they're going to do to whatever weight you tell them.* (FM31)
Fail to correct members	*I wouldn't say it [injury]'s the athlete's fault entirely all the time, because there are coaches that let things slide.* (FM24)
Prescribe amounts	*With this high injury rate, you get people that have never done these complex Olympic weightlifting components, going into an environment where the trainer throws weight on and says let's see if you can do it.* (MM42)

Members' Perceptions of Injury in CrossFit® Context (Page 4)

Behavioural Responses to Injury: Members

Category	Sample Descriptors
Checked form	*The second I feel a pull in my back, I know I need to stop, or, I'm doing my form wrong, and I need to pay attention more to my form, and if that's where I feel a pull, and I start paying attention to my form and it feels fine, then I'll keep going. But if I pay attention to my form and it still hurts, I'll stop.* (FM24)
Pushed through pain	*I kind of tweaked my back, and I was like "Oh I'm fine. It's probably like just a little muscle spasm strain, no big deal." That happened like November, and I kept going until February to the point where I couldn't sit, I couldn't sleep, I was crying, I popped Advil® every few hours.* (FM24)
Reduce effort	
Scale back	*This whole week, literally every day this week, I was not going to go. I was going to take a day off because my shoulder kind of got a little tweaked doing overhead squats on Monday. We were doing a lot of shoulder work this week, so every day, it's really sore. I know it's sore. I eventually talk myself into doing it, into going, and I just, I scale it way back...There is no way I'm going to be able to do these cleans at the end, so I'm like, "You know what? I'm not going to push myself."* (MM43)
Time-loss	2-3 days; 3 months; 6 months
Quit	*CrossFit will find your weakness, so a lot of people, they get their weakness exploited, and they look for the door. It takes a lot of patience to figure out a way around it.* (MM1)
Sought medical help	*Not just going home and icing it and wondering, "Why isn't it getting better?" and that's all you're doing, you know. I try to get everybody to do physical therapy. If anything's hurting on anybody, and they talk to me about it, I'm like, "Go see a physical therapist, because they're awesome."* (FM2)
Used pain management tactics (ice, massage, stretch, over-the-	*I soaked in bath salt or whatever Epsom salt. I was cracking open Advil® every night, putting ice packs on the knees and the ankles.* (MM32)
Used physical appliances	braces, kinesiology tape

Behavioural Responses to Injury: Trainers

Category	Sample Descriptors
Consult other trainers	*They were good, I mean, they actually talked amongst one another to try and get different perspectives on what the actual diagnosis might be, what the actual problem might be, ways to circumvent that injury.* (MM30)
Check on injured members	*I hadn't seen MT 1 in weeks, and I was doing squats, and he walked over and said "Hey man, how is your shoulder?" Just out of the blue. I hadn't talked to him about it. It was genuine concern there, probably because the workout that day had a lot overhead stuff, and he wanted to get his gears going on what might need to be scaled, or addressed. He was genuinely understanding, and we talked about what I've been doing to fix it, and he gave me more advice on how to strengthen those rotator cuff muscles.* (MM44)
Direct member to reduce effort	*I just kept going. They would just be like, "Okay, go easy on yourself." They would scale the next day's workout and the rest of the week's workout.* (MM29)
Direct workout modifications	*Injury pain is a case by case thing, and I am getting better at it, at saying hey I need to pump the breaks today so that tomorrow you will be fine. MT6 and the trainers help me with that. They are well aware of the issue, and help me scale a workout or change it so that maybe I don't affect the shoulder. I gave the example of a workout last week where MT6 helped me do squats instead of overhead stuff, so that my shoulder got the day off essentially.* (MM44)
Emphasize form	*With the knee...you know there was a good couple weeks where we [referring to MM43 and trainers] had just scaled back a lot of the squats and stuff like that, and worked a lot more on form and making sure my knees didn't go out in front of my toes and that kind of stuff.* (MM43)

Members' Perceptions of Injury in CrossFit® Context (Page 6)

Category	Sample Descriptors
Express empathy	*Went to MT4, told him, "Hey look, I don't think squatting's a good idea today. What do you recommend?" He said just do a couple of sets on the rowing machine. Never ever any pressure, "Oh you should be squatting. You need to get back. Try and hurry up and get better." Nothing like that. I think having that empathy and compassion, that was there. It's nice to know that you still show up and not have to strictly follow the WOD [workout of the day], that they were accommodating.* (MM30)
Identify possible causes	*With the biceps, you know I asked the trainer. I was like, "What do I need to do? I think I need to warm up my biceps more before class, because when we're doing pullups or something, I keep tweaking my bicep. And it's frustrating, because it's not my back that's giving out, it's my bicep that's preventing me from doing more." They're like, "Actually, probably what it is is actually more of a shoulder issue that might be relating down to the bicep."...You've got all this sort of rote thinking in a normal gym, but then now you've some more educated people that maybe have some better understanding of actually how the body works...I'm like, "Okay, so I'll stretch out." They show me like, "Okay, stretch out your shoulders here, and see if that will actually help with the bicep."* (MM43)
Seek information from "Supple Leopard" (book about injury)	*They're usually really helpful. They usually have stretching suggestions, or they'll whip out that Supple Leopard book.* (FM2)
Suggest pain management techniques (e.g., stretching, icing)	Observation: MT1 takes FM7 to stretching area, saying *"Instead of doing squats, I just want you to roll."* I hear FM7 say, *"It's been hurting".*

Factors Influencing Behavioural Response

Category	Sample Descriptors
Aesthetic concerns if stopped working out	*It was more of like, "I can't stop because I don't want to gain that weight"* (FM24)
Delayed onset of symptoms	*I didn't even feel it that day…Then I guess the next day is when I really felt some pain and some achiness. I was like, "No, I can't. I'm not even going to go in for a few days until this really does sort of calm down."* (MM32)
Personality of members	
Conservative	*I wanted to kind of take it easy...I guess I'm just more conservative in general. You know your limits. It's good to push yourself. I definitely come with aches and pains every day, don't get me wrong, but...one time where I really felt like I hurt myself, I wasn't going to go in for a few days through that.* (MM32)
Competitive	*CrossFit can be very, very competitive with other people in it and wanting to sometimes lift more than the girl next to you, but I've never been a competitive person...I'm not looking at the person next to me and going, "Oh, I have to lift more than her, squat more than her."* (FM31)
Prior injury	*Because I don't, again, I don't want to re-injure it, um, and I don't want to cause more problems. So like one day I was trying to max out my dead lifts. I went to go do 150, something that's pretty simple for me. I felt an instant pull in my back. And I was like, nope, I'm not even going to try anymore, so just stuff like that where I'm more conscious. I don't want to hurt myself again. I know the pain and the trial I had to go through to get back to where I am today. I had to start all over again with weights. And just so I didn't want to do that again so I had to like that's where I just back off. You know what today is just not the day. I'm not going to push myself any harder than I, just kind of walk through the wod, take it easy, and maybe bring it down on weights, like nothing too intense.* (FM24)
Sport role models	*Just like in the NFL, if you get injured, the games go on regardless.* (MM29)

Members' Perceptions of Injury in CrossFit® Context (Page 8)

Effects of Injury

Category	Sample Descriptors
Impaired activities of daily living	*It's such a pain in the ass. Like I'll just reach and get something out of the cabinet, "Ah, fuck."* (MM1)
Injured part is strengthened	*I have a much better feel for what I can do and at what point I'm going to get injured, along with the fact that I've been injured so many times, like I said, I literally I think I've kind of built up my tendons and ligaments and scar tissue and everything is just to the point where now I'm kind of adapted I guess.* (MM34)
Learn from it	*Every injury I've had, I've rehabbed and overcome. Wiser for it. (MC1) I think that's the biggest part, and that's probably, too, I think, what people learn from being hurt.* (FM31)
Loss of membership	*Overuse does happen. I've gone through that. I've actually struggled with it more from a mental side of the game than like oh, I've just done so much with my shoulders. My shoulders are so sore. That's a real shame because we lost somebody who was so interested in exercise, so enthusiastic about it, but we didn't guide them well enough to keep them safe...These guys'll come in. They'll be so excited. They'll do all this work. They'll do all this work. They'll do all this work. They'll get injured. They'll get miserable about it. They'll stop coming in.* (MT1)
More attentive to form afterwards	*I came back is when I paid attention more to form because I didn't want to re-injure it or to hurt something else* (FM24)
Negative emotions	*I felt really trapped, not knowing how long it would take for my back to heal…You just feel really helpless, when your back is injured.* (FM2)

Members' Perceptions of Injury in CrossFit® Context (Page 9)

Category	Sample Descriptors
Performance decrements	*I started really feeling pain on my shoulder. And I don't know what caused it because you do so many things. And then it's, I've done physical therapy. I've got massages. I went from 155 pound shoulder press to 65 pounds.* (MM1)
Resist pressure from others to push hard	*I have another friend who's been hurt in her back and now she's like, "I don't care, I'm not doing it. If they tell me, like, I know my body and I know what way I should do, and I'm just going to go for a good workout and that's it." She quit doing that. She quit being so competitive.* (FM31)
Stop being physically active	*One of the big reasons that people stop being physically active is they encounter injuries. If they could avoid injuries, if they could heal better, for instance, then they might exercise more and might reap the benefits of exercise.* (GO1)
Warn others to be careful	*FC# is currently having the same issue I had, and I told her to be careful because I don't want her to, what happened to me to happen to her.* (FM24)

APPENDIX N

Injury-Prevention Actions in CrossFit®

Members' Perceptions of Injury-prevention Actions in CrossFit® Contexts

What CrossFit® gym/trainers can do
Become educated about injury (e.g., substitute movements, how to strengthen weak areas)
Customize amounts to individuals
Actively endorse scaling back
Ask members about pain/injury before prescribing amounts
Increase prescribed amounts gradually
Know members' abilities before prescribing amounts
Know members' personalities in relation to prescribing amounts
Provide workouts that only beginners/unfit members attend
Educate members about overuse injury pain
Guide members with overuse injury pain to modify workouts
Prompt members to seek multiple solutions until pain/injury is resolved
Teach members about pain and injury types
Teach members the desired behavioral responses to each pain/injury type
Emphasize form
Enforce good form
Give form feedback
Increase members' comfort level in giving form feedback to other members
Maintain small class size so members' form can be monitored closely
Monitor members during workouts
Require members to demonstrate proper form at lower weight before moving up to higher weights
Require members to demonstrate proper form consistently before they attempt one-repetition maximums
Show videos with good form before members do movements
Teach/demonstrate movements before members do them, every time
Video members during movements so form can be analyzed
Incorporate injury-prevention behaviors into workouts instead of leave to members' discretion
Enforce adherence to warm-up
Ensure workout is done immediately after warm-up so benefits of warm-up aren't lost
Include a guided cool-down in workout
Provide access to free chiropractor at gym
Provide access to yoga

Injury-Prevention Actions in CrossFit® (Page 2)

What CrossFit® members can do
Become educated about injury
Consult trainer about pain
Know proper use of weightlifting belt and other equipment
Emphasize form
Do movements without weight first
Don't go up in weight if form is not perfect
Guard against bad form
Rest or stop when form is bad
Solicit form feedback from trainers and established members
Start slow until comfortable with technique
Watch videos about form for movements being used in workouts
Engage in injury-prevention activities
Complete cool-down activities and stretching after workout
Engage in warm-up and mobility activities fully as directed during workouts
Practice yoga
Replace movement causing pain with other movements
Scale back appropriate to pain/injury stage
Seek multiple solutions to resolve pain
Step down instead of jump down in box jumps
Strengthen weak areas
Stretch sufficient amount of time before workout
Exert the amount of effort that reaps health benefits without inducing injury
Be smart about pushing yourself
Don't lift heavy
Don't overexert yourself
Don't push to maximum
Individualize workouts
Know limitations
Let trainer know you're new
Resist social pressure
Seek information from established members and trainers

APPENDIX O

Social Identity Constructs in CrossFit® Context

Table O1

In-group Homogeneity Reflecting Perceived Similarities between CrossFit® Group Members

Category	Sample Descriptors	Sample Excerpts
Attend workouts despite negative feelings	During time we really don't want to be doing it; That sucked but come again tomorrow	*We wake up the next day and come to it no matter how sore we are, no matter what we feel like, like oh, "I don't want to go", we still show up.* (FM24)
Competitive personality	Driven; Motivated; Competetive streak; Overachievers; Enjoy challenge; Addictive; A little crazy	*We all are there for a good workout, and probably somewhat competitive, either with yourself or with people that are of similar ability.* (FM2)
Inclusive	Community; Like family; Encouraging; Friendly; Outgoing; Welcoming	*The one thing, really, that surprised me, was the friendliness. It's like, from that first class I went to at 6 AM, everyone was walking up and introducing themselves. When you see new people, you'll be like "Hey, I'm MM 44. Nice to meet you. You're one of us." It's just that family atmosphere. They're very inclusive. There's no cliques. There's no cool kids club. I've never seen judgement from anybody on anybody.* (MM44)
Need to burn off anxiety	Therapeutic; Stress relief; Cathartic mentally; Dopamine dump	*I think more of them...do it in large part too for mental reasons, to burn off angst and anxiety and stuff.* (MM34)
Want to push themselves	We push ourselves to the limit; Hard-coreness; Not afraid of discomfort; Enjoy intense workouts; Mentality to put self through torture	*People that voluntarily join CrossFit are people that want to sort of push themselves more or exert more effort.* (MM42)

Table O2 (Page 1)

Sources of Positive Distinctiveness in CrossFit® Contexts

Category	Sample Excerpts
Higher intensity	*I guess the [name of traditional gym] group class was not intense enough...I would sweat a little, but it wasn't like, it wasn't as intense, I guess, is the only way for me to describe it.* (FM31)
More camaraderie	*There's a lot of one-on-one time with the trainers. You feel connected with them. You feel like the workout that you're doing with other people is so intense and so hard, but you're cheering each other on through it, and I think that that's what makes, brings you together. That even when the other person has finished their workout, they're still rooting for you, you know? And with these boot camp classes, there's not that type of camaraderie.* (FM31)
More consistent attendance	*Really, CrossFit has been the first time I was almost religious about it in terms of truly dedicated, five days a week. Obviously now it's been 20 months straight. It really is the first sort of exercise that I've started and kept at for this length of time...I go to the 4:30 class, yet I see the people who are there at 3:30, and I see the people who are coming in at 5:30. There truly is this dedication. You see them every day or almost every day. They really do come in on a regular basis.* (MM32)
More knowledgeable staff	*One thing that's actually interesting too, the education aspect of Crossfit. I guess this comes from just being around people with more knowledge...You've got all this rote thinking in a normal gym, but then now you've some more educated people that maybe have some better understanding of actually how the body works.* (MM43)

Table O2 (Page 2)

Category	Sample Excerpts
More results	*Going to the global gyms after I finished playing [football] in college, I wasn't pushing myself. I wasn't challenged. I became complacent with the status quo. In hindsight, I wish I'd done CrossFit(r) supplementary to my training for playing professional football. I think that would've probably helped me out a lot. It might have gotten me to that next level to get a starting job. Because I can tell you today, I hit the highest numbers I've ever hit in terms of squat, in terms of dead lift. Numbers I wasn't even coming close to [before CrossFit].* (MM30)
More variety	*Running was super boring. Going to the [traditional] gym was super boring. It was very repetitive. What I learned about CrossFit is...it was a varied workout. You do all sorts of different things every day, as opposed to running, you put one foot in front of the other. Going to the gym you kind of do this rotation of machines and free weights, and it's just rote, just over and over.* (MM32)

Table O3

Characteristics of Prototypical Members

Category	Sample Excerpts
Performance Attributes	
Best performer	*I mean I guess it's hard not to be impressed by the people who you know have big numbers and always at the top of the list.* (FM12)
Performs well at specific activities	*I wouldn't say a specific person impresses me but rather, individual traits, or, individual accomplishments of each person like how this FM got a ring muscle up.* (FM24)
Improves performance	*MM7's snatch went from 75 pounds to 245.* (MT1)
Performs better than others	*I'm very impressed by the women who can back squat and dead lift more than me.* (MM32)
Non-performance Attributes	
Encourages others	*I'm also very impressed by the good people who encourage the people who are struggling. I see that all the time.* (FM12)
Attends regularly	*Pretty much everyone that comes there on a regular basis, doesn't mean daily, but on a regular basis, I have a great affinity for and admiration for.* (MM32)

Table O4 (Page 1)

Social Threats: Criticisms of CrossFit® by Non-CrossFit® Members Heard by CrossFit® Members

a. Criticisms of the Program

Category	Sample Descriptors
Cult-like	*There are those who think that it's, you know, a cult, where you're going to injure yourself.* (MM34)
Excessive intensity	*The exercise science student was telling FM31 that they're teaching students now that CrossFit is bad, something about how it's bad for your muscles to do really intense.* (FM2)
Females will get bulky	*I've heard that you bulk up like a guy.* (FM31)
Injury	*A lot of people say that CrossFit's bad because you injure yourself.* (FM2)
Price	*Maybe one or two people wer elike, "How much does it cost? What?!" That's how my roommate reacted. He's like, "I'm paying, you know, like ten dollars a month at," whatever his gym is.* (MM29)
Unconventional movements	*My brother's friend think it's dumb. He's a body builder, and he's like "Why would you do these kipping pull ups and all this stuff. Just work out like a normal person."* (MM44)

Table O4 (Page 2)

b. Criticisms of CrossFit® Members

Category	Sample Descriptors
Display pictures excessively	*Like the pictures that they take, people sometimes can get obsessive about it, and post it on Facebook. If you're not a CrossFitter and people are constantly seeing it on your newsfeed…that can be annoying.* (FM2)
Engage in extreme nutrition	*The other criticism...kind of goes hand in hand with CrossFitters nutrition. They're sort of real focused on the Paleo type of eating.* (MM34)
Masochistic	*They're masochistic. That these are people that want to hurt themselves. They'll do burpees until they throw up, or something. They're not healthy, they just want to appear to be healthy and need something to identify themselves with.* (MM44)
Overly-sensitive to criticism	*People on the internet saying CrossFitters are butthurt...It's when you pretend you're really offended by something....Just anybody who thinks they're being picked on...People on the internet will say something about CrossFitters like, "Oh, we do real pull-ups instead of kipping ones..." Then CrossFitters reply with rage, diatribe.* (MM1)
Talk about CrossFit® excessively	*You can't shut a CrossFitter up, because all they talk about is that.* (MM32)
Use poor form	*that people [in CrossFit]will sacrifice form for reps [repetitions].* (MM44)

Table O5 (Page 1)

Sources of In-group Status for CrossFit® Members

Category/Sub-category	Sample Descriptors
Attend consistently	*I think it should be attendance because the way the workouts are kind of coached and pre-designed, if you can show up, you're going to get in better shape. Just people getting into the door should be rewarded.* (MM42)
Be coachable	
Try	*Being uncoachable would be someone who said, "I can't do that. No. I'm not going to try." That's uncoachable.* (GO1)
Comply with trainers' input	*In order to be perceived favorably with them, you have to be willing to take their advice and implement it.* (MM44)
Learn	*Just learning the movements because, even now, I'm constantly having to ask them, "How do you, how does this lift go? How far apart should my feet be? What's the motion for such and such lift?". To me, I don't remember. I don't know the difference between a jerk and a snatch. After six plus months, I still don't remember what the difference is...so every single time, I have to ask him, "Wait. How does this move go again?" I guess if I could somehow remember that and have to ask them less the basics, that would probably impress them [referring to trainers].* (MM29)
Be safe	*...not making their job to constantly stop you from doing something unsafe.* (MM44)
Don't whine	*Even if, even if you're the slowest person there, if people see you working hard and trying to get better, and you've got a positive attitude, you know you're not whining about you know this or that exercise.* (MM43)
Finish workouts	*For me to be perceived favorably, I think it's simply finishing. I think most people know whether you've tried or not. That's really all I see. I'm not going to be at the top of some leader board or something like that...I'm just kind of that guy who's been there forever and just chugs along...MT6 always makes it a point to praise you simply for finishing.* (MM34)

Table O5 (Page 2)

Category/Sub-category	Sample Descriptors
Help other CrossFit® members	
Encourage others	*There have been times when I've been running with somebody who I know that's new and I'm helping push them too. During the run, I'm running with them, beside them, like, "We can do this. Come on. We only have like one more lap to go."* (FM31)
Guide new members	*15, 16 people at a class and the new kid is like, "What's this? What's that?", and I'd be like, "That's this one." I'd be like, "Try 75 pounds," you know, and I'll help him with that, and I'll demo one.* (MM1)
Put up others' equipment	*That's helping them load their bar, or helping them put away their stuff at the end of the WOD [workout of the day], when they're laying on the floor about passed out...I think that that's what will make people perceive you in a positive way, is that we're trying to all help each other.* (FM31)
Perform well	
Improve performance	*Any time you actually attempt a new one rep max, like a personal best, then they will have you let them know so they come over to watch. Usually other gym members will watch, and so if someone succeeds, there's a lot of congratulations.* (MM42)
Perform better than others	*Be #1. Be the first one done.* (FM24)
Perform specific activities well	*I'm certainly not the, like, weight-wise the strongest person at the gym, but...Just every once in a while, surprising people is kind of fun, like I was able to do dips without bands fairly quickly...I mean not that there's a hundred of them, but...people were blown away by that.* (FM12)

Table O5 (Page 3)

Category	Sample Descriptors
Push yourself	*I think just continuing to push yourself. I think people, they don't, people can better empathize with you if you're pushing yourself, if you're kind of struggling...Not that you look down on anyone else, but you join CrossFit for a reason: to push yourself. Not to coast through and remain at the status quo. I think if I wanted people to perceive me in a favorable light, I'm busting my ass and giving it everything I have. At the end of WOD, I'm spent.* (MM30)
Use good form	*They'd [referring to trainers] be like, "Good job," referring to my form on a particular lift movement.* (MM29)