Beyond the Physical Wounds: Examining Male Varsity Athletes' Psychological Responses to Hypothetical Sport Concussions

by

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Abstract

Following Wiese-Bjnorstal et al.'s (1995) sport injury response model, this dissertation used hypothetical scenarios to examine the relationships between sport concussion severity, post-concussion injury appraisals, and post-concussion depression and anxiety symptoms. Participants included a convenience sample of 99-male varsity athletes that played football, hockey, soccer, and basketball. The hypothetical scenarios depicted three sport concussion incidents that varied in terms of severity (return-to-play in two weeks, out for the season, and career ending). Male varsity athletes' completed a measure of current depression and anxiety symptoms and were asked to anticipate their post-injury appraisals and depression and anxiety symptoms in relation to one of the three randomly presented sport concussion scenarios. Across the three sport concussion scenario groups, there was a trend of male varsity athletes' anticipated post-concussion depression and anxiety symptoms being significantly higher than their current symptom levels. Moreover, there was a trend of male varsity athletes' anticipated depression and anxiety symptoms being significantly higher for the scenarios that depicted increased sport concussion severity. Sport concussion severity significantly effected male varsity athletes' anticipated injury appraisals and the effects were more prominent for the two week and career ending groups. Male varsity athletes' anticipated post-injury appraisals displayed positive and significant correlations with their anticipated depression and anxiety symptoms, yet the greatest support was found for the two week and season ending groups. The findings were discussed in terms of potential theoretical and practical implications, methodological limitations, and future research directions.

Preface

This thesis is an original work by Thomas Pearson. The research project, of which this dissertation is a part, received research ethics approval from the University of Alberta Ethics Board, Project Name "After the Impact: Exploring Predictors of Athletes' Post-Concussion Psychological Responses, ID No. Pro00049464, July 2014.

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Table of Contents

List of Tables

List of Figures

Appendices

Chapter One: Introduction

The following quote comes from Gulli's (2011) Maclean's article titled, "Concussions: The Untold Story," in which retired National Hockey League (NHL) player, Eric Lindros, stated, "'If no one says anything then it's status quo (. . .). That status quo is not working. What most people don't get is that underneath all the gear and styles of play, there's a person. There's a human being with feelings'" (para. 9).

Psychology and Sport Injuries

Immersed within the sport culture, athletes have been expected to go to war against their opponents. Putting one's body on the line, taking one for the team, and playing through pain and injuries have been viewed as the necessary costs of winning (Mainwaring, Comper, Hutchison, & Richards, 2012). However, as Eric Lindros alluded to in Gulli's (2011) article, athletes have been left to cope with wounds that have not been visible to others. That is, underlying athletes' battle scars has been a lurking psychological turmoil and emotional distress.

Over the past 20 years sport and rehabilitation researchers have found that sport injuries have taken a psychological toll on athletes. For example, athletes have experienced stress, sadness, anger, anxiety, depression, fear (of reinjury), guilt, grief, loneliness, lowered self-esteem and decreased vigour following an injury (Chan & Grossman, 1988; Clement, Granquist, & Arvinen-Barrow, 2013; Crossman & Jamieson, 1985; Evans & Hardy, 1995; Johnson, 1997; Lavallee, Grove, Gordon, & Ford, 1998; McDonald & Hardy, 1990; Quinn & Fallon, 1999; Ruddock-Hudson, O'Halloran, & Murphy, 2012; Team Physician Consensus Statement, 2006). Although athletes have tended to experience negative emotional reactions following a sport injury (e.g.,

McDonald & Hardy, 1990; Quinn & Fallon, 1999), it has been accepted that athletes' post-injury psychological responses are variable and dynamic (Putukian & Echemendia, 2003; Team Physician Consensus Statement, 2006; Wiese-Bjornstal, 2010). As a result, the psychological toll of a sport injury has been relatively short-lived for some athletes (McDonald & Hardy, 1990; Quinn & Fallon, 1999), while other athletes have experienced ongoing psychological disturbances (Ruddock-Hudson et al., 2012).

Various injury response models have been developed to explain athletes' post-injury psychological reactions. The most widely accepted framework is Wiese-Bjornstal and colleagues (Wiese-Bjornstal, Smith, & LaMott, 1995; Wiese-Bjornstal, Smith, Schaffer, & Morrey, 1998) Integrated Model of Psychological Response to Sport Injury and Rehabilitation Process (see Figure 1). Incorporating principles from Lazarus and Folkman's (1984) stress and cognitive appraisal theory, Wiese-Bjornstal et al.'s (1995) sport injury response model suggested that a variety of personal (e.g., injury history) and situational (e.g., sport type) factors influenced athletes' post-injury appraisal process, which, in turn, impacted their psychological responses and rehabilitation behaviour.

Although research on the psychological impact of sport injuries has gained momentum over the past 20 years, there are still a number of areas that remain unexamined within the literature. For example, only a few studies have investigated the posited variables and suggested links within Wiese-Bjornstal et al.'s (1995) injury response model (Walker, Thatcher, & Lavallee, 2007). Moreover, studies on specific sport injuries have mainly focused on musculoskeletal injuries, leaving little information on the psychological impact of other injuries (see Brewer, 2010, for a review).

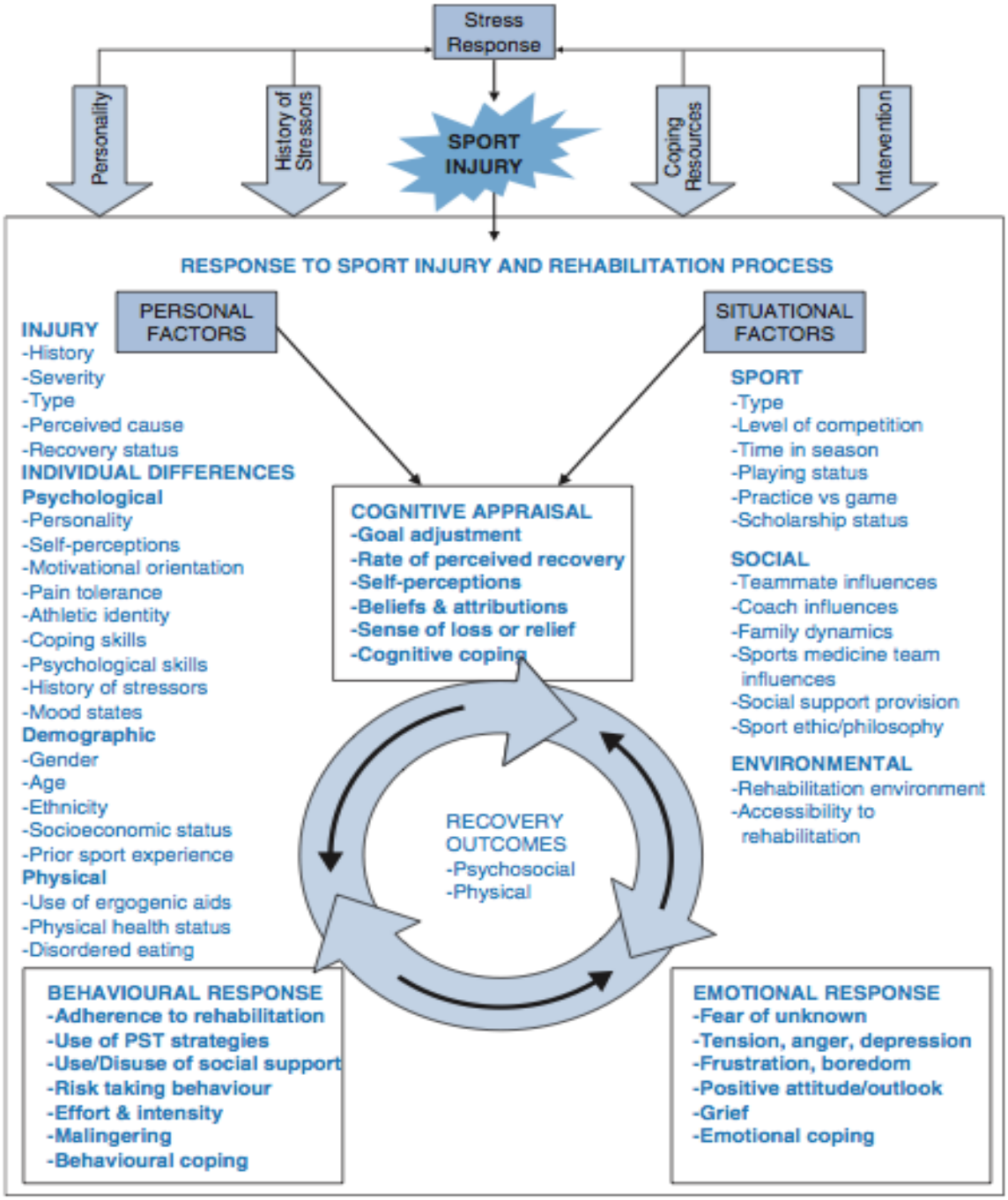

Figure 1. Wiese-Bjornstal et al.'s (1998) injury response model. Reprinted from "An integrated model of response to sport injury: psychological and sociological dynmaics," by D. M. Wiese-Bjornstal, A. M. Smith, S. M. Shaffer, and M. A. Morrey, *2008*, *Journal of Applied Sport Psychology*, *10*, p. 46-69. Copyright 1998 by Taylor & Francis Publications. Reprinted by permission of the Association for Applied Sport Psychology, (http://www.appliedsportpsych.org).

Concussion as a Type of Sport Injury

When it comes to sport injuries, cerebral concussions have received increased attention by the scientific community and the media (Comper, Hutchison, Magrys, Mainwaring, & Richards, 2010; Echemendia, 2012; Mainwaring, Comper, et al., 2012; Randolph & Kirkwood, 2009; Wojtys et al., 1999). The increased interest in sport concussions has been driven by the fact that concussions have been the most common type of head injury that athletes have endured (Jordan, 2013; Jotwani & Harmon, 2010). Moreover, concussions have been considered the most complex and challenging type of sport injury to assess, diagnose, and manage (Johnston et al., 2004; McCrory et al., 2013). That is, unlike other sport injuries, concussions are an "invisible" injury (Echemendia, 2012; Johnston et al., 2004; Mainwaring, Comper, et al., 2012). As Echemendia (2012) stated, "Concussed athletes do not wear casts, slings, orthopedic boots, or crutches. By all accounts the players look 'normal'" (p. 209). Despite athletes appearing normal on the surface, research (see Echemendia, 2012; Johnston, McCrory, Mohtadi, & Meeuwisse, 2001; Johnston et al., 2004; McCrory, Johnston, Mohtadi, & Meeuwisse, 2001, for reviews) has continued to inform the scientific community and the public on the short- and long-term biopsychosocial consequences of sport concussions. Similarly, media coverage, such as Gullie's (2011) article, has revealed how sport concussions have had a far-reaching and life-altering impact on athletes' personal lives and professional careers.

Justification for Examining the Psychological Impact of Sport Concussions

Despite the increased interest in sport concussions, research on the psychological impact of sport concussions has been largely overlooked for the past 20 years

(Mainwaring, Hutchison, Camper, & Richards, 2012). A review of the PsycINFO, SPORT Discus, MEDLINE, and PubMed databases revealed less than 10 studies that have examined athletes' psychological responses following sport concussions. Preliminary findings indicated that athletes' experienced short-term (1-2 weeks) psychological disturbances following a sport concussion (Mainwaring et al., 2004; Mainwaring, Hutchison, Bisschop, Comper, & Richards, 2010). Research on retired National Football League (NFL) players found that a greater history of sport concussions was associated with an increased risk of developing Major Depressive Disorder (MDD) later on in life (Guskiewicz et al., 2007; Kerr, Marshall, Harding, Jr., & Guskiewicz, 2012). MDD is a mental health disorder marked by uncharacteristic elevations in a number of physical (e.g., lethargy), psychological (negative self-views), emotional (e.g., sadness), and/or behavioural (e.g., withdrawal) symptoms (American Psychiatric Association [APA], 2013). A qualitative investigation of retired NHL players revealed that a history of sport concussions was associated with a variety of psychological symptoms, including depression, anxiety, stress, isolation, and suicidal thoughts (Caron, Bloom, Johnston, & Sabiston, 2013). Similar psychological concerns were reported by another sample of retired NHL players who had a history of sport concussions (Gulli, 2011).

Research on the psychological impact of sport concussions has several limitations. Specifically, research has not attempted to understand post-concussion psychological responses from any guiding theoretical framework (Mainwaring, 2011). Similarly, only a couple of factors (e.g., injury history) from Wiese-Bjornstal et al.'s (1995) sport injury response model have been directly investigated in sport concussion

studies. This is despite researchers (Hutchison, Mainwaring, Comper, Richards, & Bisschop, 2009) recognizing the need to understand the variability in athletes' post-concussion psychological responses.

As for other limitations, sport concussion researchers have only investigated a few psychological outcomes, such as depression, leaving little to be known about other types of psychological responses (Mainwaring, 2011). In particular, it has been suggested that athletes could experience anxiety symptoms following a sport concussion (Mainwaring, 2011), which has been supported through qualitative studies (Caron et al., 2013) and athlete interviews (Gulli, 2011). Anxiety involves the anticipation of a threat and is associated with physical (e.g., body tension), emotional (e.g., fear), cognitive (e.g., vigilance), and behavioural (e.g., cautious behaviour) symptoms (APA, 2013). However, anxiety, as a post-concussion response, has not been directly investigated within the existing sport and rehabilitation literature. Another limitation has been that athletes' post-concussion psychological responses have been measured for short-term return-to-play (RTP) timelines. As such, there needs to be investigation into athletes' post-concussion psychological responses across different sport concussion recovery timelines.

The need to further understand athletes' post-concussion psychological responses is highlighted by the fact that head injuries are a common occurrence in sport (Koh, Cassidy, & Watkinson, 2003). As Kutcher and Eckner (2010) stated, "Every athlete, whether previously concussed or not, walks on to the field of play with some inherent risk of being concussed" (p. 16). Within the United States, the annual rate of sport concussions has been estimated to be 1.6 to 3.8 million (Langlois, Rutland-Brown, & Wald, 2006). Moreover, sport concussions have been found to account for 5% to 18% of

all sport injuries (Covassin, Swanik, & Sachs, 2003; Gessel, Fields, Collins, Dick, & Comstock, 2007; Hootman, Dick, Agel, 2007; Powell & Barber-Foss, 1999). Liberal estimates for sport concussions have indicated that 44% to 70% of athletes have experienced a sport concussion over the course of one year or playing season (Delaney, Lacroix, Leclerc, & Johnston, 2000; 2002). It has also been common for athletes to experience multiple sport concussions over their careers (Benson, Meeuwisse, Rizos, Kang, & Burke, 2011; Echlin et al., 2010; Guskiewicz et al., 2007; Mayers, 2013) or within a season (Delaney et al., 2000; 2002; Guskiewicz, Weaver, Padua, & Garrett, Jr., 2000; Pellman, Viano, Casson, Arfken, & Powell, 2004). Finally, athletes with a history of previous sport concussions are 3 to 5.8 times more likely to have experienced a subsequent sport concussion (Delaney et al., 2000; 2002; Guskiewicz et al., 2000; 2003; Zemper, 2003).

Sport concussion statistics are important given that this type of injury has had psychological, neurological, and social implications for athletes. As mentioned, sport concussions have been associated with unpleasant psychological symptoms, which have included elevated depression and anxiety symptoms (Caron et al., 2013). There has been concern that multiple sport concussions can lead to long-term neurologicalpathological effects, such as chronic traumatic encephalopathy (CTE; Harmon et al., 2013). Professional athletes who have received a post-mortem evaluation and been diagnosed with CTE had previously displayed neuropsychiatric features (e.g., mood dysregulation) and committed suicide (Omalu, Bailes, Hammers, & Fitzsimmons, 2010). The direct neuropsychiatric implications of a sport concussion make this type of injury unique in comparison to other types of sport injuries (Mainwaring, 2011). Athletes who have

suffered sport concussions reported that their post-concussion symptoms also contributed to their experience of relational and familial strain (Caron et al., 2013).

Objectives of the Present Study

Considering the existing findings from the sport injury literature this dissertation examined athletes' anticipated psychological reactions to sport concussions. In doing so, the broader objective of this dissertation was to examine whether posited links in Wiese-Bjnorstal et al.'s (1995) sports injury response model could help explain athletes' anticipated post-concussion psychological responses. Encompassed within this broader objective, this dissertation had the following two objectives: (1) examine whether imagined sport concussion severity effected athletes' anticipated post-concussion injury appraisals and depression and anxiety symptoms and (2) examine whether athletes' anticipated post-concussion injury appraisals were related to their anticipated post-concussion depression and anxiety symptoms. Although athletes' anticipated post-concussion depression and anxiety symptoms were examined in this dissertation, it was not an objective of this dissertation to examine whether athletes' anticipated post-concussion depression and anxiety symptoms fit within a clinical nomenclature.

Summary

Sport injuries, including concussions, have been increasingly viewed as physical wounds that can carry psychological consequences. Nevertheless, research on the psychological impact of sport injuries has remained sparse and limited, especially when it has come to studies on sport concussions. Existing research limitations, the common occurrence of sport concussions, and the far-reaching impact of sport concussions were provided as justifications for further examining athletes' post-concussion psychological

responses. Drawing from a sport injury response model (Wiese-Bjornstal, Smith, & Lamott, 1995; Wiese-Bjnornstal, Smith, Shaffer, & Morrey, 1998), concussion severity and post-injury appraisals were introduced as factors that may be associated with athletes' post-concussion anxiety and depression symptoms.

The second section of this dissertation reviews relevant theoretical papers and research related to the variables under investigation. Specifically, principles of stress and appraisal theory (Lazarus, 1966; 1991; 1999; Lazarus & Folkman, 1984) are discussed given that this theory provided the structure to Wiese-Bjornstal et al.'s (1995) sport injury response model. Emotion theory (e.g., Watson & Tellegen, 1985) is also examined in order to provide a rationale for distinguishing the related experiences of (post-concussion) anxiety and depression. When necessary, in order to fill in the gaps in the sport concussion literature, studies on non-sport brain injuries or general sport injuries are discussed.

The third section of this dissertation focuses on the study methods, measures used during data collection, and an overview of the data analyses. The fourth section of this dissertation describes the study results. The final section of this dissertation involves a discussion of the findings and highlights the study limitations and implications, as well as future research directions.

Contributions to the Field of Psychology

This dissertation contributed to the field of psychology in several ways. For example, this dissertation contributed to the health psychology literature by examining how anticipated event appraisals are related to anticipated unpleasant psychological responses. Examining varsity athletes' anticipated post-concussion psychological

responses also made a contribution to the limited literature on sport injury adjustment. Moreover, this dissertation contributed to the sport psychology literature by examining whether a stress and cognitive appraisal theory (e.g., Lazarus & Folkman, 1984) and a sport injury response model (Wiese-Bjnorstal et al., 1995) could help explain athletes' anticipated post-concussion psychological reactions.

Contributions to the Field of Counselling Psychology

Within the psychology profession, the field of counselling psychology has typically focused on helping individuals across the lifespan through scientific inquiry, assessment, therapeutic intervention, and consultation (Gelso & Fretz, 2000). As such, counselling psychologists' roles have revolved around providing remedial (e.g., working with presenting concerns), preventative (e.g., helping reduce the potential for future difficulties), and educational-developmental (e.g., promoting personal growth through dispensing knowledge and information) services to their clients (Gelso & Fretz, 2000). While counselling psychologists' work hasn't been entirely distinct from other applied psychology (e.g., clinical psychologists) and health care (e.g., psychiatry) professionals, Gelso and Fritz (2000) reported a number of themes that can help differentiate counselling psychologists from other helping professionals. Specifically, counselling psychologists' have tended to: work with individuals' who have less severe mental health concerns and disturbed functioning, provide briefer (i.e., less than 15 sessions) therapy, consider personal strengths and individual-environment interactions, and emphasize career development.

In focusing on athletes' post-concussion psychological responses, this dissertation made several contributions to the field of counselling psychology. In particular, this

dissertation examined athletes' anticipated post-concussion psychological responses that may need to be assessed and treated after they have experienced a (real life) sport concussion. From a preventative and educational-developmental perspective, this dissertation could help inform athletes, sport medicine staff and personnel (e.g., coaches), school officials and family members about potential post-concussion psychological difficulties.

This dissertation also highlighted how counselling psychologists' may be well positioned to help athletes with post-concussion psychological difficulties. For instance, athletes' have been found to be relatively well-adjusted individuals (Morgan, 1980), which is congruent with the populations that counselling psychologists' have tended to work with. Moreover, counselling psychologists' ability to address career transitions could help with athletes' psychological adjustment to retirement (due to sport concussions). Given that sport places athletes' in a public forum, counselling psychologists' consideration of person-environment interactions (e.g., loss of support) may also be helpful in addressing athletes' post-concussion psychological difficulties.

Chapter Two: Literature Review

An Overview of Sport Concussions

Defining sport concussions. Although sport concussion definitions are continuously evolving to reflect new empirical findings, the Concussion in Sport Group (CISG) has described a concussion as, "a brain injury (. . .) [that involves] a complex pathophysiological process . . . induced by biomechanical forces" (McCrory et al., 2013, p. 256). Moreover, the CISG has suggested that the following injury characteristics can be considered when defining a sport concussion: a direct impact to the head, neck, or

other body location (with a force transferred to the head), functional neurologic impairment that subsides spontaneously or over a short period of time (i.e., minutes to hours), and clinical symptoms that may or may not involve loss of consciousness (LOC) and can vary in their resolution time (McCrory et al., 2013). Finally, there has been a movement towards using alteration (as opposed to a loss) in consciousness or mental state when defining sport concussions (Barr & McCrea, 2010; McCrea et al., 2003).

The terms concussion and mild traumatic brain injury (MTBI) are often used synonymously within the research literature. According to Echemendia (2012), the main difference between the terms concussion and MTBI is that the former has been used within the sport medicine field and the latter has been used within the neuroscience and psychology fields. Giza et al. (2013) suggested that concussion and MTBI are overlapping definitions in that they signify less-severe TBIs marked by short-term neurologic dysfunction without macrostructural damage. The CISG has viewed concussions as a subset of MTBIs, even though they acknowledged that the two terms have been viewed as different injuries (McCrory et al., 2013). For consistency purposes, both within this dissertation and across the existing sport and rehabilitation literature, the term *concussion* will be used in reference to athletes' who have sustained a sport-related cerebral brain injury.

Sport concussion signs and symptoms. After experiencing a direct blow to the head (or to the body), which has been referred to as a "ding" or having one's "bell rung" (Echemendia, 2012; McCrory et al., 2013), athletes have displayed clinical signs and symptoms of a sport concussion. Sport concussion signs have included those behaviours or events that are observable to others (Echemendia, 2012), such as a loss of

consciousness (LOC), balance or motor difficulties, a vacant stare, disorientation, slurred speech, and confusion (Putukian & Echemendia, 2003). Alternatively, sport concussion symptoms have involved injury-related phenomenon that are subjectively reported by athletes (Echemendia, 2012). Athletes' sport concussion symptoms have be grouped into the following categories: somatic (e.g., headache and fatigue), cognitive (e.g., amnesia and concentration difficulties), psychological (e.g., irritable and feeling sad), and sleep disturbances (Echemendia, 2012; McCrory et al., 2013). The CISG has recommended that a sport concussion should be suspected if one ore more of the symptom categories are present after a blow to an athlete's head or body (McCrory et al., 2013).

Research has indicated that some sport concussion signs and symptoms have been more common among athletes. Specifically, a headache (40-86%), dizziness (15-67%) and confusion (8-69%) have been consistently cited as the top three post-concussion signs and symptoms experienced by athletes across different sport types and levels (Benson et al., 2011; Delaney et al., 2000; 2002; Gessel et al., 2007; Guskiewicz et al., 2000; 2003).

Temporal sequence of sport concussion signs and symptoms. The following section discusses sport concussion signs and symptoms in terms of *typical* and *atypical* temporal sequences.

Typical sequence. After suffering a sport concussion athletes have tended to experience a temporary state of confusion and disorientation; however, some athletes have gone on to experience a variety of symptoms (e.g., headaches and fatigue) in the subsequent hours to days (Enchemendia, 2012). According to the CISG, the majority of sport concussions are resolved within a 10-day period (McCrory et al., 2013). As an

example, research on NFL players found that 56% of players immediately (minutes to 1 hour) recovered after suffering a concussion, 35.9% had an early (1 hour to 2 days) recovery, and 6.5% had a short (3 to 10 days) recovery (Pellman et al., 2004). Similar sport concussion recovery periods have been found in United States (US) high school and college football players (Guskiewicz et al., 2000), NHL players (Benson et al., 2011), and Canadian varsity athletes (Mainwaring et al., 2010). Typical sport concussion symptom resolution has been thought to be due to the restoration of the brain's disrupted neurometabolic functioning (see Blennow, Hardy, & Zetterberg, 2012; Giza & Hovda, 2001, for reviews).

Atypical sequence. While most athletes have recovered from their sport concussions after a short period of time, a minority of athletes have experienced prolonged post-concussion symptoms (Jotwani & Harmon, 2010; Pellman et al., 2004). Past studies have indicated that anywhere from 1.6% to 31% of athletes have experienced post-concussion symptoms beyond the typical 7 to 10-day recovery period (Benson et al., 2011; Makdissi, Cantu, Johnston, McCrory, & Meeuwisse, 2013; McCrea et al., 2013; Pellman et al., 2004). The CISG reported that 10-15% of athletes have experienced prolonged post-concussion symptoms (McCrory et al., 2013), which was a common range cited within the literature. Applying a conservative 5% rate to the US sports concussion estimate of 3.8 million per year translates into 190,000 athletes experiencing prolonged post-concussion symptoms on an annual basis (McCrea et al., 2013). Hockey players are believed to be at a greater risk for experiencing prolonged post-concussion symptoms (Makdissi et al., 2013), which was supported by Benson et al.'s (2011) findings that 31% of NHL players experienced post-concussion symptoms beyond the

10-day mark. Signs and symptoms, such as fatigue (Benson et al., 2011), persistent (i.e., greater than 3 hours following a concussion) headaches (Asplund, McKeag, & Olsen, 2004), LOC (greater than 1 minute), retrograde amnesia and immediate orientation problems (Pellman et al., 2004) have been associated with prolonged post-concussion symptoms. A previous history of sport concussions (Guskiewicz et al., 2000; 2007) and mental health concerns (Jotwani & Harmon, 2010) have also been related to prolonged post-concussion symptoms among athletes.

Post-concussion syndrome. As a clinical phenomenon, prolonged post-concussion symptoms have been conceptualized as post-concussion syndrome (PCS; Putukian & Echemendia, 2003), chronic post-concussion syndrome (CPCS; Jordan, 2013), and post-concussion disorder (PCD; APA, 2000). While the discriminating factor between post-concussion symptoms and PCS has been the persistence of symptoms (Ferguson, Mittenberg, Barone, & Schneider, 1999; Jotwani & Harmon, 2010), there has been a lack of clarity surrounding when the former ends and the latter starts (Pellman et al., 2004). As examples, PCS has been defined as post-injury symptoms lasting longer than 7-days (Pellman et al., 2004), 3 months (APA, 2000), and 1 year (Jordan, 2013). PCS has also been defined as ongoing cognitive, physical, or emotional symptoms that are present for a longer than expected length of time (Jotwani & Harmon, 2010). The variability in PCS definitions has led ongoing debate on how to conceptualize, diagnose, and manage athletes' post-concussion symptoms (Jotwani & Harmon, 2010).

Further complicating matters is that there has been increasing evidence that PCS is not a distinct clinical phenomenon among those who have suffered a concussion (Dikmen, Machamer, Fann, & Temkin, 2010). Specifically, post-concussion symptoms

have been reported by: individuals' who have suffered a non-head injury (Dikmen et al., 2010), those experiencing depression (Gunstad & Suhr, 2001; Lange, Iverson, & Rose, 2011; Trahan, Ross, & Trahan, 2001), healthy undergraduates (Suhr & Gunstad, 2002), headache sufferers (Gunstad & Suhr, 2001) and those with no prior head injuries (Gouvier, Cubic, Jones, Brantley, & Cutlip, 1992). As a result, it has been suggested that various non-neurological factors, such as emotional or psychological distress, need to be considered before making a diagnosis of PCS (Suhr & Gunstad, 2002; Trahan et al., 2001).

A PCS diagnosis has been complicated by the fact that it has been difficult to distinguish between indirect psychosocial factors and direct neurological factors related to the head injury (Gouvier et al., 1992; Putukian & Echemendia, 2003). For example, there has been moderate to high correlations (.64-.68) between indices of post-concussion symptoms, depression, and anxiety (Trahan et al., 2001). Similarly, those who reported being depressed and having a head injury also experienced elevated post-concussion symptoms (Suhr & Gunstad, 2002). Kashluba, Paniak, and Casey (2008) found that affective and behavioural symptoms primarily differentiated those individuals with prolonged (greater than 3 months) post-concussion symptoms from those with a shorter symptom recovery. The experience of daily stress following a head injury has also been associated with higher post-concussive symptom severity ratings (Gouvier et al., 1992). Together, it has been suggested that a concussion represents a stressor that exacerbates pre-existing underlying psychological conditions and/or creates increased levels of stress, which, in turn, leads to persistent post-concussion symptoms (Gouvier et al., 1992; Kashluba et al., 2008).

For the purpose of this dissertation, anticipated post-concussion psychological responses were examined across a one-week period. In turn, anticipated post-concussion psychological responses were examined within the range of typical recovery timeframes rather than an atypical or persistent recovery timeframes.

Classifying sport concussions. Sport concussion classification systems have been developed as a way of preventing further athlete injury, both in the short- and long-term, through prescribing symptom management directives and providing RTP guidelines (Asplund et al., 2004; Harmon et al., 2013; Johnston et al., 2004; Tator, 2013). For example, if athletes were to experience a second concussion before the neurological effects of an existing concussion had subsided, they were thought to be at risk for second impact syndrome (SIS; Cantu & Register-Mihalik, 2011; Randolph & Kirkwood, 2009; Tator, 2013). It has been suggested that SIS occurs when the brain is not able to properly autoregulate blood flow, which leads to cerebral swelling and the rapid development of a brain hemorrhage (Cantu & Register-Mihalik, 2011; McCrory, 2001; Tator, 2013). A catastrophic outcome of SIS has been sudden death (Cantu & Register-Mihalik, 2011; McCrory, 2001); however, SIS has been a rare phenomenon among mildly concussed athletes (1 in 1,800,000; Randolph & Kirkwood, 2009) and has lacked scientific validation as a clinical entity (McCrory et al., 2001). Nevertheless, the potential for SIS led to the development of specific concussion management and RTP guidelines (McCrory, 2001; 2002).

Dating back to 2004, there were more than 27 concussion classification and management systems in existence (Bender, Barth, & Irby, 2004). The three commonly used classification systems were developed by Cantu (1998), the American Academy of

Neurology ([AAN]; 1997), and Kelly et al. (1991; known as the Colorado Medical Society Guidelines) (for a review see Bender et al., 2004; Echemendia, 2012). Each classification system had a concussion gradation (severity) scheme (i.e., mild, moderate, and severe) that was used to determine RTP guidelines (Bender et al., 2004; Echemendia, 2012). The three gradation systems used the presence of LOC, amnesic symptoms, and sign/symptom duration as indicators of concussion severity; however, there was not unanimous agreement on how the signs and symptoms should present across the mild, moderate, and severe gradation levels (Bender et al., 2004; Echemendia, 2012). Similarly, there was a lack of agreement on the length of time that an athlete should be removed from play across the three classification systems (Bender et al., 2004; Echemendia, 2012). Given this variability, it is not surprising that there has been a lack of consistency in how athletes' sport concussions have been managed and confusion surrounding which classification system represented best practices (Echemendia, 2012).

Beyond the inconsistency of the concussion classification systems, these systems have several other limitations. Specifically, the concussion classification systems are based on the opinions of different experts rather than scientific evidence (Aubry et al., 2002; Bender et al., 2004; Echemendia, 2012, Giza et al., 2013; McCrory, 2002). Given that more than 90% of sport concussions are considered to be of mild severity (Gunstad & Suhr, 2001), there has been criticism about overemphasizing the signs (i.e., LOC) and symptoms (i.e., amnesia) used to determine sport concussion gradation (Barr & McCrea, 2010). Research has shown that LOC and amnesia (retrograde or anterograde) are present in a minority (6.3% to 28.3%) of sport concussions (Benson et al., 2011; Echlin et al., 2010; Guskiewicz et al., 2000; 2003; McCrea, Kelly, Randolph, Cisler, & Berger,

2002; McCrea et al., 2003). Finally, clinicians have reported that the classification grading criteria lacks sensitivity and specificity and, as a result, they have had a difficult time predicting athletes' sport concussion recovery times (Pellman et al., 2004).

In 2002 the CISG reviewed the limitations of the concussion classification systems and recommended that an individualized approach to concussion assessment and management be adopted (Aubry et al., 2002). As such, the CISG suggested that neuropsychological testing be incorporated into the assessment of sport concussions (Aubry et al., 2002). Moreover, the CISG advised that medical and clinical professionals follow a graded RTP process that takes into consideration symptom resolution, normal neuropsychological functioning (using baseline testing), and a stepwise progression in activity level until the athlete returns to game play (Aubry et al., 2002). Recently, the AAN developed an evidence-based, individual approach to managing sport concussions that replaced their 1997 concussion management guidelines (Giza et al., 2013). The AAN sport concussion guidelines are similar to the 2002 recommendations provided by the CISG (see Aubry et al., 2002; Giza et al., 2013).

Occurrence of Sport Concussions

When it comes to sport injuries, research (Covassin et al., 2003; Gessel et al., 2007; Guskiewicz et al., 2000; Hootman et al., 2007; Powell & Barber-Foss, 1999) has indicated that concussions account for 5% to 18% of all the injuries that athletes endure. The variability in sport concussion frequency has been partly attributed to differences in: study methodologies, level of competition, gender, and sport type (Covassin et al., 2003; Covassin & Elbin, 2010; Macciocchi, 2006). Nevertheless, four sports, ice hockey, football, basketball, and soccer have higher concussion rates in comparison to other

sports (Covassin et al., 2003; Gessel et al., 2007; Harmon et al., 2013; Hootman et al., 2007). Given that ice hockey, football, basketball, and soccer players are at a greater risk to experience sport concussions, this dissertation focused on the psychological impact of sport concussions across these four sports. Below is a review of the concussion rate findings for men's ice hockey, football, soccer, and basketball.

Ice hockey. Across different ice hockey competition levels, sport concussion rates have ranged from 5% to 10.66% (Covassin et al., 2003; Goodman, Gaetz, & Meichenbaum, 2001; Hootman et al., 2007; Tegner & Lorentzon, 1996). Sport concussion injury rates have spanned from .72 to 21.52 per 1000 athlete exposure hours (Agel & Harvey, 2010; Benson et al., 2011; Daneshvar, Nowinski, McKee, & Cantu, 2010; Echlin et al., 2010; Goodman et al., 2001). A history of previous sport concussions has been common among ice hockey players, with 22% to 42% of ice hockey players having experienced a past sport concussion (Benson et al., 2011; Echlin et al., 2010; Tegner & Lorentzon, 1996). Based on a sample of Swedish elite ice hockey players, Tegner and Lorentzon (1996) estimated that 20% of ice hockey players would go on to experience a sport concussion during their career. Ice hockey concussions rates are likely underestimated given that hockey players have been found to deny their past sport concussion histories (Echlin et al., 2010), fail to report their presenting sport concussion symptoms (Benson et al., 2011), and are not always referred to medical professionals after suffering a head injury (Goodman et al., 2001).

Football. Sport concussion rates among football players have ranged from 5.1% to 9.3% (Covassin et al., 2003; Guskiewicz et al., 2000; Hootman et al., 2007; Powell & Barber-Foss, 1999). Among retired NFL players, 60% reported having experienced one

sport concussion during their playing career (Guskiewicz et al., 2007). Using a more liberal concussion definition (i.e., presence of concussion signs or symptoms after receiving a hit), Delaney et al. (2000; 2002) found that 44.8% to 70.4% of football players reported experiencing sport concussion symptoms during their previous playing season. Cross-sport studies (Mayers, 2013; Powell & Barber-Foss, 1999) have indicated that football players account for the majority (53% to 63.4%) of reported sport concussions. Sport concussion injury rates among football players have varied from .37 to 35.9 per 1000 athlete exposure hours (Gessel et al., 2007; Guskiewicz et al., 2000; Hootman et al., 2007; Powell & Barber-Foss, 1999). Football players who have sustained a sport concussion are 2 to 5 times more likely to sustain a subsequent concussion (Delaney et al., 2000; 2002; Guskiewicz et al., 2000). Depending on how sport concussions are tracked and defined, 14.7% (Guskiewicz et al., 2000) to 84.79% (Delaney et al., 2000) of football players have reported that they have suffered multiple concussions in a season. Football player concussions can go unreported or unnoticed (Guskiewicz et al., 2000) and, as a result, it is possible that sport concussion rates have been underrepresented.

Soccer. The sport concussion injury rate for soccer players has been found to vary from .22 to 18.8 per 1000 athlete exposure hours (Covassin et al., 2003; Gessel et al., 2007; Powell & Barber-Foss, 1999). Using a liberal concussion definition, Delaney et al. (2002) found that 62.7% of soccer players had experienced symptoms of a sport concussion during their previous playing season. Moreover, 81.7% of soccer players reported that they had suffered more than one sport concussion during their previous playing season (Delaney et al., 2002). Sport concussions have been found to account for

7.6% of all the injuries that soccer players suffer during their playing season (Covassin et al., 2003).

Basketball. Among non-contact sports, basketball players have experienced a higher rate of sport concussions (see Covassin et al., 2003; Gessel et al., 2007). The sport concussion injury rate for basketball players has been found to vary from .16 to .61 per 1000 athlete exposure hours (Covassin et al., 2003; Gessel et al., 2007; Hootman et al., 2007). As well, sport concussions make up 3.2% to 6.1% of all injuries endured by basketball players (Covassin et al., 2003; Gessel et al., 2007; Hootman et al., 2007).

Athletes' Post-Concussion Psychological Responses: A Conceptual Framework

The sport and rehabilitation literature has revealed that athletes have experienced a variety of post-injury psychological responses (Brewer, 1994; Crossman, 1997; Evans & Hardy, 1995; Leddy, Lambert, & Ogles, 1994; Team Physician Consensus Statement, 2006; Wiese & Weiss, 1987; Walker et al., 2007; Wiese-Bjornstal et al., 1995). Theories on grief and loss (Kübler-Ross, 1969) and stress and cognitive appraisal (Lazarus, 1991; 1993; 1999; 2001; Lazarus & Folkman, 1984) have been used to try and understand athletes' disparate post-injury psychological reactions. Past research (McDonald & Hardy, 1990; Quinn & Fallon, 1999) has shown mixed support for athletes' post-injury psychological responses following Kübler-Ross's (1969) discrete and sequential stages (i.e., denial, anger, bargaining, depression, and acceptance) of grief and loss. Despite the mixed support, it has been suggested that Kübler-Ross's theory of grief and loss was too linear to capture the variability in athletes' post-injury psychological reactions (see Brewer, 1994, for a review).

In contrast to grief and loss models, stress and cognitive appraisal models (Wiese-Bjornstal et al., 1995) were thought to better account for athletes' post-injury disparate psychological reactions (Brewer, 1994; 2010) and have received consistent empirical support (see Wiese-Bjnorstal, 2010, for a review). Wiese-Bjornstal et al.'s (1995) sport injury response model has conceptualized sport injuries as a *potential* stressful event. Whether athletes viewed their sport injuries as stressful events depended on how they appraised their injuries (Wiese-Bjornstal et al., 1995).

According to Lazarus (1966; 1993; 1999, 2001) when individuals are faced with an event they engaged in two types of cognitive appraisals: primary and secondary. Primary appraisal referred to whether an event was perceived as being relevant to one's psychological well-being (Lazarus, 1991; 1993; 1999, 2001). If an event had psychological well-being implications, then individuals' stress appraisals were focused on the following themes: harm/loss, threat, and challenge (Lazarus & Folkman, 1984). Harm/loss stress appraisals focused on damage that had already occurred; for example, an injury, lowered self- or social-esteem, or the loss of a valued relationship (Lazarus & Folkman, 1984). Threat appraisals involved anticipated (future) harms or losses and challenge appraisals involved perceptions of growth opportunities (Lazarus & Folkman, 1984).

Primary appraisals are further distinguished by the following emotion-centered components: goal relevance (i.e., the event has personal implications), goal congruence or incongruence (i.e., the event facilitates or thwarts what an individual wants), and ego-involvement (i.e., valued self-beliefs, goals, or commitments) (Lazarus, 1991; 1993). Goal relevance evaluations determined whether an event elicited emotions or not

(emotions will be present if there is a personal stake in the event). If an event had personal relevance, goal congruence or incongruence determined the valance of the emotion; that is, if the event was congruent with one's goals then positive emotions would occur and if the event was incongruent with one's goals then negative emotions would occur (Lazarus, 1991; 1993). Ego-involvement, which could take many identity forms (e.g., self-and social esteem, moral values, ego-ideals, meanings/ideas, life goals, and relationships with others), impacted the types of emotions elicited by an event (Lazarus, 1991; 1993). For example, anxiety occurred after an event had been appraised as threatening valued personal beliefs and meaning structures (Lazarus, 1991; 1993; 2001). Another example was that sadness occurred after an event had been appraised as involving ego-identity loss (Lazarus, 1991).

As part of the appraisal process, secondary appraisals involved an evaluation of one's options or resources for coping with an event (Lazarus, 1966; 1991; 1993; 1999, 2001; Lazarus & Folkman, 1984). The three components involved in secondary appraisals were: attributing blame or credit (i.e., towards self or others) for the event, assessing one's ability to cope with the event, and future expectations (i.e., favorable or unfavorable) about whether the impact of the event will change (Lazarus, 1991; 1993; 1999; 2001). Secondary appraisals were not construed as sequentially following primary appraisals or as having less influence on the development of emotions (Lazarus, 1966; 1999; Lazarus & Folkman, 1984). Instead, primary and secondary appraisals were thought to simultaneously interact with each other to influence one's emotional experience (Lazarus, 1999). As an example, if individuals' coping efforts were appraised

as not having an impact on an existing harm or a potential threat, then hopelessness would be experienced (Lazarus, 1966; 1991).

Following the initial appraisal process, Lazarus (1991) suggested that individuals continued to receive feedback from their environment and their own actions and reactions. This feedback provided individuals with new information to be evaluated and these new evaluations have been conceptualized as reappraisals (Lazarus, 1991; 2001). Reappraisals were thought to alter individuals' existing appraisals (e.g., an initial threat is viewed as a challenge) and, subsequently, lead to different emotional (e.g., anxiety to eagerness) reactions (Lazarus, 1991; 2001).

Although Lazarus's (1966; 1991; 1993; 1999, 2001) stress and appraisal theory provided a detailed account of the appraisal process, Wiese-Bjornstal et al.'s (1995) sport injury response model hasn't explicitly differentiated athletes' primary and secondary appraisal process. However, Wiese-Bjornstal et al. have alluded to the reappraisal process by suggesting that athlete injury appraisals and emotional responses were influenced by each other throughout the rehabilitation process. For instance, if athletes' viewed their rehabilitation as progressing towards a full recovery, then they would experience positive emotions (Wiese-Bjornstal et al., 1998). Conversely, if athletes' viewed their rehabilitation as being prolonged or unsuccessful, then they would experience negative emotions (Wiese-Bjornstal et al., 1998). Research (McDonald & Hardy, 1990; Ruddock-Hudson et al., 2012; Tracey, 2003) has found support for the association between athletes' appraisals of their rehabilitation progress (or lack thereof) and their post-injury emotional responses.

Further integrating components from Lazarus's (1966; 1991; 1993; 1999; 2001) stress and cognitive appraisal theory, Wiese-Bjornstal et al. (1995) suggested that personal and situational factors influenced the relationship between athletes' post-injury appraisals and psychological responses. Personal factors were comprised of injury characteristics (e.g., injury history, severity, or type) and psychological (e.g., athletic identity, mood states, or coping skills), demographic (e.g., age or gender), and physical (e.g., physical health status) differences (Wiese-Bjornstal et al., 1995). On the other hand, situational factors were comprised of sport (e.g., type, level of competition, or playing status), social (e.g., team or coach influences), and environmental (e.g., access to rehabilitation) considerations (Wiese-Bjornstal et al., 1995). These personal and situational factors were believed to exert their influence on post-injury appraisals and psychological responses throughout the rehabilitation process (Wiese-Bjornstal et al., 1995).

At present, Wiese-Bjornstal et al.'s (1995) sport injury response model has not been applied to athletes who have suffered a sport concussion. In an attempt to add to the existing sport and rehabilitation literature, this dissertation examined if Wiese-Bjornstal et al.'s (1995) injury response model could lend an understanding to athletes' anticipated post-concussion psychological responses. For the purpose of this dissertation, an imagined sport concussion was conceptualized as a perceived stressful event that precipitated various anticipated cognitive appraisals and psychological responses.

After the Concussion: Athletes' Psychological Responses

Although sport concussions have been characterized as a brain injury (McCrory et al. 2013), it has been suggested that the harm from sport concussions extends beyond the

physical consequences to a variety of unpleasant psychological experiences (Echemendia, 2012; Hutchison et al., 2009; Putukian & Echemendia, 2003). Following a sport concussion, athletes have reported increases in depression, confusion, fatigue, anxiety, isolation, anger, stress, fear (of reinjury) and irritability and decreases in vigor and self-esteem (Benson et al., 2011; Bloom, Horton, McCrory, & Johnston, 2004; Broshek & Freeman, 2005; Caron et al., 2013; Echemendia, 2012; Hutchison et al., 2009; Mainwaring, 2011; Team Physician Consensus Statement, 2006).

Studies on the psychological impact of sport concussions have found that sport concussions have short- and long-term effects on athletes. Short-term post-concussion symptoms have been defined as psychological experiences that have lasted up to three-weeks after a sport concussion (Mainwaring, 2011). Athletes' short-term post-concussion psychological states have been described as a concussion crevice, in which increases in depression, anger, fatigue, and confusion are split by a decrease in vigour (Mainwaring, Comper, et al., 2012). The concussion crevice has been contrasted with athletes' pre-concussion psychological states (low depression, anger, fatigue, and confusion split by high vigor) (Mainwaring, Comper, et al., 2012), which has been termed the iceberg profile (Morgan, 1980).

Within the existing research there has been no agreed upon definition for what constitutes long-term post-concussion symptoms. However, research has shown that a history of sport concussions has been related to the experience of psychological difficulties well into athletes' retirement years (Caron et al., 2013; Guskiewicz et al., 2007; Kerr et al., 2012). As an example, Guskiewicz et al. (2007) studied retired NFL athletes who had an averaged age of 53 years old and who had not played football for

some time (i.e., retired fro an average of 24 years). In their study, a dosage effect was found between the participants' past sport concussions and the likelihood that they had clinical depression. Other research (Caron etal., 2013) has indicated that athletes have experienced psychological symptoms (e.g., anxiety and depression) for months to years after a sport concussion.

While researchers have started to examine the short-and long-term psychological impact of sport concussions, the breadth of research has remained small and limited (Mainwaring, 2011). In particular, very little is known about athletes' experience of post-concussion anxiety (Mainwaring, 2011). Similarly, research on athletes' experience of post-concussion depression is in its infancy and remains sparse (Mainwaring, Hutchison, et al., 2012).

Understanding athletes' post-concussion anxiety and depression symptoms is important for several reasons. First, anxiety and depression symptoms are psychological markers used to assess the presence of a concussion (Echemendia, 2012; Echemendia & Putukian, 2003). Second, athletes' post-concussion depression and anxiety symptoms are important factors to be considered when developing and managing athletes' psychological and physical rehabilitation (Bloom et al., 2004; Echemendia, 2012; Mainwaring, 2011; Wiese-Bjornstal et al., 1995). Finally, athletes' post-concussion depression and anxiety symptoms have been found to interfere with their daily functioning and fuel other concerning psychologist states, such as being suicidal (Caron et al., 2013).

Post-concussion depression. The following quote comes from Caron et al.'s (2013) qualitative study of former NHL players who had to retire after suffering sport concussions:

> There were two or three months where I was down and out. I didn't feel good (. . . .) Deep depression. Emotional, because you think your career is over. Really, I think my wife came home one day and I think I was under the table crying (p. 173).

As depicted by the participant in Caron et al.'s (2013) study, athletes' have reported feeling depressed after receiving a sport concussion. Within the past decade, prospective studies (Hutchison et al., 2009; Mainwaring et al., 2004; 2010) have primarily investigated the short-term experience of depression symptoms following a sport concussion. Results from these studies have indicated that athletes' post-concussion depression symptoms follow a quadratic trend. Specifically, athletes' depression symptoms typically peaked (from a pre-concussion baseline) four days following their sport concussion and then declined to pre-concussion levels within seven days (Mainwaring et al., 2004; 2010). In the days following a sport concussion, athletes' depression symptoms have increased three-fold from their pre-concussion baseline levels (Mainwaring et al., 2010). As well, athletes' have reported elevated depression symptoms in comparison to uninjured athletes and healthy undergraduates (Mainwaring et al., 2004). However, across a two week period, one study failed to find a significant difference between concussed athletes and healthy undergraduates' depression ratings (Hutchison et al., 2009). A potential explanation for this null finding is that healthy undergraduates have been found to report symptoms that are experienced by individuals

who have concussion (Suhr & Gunstad, 2002). Despite this null finding, short-term increases in athletes' post-concussion depression symptoms have been attributed to an acute neurometabolic disruption in the brain's functioning (Mainwaring et al., 2004; 2010; 2012).

Only a few studies (Guskiewicz et al., 2007; Kerr et al., 2012) have examined whether athletes' sport concussions are associated with long-term depression symptoms. Guskiewicz et al. (2007) surveyed retired NFL football players and found a dosage effect between retirees reported number of sport concussions and the probably of being diagnosed with clinical depression. That is, in comparison to retirees who never received a sport concussion, retirees with a history of 1 or 2 sport concussions were 1.5 times more likely to have received a diagnosis of clinical depression (Guskiewicz et al., 2007). Retirees with 3 or more sport concussions were 3 times more likely to have received a diagnosis of clinical depression (Guskiewicz et al., 2007). In a similar study of retired NFL football players, Kerr et al. (2012) found that the 9-year risk of receiving a diagnosis of clinical depression increased with the number of previous sport concussions. Only 3% of retirees with no sport concussion history had received a diagnosis of clinical depression over the 9-year period, whereas 26.8% of the retirees with a history of 10 or more sport concussions had received a diagnosis of clinical depression (Kerr et al., 2012).

As revealed in the opening quote for this section, Caron et al. (2013) found that retired NHL players with a history of sport concussions continued to struggle with depression. Specifically, participants' post-concussion depression symptoms lasted anywhere from 2 or 3 months to 2 years (Caron et al., 2013). Similar to other studies (Kerr et al., 2012), it was suggested that concussion-related circumstances or stressors

(e.g., early retirement, decreases in functioning, or financial strain) could have perpetuated and prolonged retirees' depression symptoms (Caron et al., 2013).

Post-concussion anxiety. The experience of anxiety following a sport concussion has received minimal empirical attention (Mainwaring, 2011; Mainwaring, Hutchison, et al., 2012). Using the abbreviated Profile of Mood States (POMS) questionnaire, researchers (Hutchison et al., 2009; Mainwaring et al., 2004) have found that athletes' reported level of tension (subscale that lists anxiety as an item) remained unchanged (in comparison to pre-concussion levels) following a sport concussion. However, it is possible that a significant difference in athletes' pre-and post-concussion tension scores was not found due to the athletes' psychological and physical state during their baseline tests. That is, baseline test results can be influenced by a variety factors, including sleep deprivation and stress (Mainwaring, Comper, et al., 2012). As training camp begins, athletes may experience increased stress and sleep disruptions. If tenable, it is reasonable to suggest that these factors could have elevated athletes' baseline tension scores, making it less likely that a significant difference would have been found when comparing athletes' pre-and post-concussion tensions scores.

Nevertheless, other research (Caron et al., 2013) has shown that retired NHL players experienced anxiety after receiving a concussion. When discussing past post-concussion experiences, one NHL retiree stated, "Anxiety. Absolutely. That year was the worst I've ever felt" (p. 172). For these NHL retirees, the unknowns (e.g., long-term consequences) surrounding their sport concussion injury fuelled their anxiety (Caron et al., 2013). Together, one qualitative study has indicated that athletes' have experienced persistent anxiety following a sport concussion, whereas a few quantitative studies have

shown that athletes have not experienced short-term increases in tension (as a composite index that included an anxiety-focused item) following a sport concussion.

Although prospective studies (Hutchison et al., 2009; Mainwaring et al., 2004) have suggested that markers of anxiety (i.e., tension) are not elevated following a sport concussion, further investigations are needed. Athletes' experience of post-concussion anxiety symptoms should be further examined given that the non-concussion sport injury literature has found that athletes have experienced anxiety symptoms following their injuries (e.g., Chan & Grossman, 1988; Clement et al., 2013; Johnson, 1997; Tracey, 2003). Outside of the sport injury literature, concussion research (Horner, Selassie, Lineberry, Ferguson, & Labbate, 2008; Powell, Collin, & Sutton, 1996) has shown that individuals have experienced post-TBI anxiety elevations.

Distinguishing post-concussion depression and anxiety. While sport concussion research (e.g., Hutchison et al., 2009; Caron et al., 2013) has provided mixed findings on athletes' experience of post-concussion depression and anxiety, the sport injury literature (e.g., Chan & Grossman, 1988; Ruddock-Hudson et al., 2012) has suggested that these two psychological responses can co-occur. Moreover, findings from concussion (Trahan et al., 2001) and emotion (Watson, Clark, & Carey, 1988) research have found moderate to strong (.40 to .70) relationships between measures of anxiety and depression. The shared experience of negative emotion is thought to be responsible for the co-occurrence of anxiety and depression (Watson et al., 1988; Watson, O'Hara, & Stuart, 2008). To this point, Larazus (1966; 1991; 1999) has suggested that both depression and anxiety share an underlying negative emotional valence.

Although it has been argued that anxiety and depression represented the same underlying experience, emotion researchers (see Watson & Naragon-Gainey, 2010) have found that depression and anxiety can be differentiated through the positive emotion dimension. Specifically, a strong and consistent negative relationship has been found between depression and positive emotion in comparison to anxiety and positive emotion (Watson et al., 1988; Watson & Naragon-Gainey, 2010). The moderate to strong relationship between anxiety and depression has led to the suggestion that these two emotional experiences were not identical (i.e., unaccounted for variance) in nature. Lazarus (1966; 1991) has also proposed that depression and anxiety can be differentiated based on the perceived certainty (in the case of depression) or uncertainty (in the case of anxiety) of a stressful event. Integrating the existing research findings and theories, there was reason to examine anxiety and depression symptoms as separate, yet related, post-concussion responses.

The Role of Appraisals in Athletes' Post-Concussion Psychological Responses

When it comes to the psychological impact of sport injuries, researchers (Brewer, 1994; Gould, Udry, Bridges, & Beck, 1997; Tracey, 2003; Wiese-Bjnorstal et al., 1995) have suggested that athletes' injury appraisals play a crucial role in determining their post-injury responses. Nevertheless, only a few studies have focused on the nature of athletes' injury appraisals (Albinson & Petrie, 2003). Wiese-Bjornstal et al. (1998) suggested that injured athletes' appraise their sport-related goals, rate of injury recovery, self-perceptions (e.g., self-efficacy and self-esteem), reasons for the injury, and whether a loss has occurred. Based on her work with injured athletes, Cassidy (2006) developed the Sport Injury Appraisal Scale (SIAS). The SIAS is a multi-domain scale that captured the

following seven injury appraisals: being perceived as weak, experiencing pain, letting important others down, loss of athleticism, loss of social support, possibility of re-injury, and impaired self-image (Cassidy, 2006). Cassidy's injury appraisal domains have received ancillary support within the sport and rehabilitation literature (e.g., Albinson & Petrie, 2003; Daly, Brewer, Van-Raalte, Petitpas, & Sklar, 1995; Lavallee et al., 1998; Ruddock-Hanson et al., 2012; Tracey, 2003).

Due to the small amount of research on sport-injury appraisals there have been few investigations into the appraisal-emotion link specified in Wiese-Bjornstal and colleagues (1995) injury response model. A prospective study (Albinson & Petrie, 2003) found that if athletes remained injured for one month, their initial negative injury appraisals (e.g., difficulties with coping) were positively correlated to their mood difficulties 28 days later. Moreover, immediate (a day after injury) post-injury mood difficulties positively predicted negative injury appraisals during the subsequent week (Albinson & Petrie, 2003). Together, the findings reflected the reciprocal relationship between post-injury appraisals and mood difficulties. In another study, Rex (2011) found that athletes' higher SIAS subscale scores were associated with increases in sport anxiety and negative emotions, as well as decreases in quality of life and positive emotions.

Building on the existing literature, this dissertation examined whether athletes' anticipated post-concussion appraisals were related to their anticipated post-concussion anxiety and depression symptoms. The blending of theory (Lazarus, 1966; 1991; Lazarus & Folkman, 1984) and research findings (Caron et al., 2013) provided a framework for understanding the possible relationships between athletes' anticipated post-concussion injury appraisals and depression and anxiety symptoms.

Post-concussion appraisals and depression. Existing theories have suggested that depression symptoms are precipitated by a stressful incident (Lazarus, 1966; Lazarus & Folkman, 1984) or negative life event (Oatley & Bolton, 1985; Pyszczynski & Greenberg, 1987) that involved some type of loss. According to Peretz (1970) loss can be defined as being deprived of, or being without, something that one once had. Moreover, loss can take many different forms, including the loss of a valued or loved person, some aspect of the self, external objects, and development through human growth (Peretz). Lazarus (1966) suggested that the most substantial losses involved losing something that one was committed to.

Athletes are believed to experience different losses to varying degrees (Astle, 1986; Lavallee et al., 1998). Moreover, when athletes are injured they are more inclined to experience a sense of loss (Astle, 1986; Gould et al., 1997; Lavallee et al., 1998). For instance, injured athletes' may lose self-esteem or confidence, independence, money or rewards, social support, or physical ability (Astle, 1986; Lavallee et al., 1998; Tracey, 2003). Paralleling the existing literature, it is plausible that athletes may appraise a sport concussion as a stressful event because it is associated with various losses (e.g., decline in athletic ability).

Following the tenants of Lazarus's (1991; 1999; 2001) stress and cognitive appraisal theory, if athletes suffered a sport concussion and appraised their injury as involving *irrevocable* losses, then they should experience sadness. Similar to other researchers (Astle, 1986; Peretz, 1970), Lazarus (1991) viewed appraisals focused on ego-identity (or self-relevant) loss as central to the experience of sadness. While Lazarus (1991) viewed sadness and depression as overlapping emotions, depression can be

conceptualized as being distinct from sadness in several ways. Specifically, depression occurred when various emotions (e.g., anger, shame, and anxiety) were experienced together, whereas sadness was a distinct emotion (Lazarus, 1991). Furthermore, depression was experienced when an event lead to a hopeless view of one's life (as a whole) and sadness was experienced in relation to the loss event itself (Lazarus, 1991). As such, athletes may experience post-concussion depression if they experienced irrevocable self-related losses that left them viewing their future as bleak and empty.

As research has not examined athletes' appraisals immediately following a sport concussion, the impact of appraisals on depressive symptoms remains unknown. Although short-term increases in post-concussion depression symptoms are thought to be the result of neurochemical disruptions (Hutchison et al., 2009; Mainwaring et al., 2004; 2010), the sport injury literature has found that athletes' post-injury appraisals (e.g., viewing oneself as worthless due to loss of athletic prowess) are linked to their increased depression symptoms (Broshek & Freeman, 2005). Moreover, athletes' immediate post-injury mood disturbances have been associated with the onset of negative injury appraisals (Albinson & Petrie, 2003). Based on these sport injury studies it is plausible that athletes' post-concussion appraisals could be related to their short-term depression symptom elevations.

Athletes' appraisals of irrevocable (self-related) loss may be prevalent if they received feedback that they have sustained a season- or career-ending concussion or if they have experienced persistent post-concussion symptoms. Research on sport concussions (Caron et al., 2013) and retirement (e.g., Lavallee & Robinson, 2007) have indicated that when athletes stop playing their chosen sport they have experienced self-

related losses (e.g., social status) and ongoing psychosocial difficulties (including depression). For example, retired NHL players discussed their emotional difficulties that stemmed from losing their celebrity status, needing to reinvent themselves, and retiring before they had accomplished their sport-related goals (e.g., length of career or winning Stanley's Cup) (Caron et al., 2013). Following the existing research findings, it was hypothesized that athletes' anticipated post-concussion loss appraisals would be positively associated with their anticipated post-concussion depression symptoms.

Post-concussion appraisals and anxiety. Lazarus (1966; 1999) suggested that anxiety was related to threating appraisals. As threats are future-orientated, perceptions of ambiguity (e.g., coping potential) and uncertainty (e.g., whether the threat will occur) are believed to fuel anxious feelings (Lazarus, 1966; 1991). Similar to depression, threats to ego-identities have also been thought to underlie the experience of anxiety (Lazarus, 1991; 1999). As examples, ego-identity threats were thought to involve perils to self-views, social status, and accomplishing desired aspirations (Lazarus, 1966; 1991; 1999). Together, these threats were existential in nature, in that they challenged self-derived meaning structures and self-in-relation-to-other/world beliefs (Lazarus & Folkman, 1984).

Preliminary and indirect support for Lazarus's (1966; 1991) view of anxiety has been found in Caron et al.'s (2013) study of former NHL players. Specifically, retired NHL players reported feeling anxious about the uncertain course of their post-concussion symptoms (Caron et al., 2013). With limited research on post-concussion anxiety, associations between athletes' sport concussion appraisals and feelings of anxiety need to be directly investigated. It is possible that sport concussions could be perceived as

threatening athletes' valued internal (e.g., sense of self) and external (e.g., social support) resources, leading them to experience increased post-concussion anxiety symptoms. It was hypothesized that athletes' anticipated post-concussion threat appraisals would be positively related to their anticipated post-concussion anxiety symptoms.

Factors Influencing Athletes' Post-Concussion Appraisals and Psychological Responses

Wiese-Bjornstal et al. (1995) sport injury response model suggested that a variety of personal and situational factors influenced athletes' post-injury appraisals, emotional reactions, and moods. Specific to this dissertation was the personal factor of sport concussion severity.

Sport concussion severity. Presently, research has not focused on the relationship between sport concussion severity and athletes' post-concussion appraisals. However, Cassidy (2006) found that athletes who were injured for a longer period of time (i.e., 1 year versus 3 months) were more likely to perceive that they had less social support. Athletes with a severe (versus mild or moderate) injury were also more likely to rate themselves as losing their athleticism and social support, being susceptible to future injuries, and experiencing greater pain (Habif, 2008). Qualitative studies have revealed that athletes' appraised their severe injuries as threatening their sport careers (Gould et al., 1997; Ruddock-Hudson et al., 2012). Finally, research (Lavallee, Grove, & Gordon, 1997) has found that athletes who non-voluntarily retire (due to injury) believed that they had less control over their sport retirement decision.

Within the sport and rehabilitation literature, injury severity has been found to influence athletes' post-injury psychological responses (Evans & Hardy, 1995). For

example, Smith, Scott, O'Fallon, and Young (1990) found a positive association between athletes' injury severity and their post-injury depressive symptoms. As well, Smith et al. (1993) found that athletes' who were injured for a longer period of time experienced greater levels of tension and depression. Similar research has revealed that the time since an injury (McDonald & Hardy, 1990; Quinn & Fallon, 1999) and surgery (Brewer et al., 2007), as well as higher levels of rated (by a physician) injury recovery (Brewer, Linder, & Phelps, 1995), were associated with athletes' mood adjustment. Despite the findings on sport injury severity, there is no existing research that has focused on the link between athletes' sport concussion severity and their post-concussion psychological responses.

For the purpose of this dissertation, concussion severity was operationalized as imagined RTP timelines. This definition was in contrast to the sport concussion grading systems, which have relied on sport concussion signs and symptoms to classify athletes' sport concussion severity. It is possible that imagined RTP implications, rather than the imagined sport concussion, itself, are critical to understanding athletes' anticipated post-concussion psychological responses. This would fit with the sport and rehabilitation research (e.g., Ruddock-Hanson et al., 2012) that has shown that athletes' psychological responses vary based on how long they are placed on the sidelines with an injury.

Considering the sport injury literature, it was hypothesized that athletes who were presented with more severe sport concussion scenarios (i.e., longer imagined RTP timelines) would anticipate experiencing elevated post-concussion injury appraisals and depression and anxiety symptoms.

Literature Review Summary

In summary, when athletes step on to a playing surface they are at-risk to experience a concussion (Kutcher & Eckner, 2010). Sport concussions have represented 5% to 18% of all athletic injuries (Covassin et al., 2003; Gessel et al., 2007; Hootman et al., 2007; Powell & Barber-Foss, 1999), yet sport concussions, as a distinct clinical entity, are poorly understood. Sport concussions are a unique injury, in that implications of the injury are often invisible (Echemendia, 2012; Johnston et al., 2004), making them difficult to diagnosis, assess, and mange (McCrory et al., 2013). Of importance, is that up to 31% of athletes have experienced persistent post-concussion symptoms (Benson et al., 2011), which included ongoing psychological disturbances (e.g., Kerr et al., 2009).

Within the last decade, researchers (e.g., Mainwaring et al., 2004) have started to examine the psychological consequences of sport concussions. With the exception of one study (Caron et al., 2013), investigations into the psychological impact of sport concussions have utilized quantitative research methods. The research studies have mainly incorporated quasi-experimental prospective research designs that involved pre-post-injury measurements with control and/or cohort groups. Depending on the study design and the population sampled, the number of athletes with sport concussions has ranged from 16 to 1513. Across the sport concussion studies data has been collected through self-report surveys (excluding the one qualitative study by Caron et al., 2013). Common limitations found within this small collection of studies have included: samples being composed of football players or primarily of football players, the absence of a non-concussion injury control group or healthy control group, the lack of gender separation, and the reliance on self-report questionnaires.

Independent of the existing research limitations, preliminary support has been found for the relationship between sport concussions and athletes' short- (e.g., Mainwaring et al., 2010) and long-term (Kerr et al., 2012) experience of depression. In-depth interviews with retired athletes' (Caron et al., 2013; Gulli, 2011) have suggested that the psychological impact of sport concussions extends beyond depression to include other unpleasant psychological disturbances (e.g., anxiety, hopelessness, and loneliness). Nevertheless, research on the psychological impact of sport concussions is still in its infancy.

Drawing from the sport and rehabilitation literature, Wiese-Bjornstal et al.'s (1995) sport injury response model was introduced as a guiding framework for understanding athletes' anticipated post-concussion psychological responses. Research findings were reviewed to provide a rationale for examining imagined sport concussion severity as a factor that influenced athletes' anticipated post-concussion appraisals and depression and anxiety symptoms. As well, theoretical papers and research findings provided the basis for examining whether athletes' anticipated post-concussion injury appraisals were related to their anticipated post-concussion anxiety and depression symptoms.

Research Questions and Hypotheses

Based on a review of the sport and rehabilitation literature, as well as relevant theoretical papers, this dissertation addressed two research questions: (1) Does athletes' imagined sport concussion severity effect their anticipated post-concussion appraisals and depression and anxiety symptoms?; and (2) Are athletes' anticipated post-concussion

appraisals related to their experience of anticipated post-concussion depression and anxiety symptoms?

To examine the first research question, the following hypotheses were proposed:

(1) Athletes who imagined themselves experiencing a more severe sport concussion (i.e., longer imagined RTP timeline) would anticipate experiencing elevated:

(a) Post-concussion injury appraisals.

(b) Depression and anxiety symptoms.

To examine the second research question, the following hypothesis was proposed:

(1) After reading a hypothetical sports concussion scenario, athletes' anticipated post-concussion injury appraisals would be positively related to their anticipated depression and anxiety symptoms.

Chapter Three: Methods

Participants

Participants included male varsity athletes from the University of Alberta and the University of Calgary. Specifically, male varsity athletes who played ice hockey, football, soccer, and basketball had the opportunity to participate in this study. Across both universities and the different sports, a total of 228 male varsity athletes filled out the survey. Four surveys were omitted due to a large majority of the items not being filled out (e.g., 2 of the 7 pages were filled out). Of the remaining 224 participants, 99 had a history of receiving a medically diagnosed sport concussion. These 99 male varsity athletes were used to test this study's hypotheses. The rationale for using the subsample of male varsity athletes who had experienced a medically diagnosed concussion was that these athletes could have drawn on their own sport concussion history when trying to visualize themselves in a sport concussion scenario. Participants' sport type and concussion history is further detailed in Table 1.

Procedure

Participant recruitment. Male varsity athletes were recruited using the convenience sampling method. Preseason medical tests were used as an opportunity to gather data from the male varsity athletes at the University of Calgary and the University of Alberta. At the University of Calgary, I attended the Sport Medicine Centre on the days that the male varsity athletes were scheduled for their preseason medicals. After the male varsity athletes completed their required medical tests, they had the opportunity to participate in this study. At the University of Alberta, male varsity athletes were asked to

Table 1

Sport and Concussion History Descriptors

Descriptor	Frequency	Percent
Sport Type		
Hockey	22	22.2%
Football	58	58.6%
Soccer	14	14.1%
Basketball	5	5.1%
Previous Medically Diagnosed Sport Concussions		
1-2	84	84.8%
3 or More	15	15.2%
Last Medically Diagnosed Sport Concussion		
Last Season	20	20.2%
Two Playing Seasons Ago	28	28.3%
Three or More Seasons Ago	51	51.5%
Previous Season Concussion Symptom Occurrence Without Medical Diagnosis		
0	44.4	44.4%
1-3 Times	42.4	42.4%
4-6 Times	12.1	12.1%
7-9 Times	1	1%
Stress Associated with Sport Concussion		
Not at All Stressful	11	11.1%
A Little Bit Stressful	29	29.3%
Moderately Stressful	30	30.3%
Very Stressful	23	23.2%
Extremely Stressful	6	6.1%

Note. $N = 99$

complete a baseline concussion assessment as part of their preseason medical tests. The University of Alberta male varsity athletes had the opportunity to participate in this study after they completed their baseline concussion test.

Completing the survey and compensation. At each university, male varsity athletes were presented with a survey package that included the study's information page (see Appendix A) and consent form (see Appendix B). Each survey package included one hypothetical sport concussion scenario and two versions (i.e., current feelings and anticipated feelings in relation to the sport concussion scenario) of the depression and anxiety symptoms. The two versions of the depression and anxiety symptoms were counterbalanced (i.e., current symptoms filled out before or after anticipated symptoms) across the survey packages.

Before filling out the self-report measures, the male varsity athletes had the opportunity to ask the writer any questions. As well, the male varsity athletes signed the study consent form. Once the male varsity athletes had completed their survey package they returned their signed consent form and survey package to me. At that time, the male varsity athletes received a $5.00 gift card for their participation in this study.

Measures

Sport and concussion questionnaire. The sport and concussion questionnaire was developed for the purposes of this proposed dissertation (see Appendix C). Male varsity athletes were asked to indicate their primary varsity sport (i.e., ice hockey, football, basketball, or soccer). Moreover, male varsity athletes were asked questions regarding their sport concussion history and their level of stress associated with receiving a diagnosed (by a medical professional) sport concussion.

Imagined sport concussion severity. To capture differences in sport concussion severity, male varsity athletes were presented with one of the three scenarios that were created for the purposes of this dissertation. The scenarios were based on a non-concussion sport injury scenario that was utilized in past research (see Brewer, 1993). The three sport concussions scenarios varied on RTP timelines (i.e., two weeks, rest of the season [season ending], and the rest of their life [career ending]) and male varsity athletes were asked to imagine themselves experiencing the presented scenario. The following scenario template (one of the injury time frames was inserted in the blank space) was used for this study:

> You are halfway through your playing season and you are playing an important role in your team's success. While playing in a game you receive a hard hit that knocks you down. Immediately you experience a headache, dizziness, and confusion. You are removed from the game and assessed by the team's medical staff. You are told that you have received a concussion and that you can't return to the game.
>
> The next day you meet with the team's medical staff. The medical staff informs you that you will not be able to participate (practice or game play) in your sport for _____. What you would think and feel after receiving this news (take 20 seconds to image your thoughts or feelings)?

After reading the sport concussion scenario, male varsity athletes were prompted to fill out items that focused on injury appraisals and depression and anxiety symptoms (see Appendices D, E, & F). Given that varsity athletes were asked to respond to these items based on a sport concussion scenario, their ratings reflected their *anticipated*

thoughts and feelings. The appraisal and the depression and anxiety symptom measures are discussed below.

Anticipated post-concussion injury appraisals. Male varsity athletes' anticipated post-concussion appraisals were measured using the Sport Injury Appraisal Scale (SIAS; Cassidy, 2006). The SIAS contains 29-items that reflect 7 appraisal domains: loss of athleticism, being perceived as weak, pain, loss of social support, fear of reinjury, letting important others down, and impaired self-image (see the first section of the Reactions to Sports Concussion Questionnaire in Appendices D, E, & F). Male varsity athletes rated each item along a 5-point Likert scale ranging from *Strongly Disagree* (a score of 1) to *Strongly Agree* (a score of 5). As a result, higher scores reflected a stronger endorsement of an injury appraisal.

For the purposes of this study, the SIAS stem of "When I am injured:" was changed to reflect the presented sport concussion scenario. For example, the original SIAS stem was changed to "After suffering my sport concussion that has sidelined (unable to practice or play) me for two weeks:". Changing the SIAS stem was done for two reasons. First, it served as a prompt for the male varsity athletes to respond to the SIAS items while imagining themselves in the sport concussion scenario. Second, the term "injury" was too broad for context of this study given that the focus was on sport concussion psychological reactions.

A few studies have examined the psychometric properties of the SIAS among collegiate athletes. In creating the scale, Cassidy (2006) found that the SIAS items loaded on to 7 factors. Cronbach's alpha was .95 for the total SIAS and ranged from .81 to .90 for the 7 SIAS subscales. Habif's (2008) study found a total SIAS Cronbach's

alpha value of .90 and values ranging from .59 to .82 for the SIAS subscales. In this study, across the three sport concussion scenarios, the Cronbach's alphas ranged from .91 to .95 for the total SIAS and ranged from .65 to .89 for the different SIAS subscales (see Table 2). Convergent validity for the SIAS has been evidenced by the positive correlation between the SIAS (total and subscales) and other measures of sport anxiety (Rex, 2011). The SIAS (total and subscales) was found to be uncorrelated with a measure of social desirability (Rex, 2011).

Current and anticipated depression and anxiety symptoms. Male varsity athletes' current and anticipated post-concussion depression and anxiety symptoms were measured using Lovibond and Lovibond's (1993) 21-item (versus the full 42-items) version of the Depression Anxiety Stress Scale (DASS). As the scale name suggests, the DASS-21 includes 3 subscales that measure characteristics of depression, anxiety, and stress. Male varsity athletes were asked to rate each item based on how they have felt during the *past week*. Each item was ranked along a 4-point Likert scale that ranged from *Did Not Apply to Me at All* (score of 0) to *Applied to Me Most of the Time* (score of 3). As such, higher scores reflected elevated depression and anxiety symptoms.

The DASS-21 was chosen for several reasons. First, the DASS-21 omits items from the full scale that are problematic (e.g., items that cross loaded on factors), allowing for a cleaner factor solution (Henry & Crawford, 2005). Second, using a short-form scale was desirable given the study length and concerns surrounding participant fatigue. Third, the DASS-21 has maintained similar psychometric properties to that of the DASS full-version despite the former having half the number of items (Clara, Cox, & Enns, 2001).

Table 2

Cronbach's Alphas for the Current Study SIAS Versus Cassidy's (2006) and Habif's (2008) Studies

SIAS Domain	Two week Scenario	Season Ending Scenario	Career Ending Scenario	Cassidy (2006)	Habif (2008)
Pain	.77	.86	.73	.89	.80
Mentally Weak	.88	.81	.89	.90	.59
Letting Important Others Down	.87	.88	.89	.86	.79
Impaired Self-Image	.73	.70	.66	.81	.74
Loss of Social Support	.74	.88	.86	.87	.76
Loss of Athleticism	.83	.87	.65	.89	.82
Fear of Reinjury	.88	.79	.83	.87	.79
SIAS Total	.94	.95	.91	.95	.90

Note. $n = 38$ for the two week scenario; $n = 33$ for the season ending scenario; and $n = 28$ for the career ending scenario. Cassidy's (2006) study included an N of 300 and Habif's (2008) study included an N of 1033.

For the purposes of this study, the DASS-21 Stress subscale was used as an index of anxiety symptoms. There are several reasons for using the DASS-21 Stress subscale instead of the DASS-21 Anxiety subscale. First, the DASS-21 anxiety items are too physiologically specific (e.g., "I was aware of dryness in my mouth"), less relevant (e.g., "I was worried about situations in which I might panic and make a fool of myself"), and vague (e.g., I felt scared without any good reason) for the context of sport concussions. Alternatively, the DASS-21 stress items emphasize feelings of nervousness (e.g., "I felt that I was using up a lot of nervous energy"), tension (e.g., "I found it difficult to relax"), and agitation (e.g., "I tended to over-react to situations"), which are more relevant to the context of sport concussions. For example, past research has examined whether athletes experience tension following a sport concussion (Mainwaring et al., 2004; 2010).

Another reason for using the DASS-21 Stress subscale as an index of anxiety symptoms was that past research has found that the DASS-42 Stress subscale (compared to the anxiety subscale) displayed a stronger association with indices of worry (Szabo, 2011) and generalized anxiety (Brown, Chorpita, Korotitsch, & Barlow, 1997). For example, through hierarchical regression analyses, Szabo (2011) found that the DASS-42 Stress subscale was the only subscale to add unique variance to the prediction of worry outcomes. Using the DASS-42, Brown et al. (1997) found that the Stress subscale had a stronger positive correlation with an index of worry in comparison to the Anxiety subscale (.60 versus .38, respectively). Similarly, the DASS-42 Stress subscale displayed a stronger positive correlation with a clinical measure of Generalized Anxiety Disorder (GAD) in comparison to the Anxiety subscale (.17 versus .04, respectively). Considering

these findings, the DASS-42 Stress subscale has been conceptualized as capturing the emotional component of worry and GAD (Brown et al., 1997).

The original version of Lovibond and Lovibond's (1993) DASS-21 Depression and Stress subscales were used when male varsity athletes rated their current symptoms (see Appendix G). However, following the sport concussion scenarios, the DASS-21 stem was changed so that the items corresponded to the presented sport concussion scenario (see the second section of the Reactions to Sports Concussion Questionnaire in Appendices D, E, & F). Specifically, the DASS-21 stem was changed to "During the past week since I suffered my sport concussion:". Changing the DASS-21 stem served as a prompt for male varsity athletes to respond to the items while envisioning themselves in the sport concussion scenario.

DASS-21 depression subscale. The DASS-21 Depression subscale is composed of 7-items that reflect feelings of dysphoria and hopelessness, difficulties with motivation, self-depreciation and a lack of meaning in life (Lovibond & Lovibond, 1993; see Appendices D, E, & F). An example of an item is, "I felt downhearted and blue." Chronbach's alpha for the DASS-21 Depression subscale has been found to range from .85 (Osman et al., 2012) to .94 (Antony, Bieling, Cox, Ennis, & Swinson, 1998). In this study, the Chronbach's alpha for the original version (i.e., current symptoms) of the DASS-21 Depression subscale was .91. Across the three sport concussion scenarios, the DASS-21 Depression subscale Chronbach's alphas ranged from .86 to .94 (See Table 3). Convergent validity has been demonstrated through moderate to strong positive correlations between the DASS-21 Depression subscale and other indices of depressive symptomology (Antony et al., 1998; Henry & Crawford, 2005).

Table 3

Cronbach's Alphas for Current and Anticipated DASS-21 Depression and Stress Subscales

Emotion	Current	Two week Scenario	Season Ending Scenario	Career Ending Scenario
Depression	.91	.86	.87	.94
Anxiety	.90	.87	.93	.92

Note. $N = 99$ for current emotion. $n = 38$ for the two week scenario; $n = 33$ for the season ending scenario; and $n = 28$ for the career ending scenario. The DASS-21 stress subscale was used as an index of anxiety symptoms.

DASS-21 stress subscale. The DASS-21 Stress subscale is composed of 7-items that reflect experiences of arousal and tension and a low threshold for becoming upset or frustrated (Lovibond & Lovibond, 1993; see Appendix E). An example of an item is, "I found it hard to wind down." Chronbach's alpha for the DASS-21 Stress subscale has been found to range from .88 (Osman et al., 2012) to .91 (Antony et al., 1998). In this study, the Chronbach's alpha for the original version (i.e., current symptoms) of the DASS-21 Stress subscale was .90. Across the three sport concussion scenarios, the DASS-21 Stress subscale Chronbach's alphas ranged from .87 to .92 (See Table 3). Convergent validity has been demonstrated through moderate to strong positive correlations with measures of anxiety (.64-.85) (Antony et al., 1998; Lovibond & Lovibond, 1995).

Overview of Analyses

Several statistical analyses were conducted to examine the study's hypotheses. Below is an overview of the preliminary and main analyses.

Preliminary analyses. The purposes of the preliminary analyses were: (a) to address whether male varsity athletes' anticipated post-concussion depression and anxiety symptoms varied as a function of survey order (anticipated symptoms filled out before or after current symptoms); and (b) to determine whether male varsity athletes' current and anticipated depression and anxiety symptoms differed as a function of the sport concussion scenarios. To complete the preliminary analyses, the statistical method of analysis of variance (ANOVA) was utilized. Given that the survey orders and the symptom responses (i.e., current versus anticipated) had two levels, post-hoc analyses were not required.

Main analyses. Main analyses examined the effects of imagined sport concussion severity on male varsity athletes' anticipated post-concussion injury appraisals and depression and anxiety symptoms. ANOVAs were used to examine whether imagined sport concussion severity had an effect on male varsity athletes' anticipated post-concussion depression and anxiety symptoms. A multivariate analysis of variance (MANOVA) was used to test whether imagined sport concussion severity had an effect on male varsity athletes' anticipated post-concussion injury appraisals. All post-hoc pairwise comparisons were conducted using Fisher's Least Significance Difference (LSD) Test. The Bonferroni procedure was used to control for Type I errors when: (a) univariate tests were run to follow up a multivariate effect; and (b) planned post-hoc comparisons were completed.

The main analyses also involved examining whether male varsity athletes' anticipated post-concussion injury appraisals were positively correlated to their anticipated post-concussion depression and anxiety symptoms. Two-tailed bivariate correlations were utilized to test the relationships between male varsity athletes' anticipated post-concussion injury appraisals and depression and anxiety symptoms. Due to the number of correlation analyses completed, the Bonferroni procedure was used to control for Type I errors.

To address the insufficient nature of null-hypothesis significance testing (NHST), it was important to report effect sizes. When using ANOVAs to examine differences between three or more groups it has been suggested that eta squared is an appropriate measure of effect size (Téllez, García, & Corral-Verdugo, 2015). It has also been noted that eta squared is equivalent to partial eta squared when conducting one-way ANOVAs

(Lakens, 2013). As an effect size estimate, partial eta squared provides a measure of the strength association between the independent variable and the dependent variable (Shieh, 2015). While different effect size interpretation benchmarks exist, Cohen (1988) has suggested that an eta squared value of .01 represented a small effect, .06 represented a medium effect, and .14 represented a large effect. When conducting correlations it has been suggested that an *r* of .20 represented a small effect, .5 represented a moderate effect, and .8 represented a large effect (Ferguson, 2009). These effect size benchmarks were used when discussing the findings from this dissertation.

Data Screening

The raw data from the questionnaires was entered into SPSS, Version 22. Examination of the data revealed 5 missing scale values, which was less than one percent of the total participant responses. Missing scale values were treated using case mean substitution. Case mean substitution involves creating an imputation value that is based on a participant's responses to the other scale or subscale items (El-Masri & Fox-Wasylyshyn, 2005). The main benefit of case mean substitution is that it estimates imputation values using specific participant responses, rather than the responses of all the participants (El-Masri & Fox-Wasylyshyn, 2005). Case mean substitution has been found to be a robust imputation method when the missing data does not exceed 30% (El-Masri & Fox-Wasylyshyn, 2005).

The assumptions of normality, linearity, homoscedasticity, and multicollinearity were investigated. As well, the data was examined for potential outliers. Of note, the data was screened separately for each sport concussion scenario. Boxplots were used to identify potential univariate outliers. Three outliers were identified on the SIAS

subscales across the different sport concussion scenarios. However, these outliers did not have standardized scores that exceeded 3.29 (corresponds to an alpha of .001), which Tabachnick and Fidell (2001) recommended as a critical value for identifying outliers. As such, the three outliers were kept as part of the sample.

Normality was assessed using histograms and kurtosis and skewness indices. Visual inspection of the histograms indicated that the scale score distributions were relatively symmetric. Kline (2004) suggested that absolute skewness scores greater than 3 are a sign of extreme skewness. As well, kurtosis absolute values over 10 may be considered problematic and an indication of extreme kurtosis. Scale skewness scores ranged from -.04 to -.961, with the majority of the absolute values ranging between 0 and .50. Scale kurtosis values ranged from -.025 to -1.231, with the majority of the absolute values being below 1. Using a critical standardized value of 3.29 (Tabachnick & Fidell, 2001), none of the skewness and kurtosis values were found to be significantly different from 0.

Linearity and homoscedasticity were examined using bivariate scatterplots. The scatterplots displayed linear patterns and no non-linear relationships were observed. As well, the scatterplots were symmetrical in nature, which indicated that the assumption of homoscedasticity was met. Correlations among the SIAS and DASS-21 subscales were assessed for multicollinearity. When correlations exceed .90, multicollinearity is believed to be present (Tabachnick & Fidell, 2001). All the correlations were found to be below a .90, which indicated that multicollinearity was not a concern.

Chapter Four: Results

Preliminary Analyses

Survey order effect. ANOVAs were conducted to test whether the survey order (anticipated emotions filled out before or after current emotions) had an effect on male varsity athletes' anticipated post-concussion depression and anxiety symptoms. Table 4 provides the descriptive statistics for anticipated post-concussion depression and anxiety symptoms for each survey order and sport concussion scenario. Levene's test for equality of variance revealed non-significant results at $p > .05$, which suggested that the assumption of homogentity of variance was met. For the two week sport concussion scenario, non-significant survey order effects were found for anticipated depression, $F(1, 36) = .75$, $p > .05$, $\eta_p = .02$, and anxiety, $F(1, 36) = 1.99$, $p > .05$, $\eta_p = .05$, symptoms. Similarly, for the season ending sport concussion scenario, non-significant survey order effects were found for anticipated depression, $F(1, 31) = .001$, $p > .05$, $\eta_p = .00$, and anxiety $F(1, 31) = .575$, $p > .05$, $\eta_p = .02$, symptoms. Finally, for the career ending sport concussion scenario, non-significant survey order effects were found for anticipated depression, $F(1, 26) = .141$, $p > .05$, $\eta_p = .01$, and anxiety, $F(1, 26) = .647$, $p > .05$, $\eta_p = .02$, symptoms. Together, the findings indicated that male varsity athletes' anticipated depression and anxiety symptom ratings were not differentially effected by the survey order.

Scenario manipulation check. Repeated measures ANOVAs were conducted to test whether male varsity athletes' current and anticipated (post-concussion) depression and anxiety symptoms differed as a function of the sport concussion scenarios. Table 5 provides the descriptive statistics and the corresponding DASS-21 qualitative descriptors

Table 4

Anticipated Anxiety and Depression Symptoms for the Sport Concussion Scenarios as a Function of Survey Order

Scenarios/Emotions	Anticipated Emotions First	Anticipated Emotions Second
Two Week Scenario		
Depression	5.82 (4.35)	4.52 (4.79)
Anxiety	8.12 (4.59)	5.86 (5.13)
Season Ending Scenario		
Depression	13.08 (6.86)	12.13 (6.57)
Anxiety	13.75 (5.40)	11.94 (6.24)
Career Ending Scenario		
Depression	8.72 (5.23)	8.67 (5.18)
Anxiety	8.44 (6.37)	9.93 (4.53)

Note. $n = 38$ for the two week scenario; $n = 33$ for the season ending scenario; and $n = 28$ for the career ending scenario. Standard deviations are provided in the brackets. With the alpha level set at .05, no significant differences were found between the survey versions.

Table 5

Current and Anticipated Depression and Anxiety Symptoms, Along with DASS-21 Qualitative Descriptors, as a Function of the Sport Concussion Scenarios

Scenarios/Emotions	Current Emotions	DASS-21 Descriptor	Anticipated Emotions	DASS-21 Descriptor
Two Week Scenario				
Depression	1.50 (2.44)[a]	Normal	5.10 (4.58)	Mild
Anxiety	3.08 (3.73)[a]	Normal	6.87 (4.97)	Normal
Season Ending Scenario				
Depression	2.58 (3.76)[c]	Normal	8.70 (5.13)	Moderate
Anxiety	3.91 (4.55)[a]	Normal	9.12 (5.58)	Mild
Career Ending Scenario				
Depression	1.89 (4.34)[b]	Normal	12.54 (6.56)	Severe
Anxiety	4.43 (4.61)[a]	Normal	12.71 (5.86)	Moderate

Note. $n = 38$ for the two week scenario; $n = 33$ for the season ending scenario; and $n = 28$ for the career ending scenario. Standard deviations are provided in the brackets. [a] $p < .001$; [b] $p < .01$; [c] $p < .05$.

for current and anticipated depression and anxiety symptoms for each sport concussion scenario. For the two week sport concussion scenario, significant effects were found for depression, $F(1, 37) = 21.21$, $p < .001$, $\eta_p = .36$, and anxiety, $F(1, 37) = 27.99$, $p < .001$, $\eta_p = .43$, symptoms. For the season ending sport concussion scenario, significant effects were found for depression, $F(1, 32) = 3.98$, $p < .05$, $\eta_p = .11$, and anxiety, $F(1, 32) = 51.39$, $p < .001$, $\eta_p = .62$, symptoms. Finally, for the career ending sport concussion scenario, significant effects were found for depression, $F(1, 27) = 9.11$, $p < .01$, $\eta_p = .25$, and anxiety, $F(1, 27) = 74.95$, $p < .001$, $\eta_p = .74$, symptoms. Each of the analyses revealed that male varsity athletes' anticipated post-concussion depression and anxiety symptoms were significantly higher than their current depression and anxiety symptoms. Considering the DASS-21 symptom severity cut-off criteria, there was a pattern of symptoms moving from the normal range to a symptomatic range, with the exception of the anxiety symptoms for the two week sport concussion scenario. In this case, both current and anticipated anxiety ratings fell in the normal range.

Main Analyses

Effect of scenario severity on anticipated post-concussion emotions. ANOVAs were conducted to test whether male varsity athletes' anticipated post-concussion depression and anxiety symptoms differed as a function of scenario severity. Table 6 provides the descriptive statistics and the qualitative descriptors for the anticipated post-concussion depression and anxiety symptoms for each sport concussion scenario. Levene's test for equality of variance revealed non-significant results at $p > .05$, which suggested that the assumption of homogentity of variance was met.

Table 6

Anticipated Depression and Anxiety Symptoms, Along with DASS-21 Qualitative Descriptors, as a Function of Scenario Severity

Emotion	Two Week Scenario	DASS-21 Descriptor	Season Ending Scenario	DASS-21 Descriptor	Career Ending Scenario	DASS-21 Descriptor
Depression	5.11 (4.58)[a,b]	Mild	8.70 (5.13)[b,c]	Moderate	12.54 (6.59)[a,c]	Severe
Anxiety	6.87 (4.97)[a]	Normal	9.12 (5.58)[d]	Mild	12.71 (5.86)[a,d]	Moderate

Note. $n = 38$ for the two week scenario; $n = 33$ for the season ending scenario; and $n = 28$ for the career ending scenario. Standard deviations are provided in the brackets.
[a] $p < .001$; [b,c] $p < .01$; [d] $p < .016$.

Significant scenario severity effects were revealed for anticipated depression, $F(2, 96) = 15.39$, $p < .001$, $\eta_p = .24$, and anxiety $F(2, 96) = 9.35$, $p < .001$, $\eta_p = .16$, symptoms.

The significant scenario severity effects were followed up through comparing the anticipated post-concussion depression and anxiety symptom means across the scenarios. Using the Bonferroni procedure, the significance criterion for the planned comparisons was set at .016 (.05/3).

Male varsity athletes' anticipated post-concussion depression symptoms were significantly higher for the career ending sport concussion scenario in comparison to the season ending and two week sport concussion scenarios. Anticipated post-concussion depression symptoms for the season ending sport concussion scenario were significantly higher in comparison to the two week sport concussion scenario. Male varsity athletes' anticipated post-concussion anxiety symptoms were significantly higher for the career ending sport concussion scenario in comparison to the season ending and two week sport concussion scenarios. However, anticipated post-concussion anxiety symptoms for the season ending and two week sport concussion scenarios were not significantly different from each other. Examining the DASS-21 qualitative descriptors, there was a pattern of increased sport concussion severity being associated with elevated levels of depression (mild to severe) and anxiety (normal to moderate) symptoms.

As shown in Tables 5 and 6, male varsity athletes' anticipated depression and anxiety symptom scores met different DASS-21 cut-off criteria across the sport concussion scenarios. In turn, exploratory analyses were conducted to examine the percentage of male varsity athletes that fell within each DASS-21 qualitative descriptor score range across the three sport concussion scenarios (see Table 7). Male varsity

Table 7

Frequency of Anticipated Depression and Anxiety Symptoms as a Function of Scenario Severity and DASS-21 Cut-Off Descriptors

Scenarios/Emotions	Normal		Mild		Moderate		Severe		Extremely Severe	
	n	%	*n*	%	*n*	%	*n*	%	*n*	%
Two Week										
Depression	20	52.6	6	15.8	7	18.4	2	5.3	3	7.9
Anxiety	21	55.3	6	15.8	6	15.7	5	13.2	0	0
Season Ending										
Depression	7	21.2	3	9.1	11	33.3	6	18.2	6	18.2
Anxiety	15	45.5	2	6	6	18.2	7	21.2	3	9.1
Career Ending										
Depression	4	14.3	3	10.7	2	7.1	4	14.3	15	53.6
Anxiety	7	25	2	7.1	2	7.2	8	28.6	9	32.1

Note. $n = 38$ for the two week scenario; $n = 33$ for the season ending scenario; and $n = 28$ for the career ending scenario.

athletes' anticipated depression and anxiety symptom scores were less likely to fall within the normal symptom range as the sport concussion scenarios became more severe (i.e., longer RTP timelines). In contrast, male varsity athletes' anticipated depression and anxiety symptom scores were more likely (as a whole) to fall in the severe or extremely severe range as the sport concussion scenarios became more severe.

Effect of scenario severity on anticipated injury appraisals. A MANOVA was conducted to test the effect of scenario severity on male varsity athletes' anticipated post-concussion injury appraisals. Table 8 provides the descriptive statistics for the anticipated post-concussion injury appraisals for each sport concussion scenario. Box's M test for the equality of variance revealed non-significant results at $p > .05$, which suggested that the assumption of homogentity of variance was met. The analysis revealed a significant multivariate effect of scenario severity, $F(14, 182) = 3.26$, $p < .001$, $\eta_p = .20$.

The significant multivariate effect was followed up at the univariate level for the anticipated post-concussion injury appraisals. Using the Bonferroni procedure, the significance criterion for the planned comparisons was set at .007 (.05/07). The ANOVAs revealed significant sport concussion scenario effects for the following anticipated post-concussion injury appraisals: pain, $F(2, 96) = 11.67$, $\eta_p = .20$, impaired self-image, $F(2, 96) = 5.94$, $\eta_p = .20$, loss of social support, $F(2, 96) = 7.56$, $\eta_p = .14$, loss of athleticism, $F(2, 96) = 8.29$, $\eta_p = .15$, and fear of reinjury, $F(2, 96) = 8.88$, $\eta_p = .16$. The sport concussion scenarios did not have a significant effect on the anticipated post-concussion injury appraisals of being perceived as weak, $F(2, 96) = .27$, $\eta_p = .01$., and letting important others down, $F(2, 96) = .52$, $\eta_p = .01$.

Table 8

Anticipated Injury Appraisals as a Function of Scenario Severity Versus Cassidy's (2006) and Habif's (2008) Studies

Injury Appraisals	Two Week Scenario	Season Ending Scenario	Career Ending Scenario	Cassidy (2006)	Habif (2008)
Pain	2.87 (.82)[a]	3.00 (.96)[b]	3.81 (.65)[a,b]	3.33 (.93)	3.31 (.76)
Perceived as Weak	2.49 (1.04)	2.46 (.94)	2.64 (1.09)	2.63 (1.12)	2.57 (.76)
Letting Important Others Down	2.38 (1.02)	2.57 (1.12)	2.63 (1.06)	2.53 (.96)	2.25 (.79)
Impaired Self-Image	2.17 (.85)[c]	2.50 (.92)	2.93 (.88)[c]	2.87 (.97)	2.74 (.96)
Loss of Social Support	1.89 (.72)[a]	2.20 (1.02)	2.75 (.94)[a]	2.34 (.88)	1.88 (.73)
Loss of Athleticism	2.87 (.98)[a]	3.04 (1.04)[b]	3.77 (.66)[a,b]	3.02 (1.02)	3.43 (.92)
Fear of Reinjury	2.85 (1.04)[a]	3.22 (.80)[d]	3.79 (.78)[a,d]	2.98 (.94)	3.53 (.82)

Note. $n = 38$ for the two week scenario; $n = 33$ for the season ending scenario; and $n = 28$ for the career ending scenario. Standard deviations are provided in the brackets. [a,b] $p < .001$; [c] $p < .01$; [d] $p < .016$. Cassidy's (2006) study included an N of 300 and Habif's (2008) study included an N of 1033.

Planned post hoc comparisons were conducted for the significant univariate effects. Using the Bonferroni procedure, the significance criterion for the planned comparisons was set at .016 (.05/3). Male varsity athletes' anticipated post-concussion injury appraisals of pain, fear of reinjury, loss of athleticism, impaired self-image, and loss of social support were significantly higher for the career ending sport concussion scenario in comparison to the two week sport concussion scenario. Male varsity athletes' anticipated post-concussion injury appraisals of pain, fear of reinjury, and loss of athleticism were significantly higher for the career ending sport concussion scenario in comparison to the season ending sport concussion scenario. No other comparisons were found to be significant.

Anticipated injury appraisals and emotions correlations. Two-tailed correlations were run to examine the relationships between male varsity athletes' anticipated post-concussion injury appraisals and anticipated post-concussion anxiety and depression symptoms. Using the Bonferroni procedure, the significance criterion was set at .007 (.05/7). With an alpha of .007, there was mixed support for the hypothesis that male varsity athletes' anticipated post-concussion injury appraisals would be positively related to their anticipated post-concussion depression and anxiety symptoms (see Table 9).

For the two week sport concussion scenario, male varsity athletes' anticipated post-concussion injury appraisals about being perceived as weak and losing social support were positively and significantly correlated with their anticipated post-concussion depression and anxiety symptoms. Male varsity athletes' anticipated post-concussion injury appraisals about pain, loss of athleticism, and the fear of reinjury were

Table 9

Correlations between Anticipated Injury Appraisals and Depression and Anxiety Symptoms

	Two Week Scenario		Season Ending Scenario		Career Ending Scenario	
Injury Appraisals	Depression	Anxiety	Depression	Anxiety	Depression	Anxiety
Pain	.29	.55**	.50*	.47*	.22	.11
Perceived as Weak	.50*	.48*	.51*	.47*	.49*	.40†
Letting Important Others Down	.37†	.37†	.67**	.51*	.38†	.31
Impaired Self-Image	.38†	.42*	.63**	.72**	.40†	.37
Loss of Social Support	.47*	.45*	.57*	.43†	.48*	.51*
Loss of Athleticism	.41†	.57**	.55*	.57*	.10	.05
Fear of Reinjury	.35†	.60**	.56*	.51*	.33	.32

Note. $n = 38$ for the two week scenario; $n = 33$ for the season ending scenario; and $n = 28$ for the career ending scenario. ** $p < .001$; * $p < .007$; † $p < .05$

positively and significantly correlated to their anticipated post-concussion anxiety symptoms.

In response to the season ending sport concussion scenario, male varsity athletes' anticipated post-concussion injury appraisals about pain, being perceived as weak, letting important others down, having an a impaired self-image, loss of athleticism, and the fear of reinjury were positively and significantly correlated to their anticipated post-concussion depression and anxiety symptoms. Male varsity athletes' anticipated post-concussion injury appraisal about loss of social support was significantly and positively correlated to their anticipated post-concussion depression symptoms.

With regard to the career ending sports concussion scenario, male varsity athletes' anticipated post-concussion injury appraisal of loss of social support was positively and significantly correlated with their anticipated post-concussion depression and anxiety symptoms. As well, male varsity athletes anticipated injury appraisal of being viewed as mentally weak was positively and significantly correlated with their anticipated post-concussion depression symptoms. No other correlations were found to be significant at the set alpha level.

Chapter 5: Discussion

In recent years, athletes' have started to openly discuss the psychological impact of their sport concussions (Gulli, 2011). In response to athletes' disclosures, the psychological impact of sport concussions has become a hot topic within the media. However, within the scientific community, the dearth of research on the psychological consequences of sport concussions has left many unanswered questions about athletes' post-concussion psychological responses. Understanding the psychological impact of sport concussions has important implications for sport and health professionals that are involved in athletes' physical and psychological rehabilitation.

Building on the existing literature, this dissertation examined male varsity athletes' anticipated psychological responses to imagined sport concussion scenarios. Incorporating an existing sport injury response model (Wiese-Bjnorstal et al., 1995), this dissertation examined the following two research questions: (1) Does male varsity athletes' imagined sport concussion severity effect their anticipated post-concussion appraisals and depression and anxiety symptoms?; and, (2) Are male varsity athletes' anticipated post-concussion appraisals related to their experience of anticipated post-concussion depression and anxiety symptoms? Hypotheses related to the first research question posited that male varsity athletes who imagined themselves in a more severe sport concussion scenario (i.e., a longer RTP timeline) would anticipate experiencing elevated post-concussion injury appraisals and depression and anxiety symptoms. In regards to the second research question, it was hypothesized that anticipated post-concussion injury appraisals would be positively associated with anticipated post-concussion depression and anxiety symptoms. Overall, preliminary support was found

for the relationships between imagined sport concussion severity and anticipated post-concussion injury appraisals and anticipated depression and anxiety symptoms.

The first section of this discussion reviews findings related to psychological impact of sport concussions. Next, findings on how imagined concussion severity was related to male varsity athletes' anticipated post-concussion injury appraisals and depression and anxiety symptoms are reviewed. The findings on male varsity athletes' anticipated post-concussion injury appraisals and depression and anxiety symptoms are discussed next. The final sections highlight theoretical and practical finding implications, the limitations of this dissertation and future research directions.

The Psychological Impact of Sport Concussions

Post-concussion stress. Given that Lazarus and Folkman's (1984) stress and cognitive appraisal theory provided the theoretical backing for Wiese-Bjnorstal et al.'s (1995) sport injury response model, a sport concussion was conceptualized as an event that athletes may appraise as stressful. The descriptive data from this dissertation revealed that 89.9% of male varsity athletes experienced some level of stress through receiving a medically diagnosed sport concussion. In particular, 29.3% of male varsity athletes' experienced high (very to extremely stressful) levels of stress, 30.3% experienced moderate amounts of stress, 29.3% experienced low (a little bit stressful) amounts of stress, and 11.1% had not experienced any stress. The finding that the majority of male varsity athletes found being diagnosed with a sport concussion stressful lends support to the existing theoretical models (Andersen & Williams, 1988; Wiese-Bjnorstal et al., 1995) that conceived sport injuries as a stressful event. As well, the stress response finding was congruent with past sport injury research that has found that

athletes' have experienced elevated levels of stress following an injury (Clement et al., 2013).

Anticipated post-concussion depression and anxiety symptoms. Varsity athletes have been found to have a healthy psychological baseline profile that has been visually represented as an iceberg (i.e., lower levels of tension, depression, anger, fatigue, and confusion that are split by higher levels of vigor). In contrast, after varsity athletes have suffered a sport concussion their short-term psychological profile has displayed less adjustment and has been visually represented as a concussion crevice (i.e., higher levels of depression, anger, fatigue, and confusion split by lower levels of vigor) (see Mainwaring, Hutchison, et al., 2012). In support of previous findings, this dissertation found that male varsity athletes anticipated a shift in their short-term (i.e., subsequent one week following the diagnosed sport concussion) psychological responses following a sport concussion. Using the DASS-21 (Lovibond & Lovibond, 1993), male varsity athletes' current (pre-season) depression and anxiety symptoms were significantly lower than their anticipated post-concussion depression and anxiety symptoms. In terms of clinical cut offs, their current depression and anxiety symptom scores fell within the normal range. However, male varsity athletes' anticipated experiencing elevated post-concussion depression (i.e., mild to severe range) and anxiety (i.e., mild to moderate range) symptoms. As such, some of the male varsity athletes' anticipated post-concussion depression and anxiety symptom severity scores reached levels that would warrant further clinical attention and intervention.

The finding that male varsity athletes' anticipated having elevated post-concussion depression symptoms fits with the existing sport concussion literature. As examples,

elevated post-concussion depression symptoms have been reported in varsity (Mainwaring et al., 2004; 2010) and professional (Caron et al., 2013) athletes. Moreover, the anticipation of elevated post-concussion depression symptoms was congruent with the broader literature on sport injury reactions (Ruddock-Hudson et al., 2012) and non-sport head injury adjustment (e.g., Jorge & Robinson, 2002). The finding was also congruent with existing depression theories (e.g., Oatley & Bolton, 1985) that have suggested that stressful life events leave individuals at-risk to experience negative mood states.

When it comes to post-concussion anxiety, past research has provided mixed findings. That is, a few research studies (Hutchison et al., 2009; Mainwaring et al., 2004) failed to find a significant difference between varsity athletes' baseline and post-concussion ratings of tension. Alternatively, interviews with athletes who had retired from the NHL due to multiple concussions spoke about their post-concussion anxiety struggles (Caron et al., 2013). The finding that some male varsity athletes expected to have elevated post-concussion anxiety symptoms was congruent with the existing qualitative sport concussion research (Caron et al., 2013) and the broader literature on sport injury reactions (e.g., Ruddock-Hudson et al., 2012) and non-sport head injury adjustment (e.g., Powell et al., 1996).

There are various factors that may help explain the discrepancy between this dissertation's anticipated post-concussion anxiety finding and the null finding found in past sport concussion research. Methodologically, past research (Mainwaring et al., 2004) asked varsity athletes to rate how they felt "right now" during their post-concussion rating sessions. As a result, the focus was on varsity athletes' immediate state, which may not have been sensitive enough to capture their feelings of tension (i.e.,

anxious, nervous, panicky, and worried) since they had suffered their concussion. For example, Mainwaring et al. (2004) had varsity athletes rate their current symptoms anywhere from 2-6 days following their diagnosed sport concussion. It is plausible that the varsity athletes' post-concussion tension feelings fluctuated during the days leading up to the first post-concussion testing session, which wouldn't have been captured in a current state measurement. Past research (McDonald & Hardy, 1990) has supported this idea, in that injured varsity athletes' tension ratings were variable and typically showed a descending trend when measured at different points across a 7-day post-injury period. In contrast, this dissertation focused on male varsity athletes' anticipated anxious feelings over the course of a one-week period. It is possible that male varsity athletes' anticipated post-concussion anxious feelings captured more of their expected day-to-day fluctuations (i.e., higher and lower anxiety symptoms) that may not have been reflected in an immediate tension state rating.

Another possible reason for the discrepancy between this dissertation's (anticipated) post-concussion anxiety finding and the null findings found in past sport concussion studies was the use of different study designs. Specifically, past research (e.g., Mainwaring et al., 2004) has used prospective research designs that involved varsity athletes providing their post-concussion symptom ratings during the course of their playing season. In turn, it is possible that varsity athletes may have underreported their current post-concussion tension symptoms. Within the sport concussion literature (e.g., Benson et al., 2011), concerns have been raised about athletes' underreporting their post-concussion symptoms. Alternatively, this dissertation used a cross-sectional research design that involved male varsity athletes anticipating their post-concussion

anxiety symptom severity. Using anticipatory, versus current, post-concussion ratings may have had less threatening implications (e.g., playing status) for the male varsity athletes.

Imagined Concussion Severity and Anticipated Post-Concussion Responses

Following a sport concussion, varsity athletes have been found to vary in their reported levels of depression and tension symptoms. For example, Mainwaring et al. (2004) reported post-concussion depression and tension standard deviation scores that tended to be equal to, or greater than, the mean scores. As well, this dissertation found that male varsity athletes' anticipated post-concussion depression and anxiety symptoms varied from normal to moderate and severe levels. Existing sport injury models (e.g., Wiese-Bjornstal et al., 1995) have attempted to explain disparate post-injury responses through considering the influence of various personal and situational factors. Drawing from Wiese-Bjornstal et al.'s (1995) sport injury model, this dissertation examined whether imagined sport concussion severity, as measured by RTP timelines, could variably impact male varsity athletes' anticipated post-concussion injury appraisals and anxiety and depression symptoms. Using three hypothetical scenarios (i.e., out two weeks, for the season, or career ending), it was hypothesized that male varsity athletes' who imagined themselves in a more severe sport concussion scenario would anticipate experiencing elevated post-concussion injury appraisals and depression and anxiety symptoms. The following sections will discuss the support found for those hypotheses.

Imagined concussion severity and anticipated injury appraisals. The findings from this dissertation found partial support for the hypothesis that imagined sport concussions severity would effect male varsity athletes' anticipated injury appraisals.

Using Cohen's (1988) interpretive eta squared benchmarks, large effect sizes (.14 to .20) were found between sport concussion severity and anticipated injury appraisals. Male varsity athletes who were presented with the career ending scenario anticipated having significantly higher injury appraisals (with the exceptions of being perceived as weak and letting important others down) in comparison to male varsity athletes who were presented with the two week scenario. Moreover, male varsity athletes who were presented with the career ending scenario anticipated having significantly higher pain, loss of athleticism, and fear of reinjury appraisals in comparison to those male varsity athletes who were presented with the season ending scenario. These findings were congruent with previous studies (Cassidy, 2006; Habif, 2008) that have found athletes with more severe injuries are more likely to report elevated injury appraisals (e.g., loss of social support). As well, the findings provided further support for Wiese-Bjornstal et al.'s (1995) sport injury response model that has suggested injury severity was a personal factor that could impact athletes' post-injury appraisals.

It is important to note that for the two week and season ending scenarios male varsity athletes' anticipated *mean* injury appraisal ratings suggested that these injury appraisals were not perceived as playing a prominent role (i.e., scores reflected disagreement to neutral ratings) in their imagined post-concussion evaluative process. There was stronger endorsement (i.e., *mean* scores in the agreement range) of the injury appraisals for the career ending scenario. Anticipating elevated injury appraisals in response to the career ending scenario fits with Lazarus and Folkman's (1984) theory that suggested that events elicited a primary appraisal process if they were evaluated as having psychological well-being implications. The career ending sport concussion

scenario may have had greater anticipated psychological consequences for the male varsity athletes given that they had to imagine themselves no longer playing their preferred sport that they had invested years of energy and time into. In contrast, the two week and the season ending scenarios may have had less anticipated psychological consequences given that they involved shorter RTP timelines that may not have threatened their athletic careers and academic pursuits (e.g. funding for being a varsity athlete).

Across the three hypothetical sport concussion scenarios, the pain, fear of reinjury, and loss of athleticism appraisals were given the highest averaged anticipated ratings by the male varsity athletes. Within the sport literature, fear of reinjury has been recognized as a common psychological reaction among athletes (Ardern, Taylor, Feller, Whitehead, & Webster, 2013; Podlog & Eklund, 2006). However, to my knowledge, this dissertation was the first to examine an anticipated fear of reinjury following an imagined sport concussion. Post-concussion reinjury appraisals may be especially important for athletes to examine given that research has found that athletes who have a history of sport concussions are 3 to 5.8 times more likely to suffer another sport concussion (Delaney et al., 2000; 2002; Guskiewicz et al., 2000; 2003; Zemper, 2003). Experiencing multiple sport concussions has also been linked to psychiatric disorders (Guskiewicz et al., 2007; Omalu et al., 2010) and neuropathological conditions (Harmon et al., 2013). As such, reinjury (sport concussion) appraisals not only carry meaning for athletes' sport performance and longevity, but to their future health and day-to-day functioning. In the case of the latter, it could be argued that athletes' fears of reinjury are adaptive (i.e., signalling future threats and motivating apprehension behaviour), given that the risk

factors and pathways associated with long-term post-concussion psychiatric and neurological outcomes are not well understood.

Although male varsity athletes anticipated experiencing greater pain after imagining a career-ending sport concussion, the mechanism of pain was not specified in Cassidy's (2006) SIAS. Nevertheless, headaches have been a common source of discomfort and pain following a sport concussion. In a study of NHL players, Benson et al. (2011) found that 70.9% of players reported experiencing headaches following their sport concussion. Similarly, in a study of former NHL players who retired after enduring multiple sport concussions, participants reported ongoing day-to-day discomfort due to headaches (Caron et al., 2013). Considering the existing sport concussion literature, it is possible that male varsity athletes, who were presented with a career-ending scenario, anticipated experiencing greater levels of pain due to their expected discomfort with headaches.

The finding that male varsity athletes who were presented with the career-ending scenario anticipated experiencing a loss of athleticism fits with the sport concussion literature that has suggested that concussed athletes are concerned about being physically inactive and becoming physically deconditioned (Echemendia, 2012). As well, it fits with the sport injury literature that has found chronic (Cassidy, 2006) and severe (Habif, 2008) injuries are related to higher athleticism loss appraisals. Finally, anticipating a loss of athleticism (in the face of career-ending sport concussion) was congruent with the sport transition literature that has shown that athletes have concerns regarding their physical and athletic self-perceptions as they move away playing sport (Park, Lavallee, & Tod, 2013).

Imagined concussion severity and anticipated depression and anxiety symptoms. The findings from this dissertation supported the hypotheses that imagined sport concussion severity would effect male varsity athletes' anticipated depression and anxiety symptom ratings. Using Cohen's (1988) eta squared interpretation benchmarks, imagined sport concussion severity had large effects on male varsity athletes' anticipated post-concussion depression (i.e., .24) and anxiety (.16) symptoms. While comparing partial eta squared values across studies should be done with caution (Lakens, 2013), sport concussion research that has focused on depression symptoms (over time) has found similarly large partial eta squared effect sizes ranging from .25 (Mainwaring et al., 2004) to .32 (Mainwaring et al., 2010). Altogether, there is preliminary support that sport concussions have an important impact on varsity athletes' reported depression symptoms.

Male varsity athletes who imagined themselves receiving a career-ending sport concussion anticipated experiencing significantly greater depression and anxiety symptoms in comparison to those male varsity athletes who imagined themselves receiving a sport concussion that put them on the sidelines for two weeks or the rest of their season. Moreover, male varsity athletes who imagined themselves in a season-ending sport concussion scenario anticipated feeling significantly greater depression symptoms in comparison to those male varsity athletes who imagined themselves experiencing a sport concussion that involved being removed from play for two weeks. However, male varsity athletes who were presented with the two week versus the season ending sport concussion scenario did not significantly differ in their anticipated anxiety symptom ratings.

The effect of sport concussion severity on male varsity athletes' anticipated anxiety and depression symptoms was further illuminated through the use of the DASS-21 (Lovibond & Lovibond, 1993) clinical cut-offs and descriptive findings. Male varsity athletes who were presented with the career-ending sport concussion scenario had an anticipated depression symptom *mean* score that fell in the severe range, versus the moderate range for those presented with the season-ending scenario, and the mild range for those presented with the two week scenario. Moreover, among the male varsity athletes who imagined themselves in the career-ending scenario, 67.9% anticipated experiencing severe to extremely severe depression symptoms versus 38.4% of those who imagined themselves in the season-ending scenario and 13.2% of those who imagined themselves in the two week scenario.

Male varsity athletes' presented with the career-ending scenario had an anticipated anxiety symptom *mean* score that fell in the moderate range versus the mild range for those presented with the season-ending scenario, and the normal range for those presented with the two week scenario. Furthermore, for the male varsity athletes who were presented with the career-ending scenario, 60.7% anticipated experiencing severe to extremely severe levels of anxiety symptoms versus 30.3% of those who imagined themselves in the season-ending scenario, and 13.2% (0% from the extremely severe range) of those who imagined themselves in the two week scenario.

The findings on imagined sport concussion severity and male varsity athletes' anticipated depression and anxiety symptoms were congruent with past research that has found sport injury severity was positively related to athletes' post-injury depression symptoms (Smith et al., 1990). Moreover, the findings are in support of past research

that has found a positive association between the length of time that athletes were injured and their depression and tension symptoms (Smith et al., 1993). The findings also build on the existing sport concussion literature (e.g., Mainwaring et al., 2004) by providing preliminary support for examining individual difference factors, such as concussion severity, when considering post-concussion psychological outcomes.

Comparing male varsity athletes' anticipated depression and anxiety symptoms across the three sport concussions scenarios, those who were presented with the career ending scenario were at the greatest risk to experience higher levels of symptomology. Specifically, the majority of male varsity athletes anticipated having severe to extremely severe depression and anxiety symptoms following a career ending sport concussion. A potential explanation for higher anticipated depression and anxiety symptoms in response to the career ending scenario is that the scenario depicted a non-voluntary decision (i.e., decision made by the medical staff) to stop playing their chosen sport. Research on sport retirement has found that when athletes were forced to retire due to injuries they experienced poorer psychological adjustment (Alfermann, Stambulova, & Zemaityte, 2004; Kerr & Dacyshyn, 2000; Lavallee et al., 1997). When injuries forced athletes to retire from their sport, their psychological adjustment difficulties were related to unfulfilled sport-related goals and feeling unsure of who they are outside of being an athlete (Kerr & Dacyshyn, 2000). While male varsity athletes' were not directly asked *why* they would have experienced elevated depression and anxiety symptoms, it is possible that the season ending scenario put them in a position where they had to imagine the potential losses and threats that would be associated with no longer playing their chosen sport.

Anticipated post-concussion injury appraisals and depression and anxiety symptoms. Existing sport injury models (e.g., Wiese-Bjornstal et al., 1995) have suggested that post-injury appraisals can lead to variable psychological outcomes among athletes. While preliminary support has been found for the relationships between post-injury appraisals and psychological outcomes (Albinson & Petrie, 2003; Rex, 2011), the existing studies did not exclusively focus on sport concussion injuries. Building on the existing literature, it was hypothesized that male varsity athletes with higher anticipated post-concussion injury appraisals would also anticipate experiencing elevated post-concussion depression and anxiety symptoms.

Across the three sport concussion scenarios there was support for positive small to moderate associations between anticipated post-concussion injury appraisals and depression and anxiety symptoms. However, the positive correlations varied in terms of reaching statistical significance. For the two week scenario, anticipated post-concussion injury appraisals were more likely to be significantly correlated with anticipated anxiety symptoms versus depression symptoms. With regards to the season ending scenario, all but one of the anticipated post-concussion injury appraisal and depression and anxiety symptom correlations reached significance. In contrast, for the career ending scenario, only a few of the anticipated post-concussion injury appraisal and depression and anxiety symptom correlations reached significance.

One explanation for the divergent statistical support across the three hypothetical concussion scenarios was that the power was too low for small to moderate correlations. Specifically, for a power of .80 with small to moderate effect sizes (.30 and .40) and an alpha of .007, a sample size of 63 to 116 participants would have been needed. Having

sample sizes that ranged from 28 to 38 participants across the three scenarios meant that the probability of correctly detecting differences between moderately correlated variables was lowered (i.e., power was .27 and .53 for .30 and .40 effect sizes, respectively). The lowered power impacted the ability to reach statistical significance (at the more stringent alpha of .007) for a number of correlations in the two week and career ending scenarios.

Two of the anticipated post-concussion injury appraisals, being perceived as weak and losing social support, displayed consistent significant associations (across the three scenarios) with anticipated anxiety and depression symptoms. When it comes to team sports, teammates are often viewed as family members (Caron et al., 20103) and can be an important source of support for athletes during their injury rehabilitation period (Ruddock-Hudson et al., 2012; Podlug & Eklund, 2006). Family members and friends have also been found to play a crucial role in supporting athletes after they have endured a sport concussion (Covassin et al., 2014). However, athletes sidelined with sport concussions have experienced decreased levels of support from others (Caron et al., 2013). Lower levels of social support while injured with a sport concussion have been positively associated with state anxiety (Covassin et al., 2014) and increased feelings of isolation (Caron et al., 2013). The findings from this dissertation provided further support to the existing research (Caron et al., 2013; Covassin et al., 2014) that has shown that decreased social support while concussed is related to athletes' psychological struggles.

Male varsity athletes who had a heightened anticipation surrounding others viewing them as mentally weak (while sidelined with their sport concussion) also anticipated experiencing elevated depression and anxiety symptoms. This finding adds to the

existing research (Rex, 2011) that has found that injured varsity athletes' concern about being viewed as mentally weak was positively associated with state anxiety. Furthermore, the finding suggested that short-term post-concussion psychological disturbances may not be solely due to neurobiological disruptions, but may also be influenced by athletes' cognitive appraisals of their sport concussion.

Self-discrepancy theory (Higgins, 1987) can help explain the positive association between male varsity athletes' anticipated post-concussion mental weakness appraisal and their depression and anxiety symptoms. Specifically, self-discrepancy theory has suggested that actual-ideal self-discrepancies are related to depressed feelings and actual self-other ought (i.e., how others believe you should be) discrepancies are related to anxious feelings (Higgins, 1987). Considering the beliefs embedded in the sport culture (e.g., athletes should play through injuries) and the invisible impact of sport concussion injuries, it is possible that male varsity athletes are more susceptible to experience actual-ought/other discrepancies that manifests in anxiety about others viewing them as mentally weak. This discrepancy dynamic seems to have been captured in the following research excerpt on concussed male athletes, "Players are scared to be seen as weak . . . . Coaches expect their players to "shake it off" and "take it for the team" and get back on the ice." (Echlin, 2012, pg. 1).

In terms of actual-ideal discrepancies, sport concussions are an acute event that can disrupt (for shorter or longer periods of time) male varsity athletes cognitive, physical, and emotional functioning. In turn, athletes' pre- and post-concussion functioning and performance ability may become discrepant. Given the sport culture, male varsity athletes may be more prone to explain this discrepancy using internal reasons (e.g., I am

being weak and I should be able to play through a head injury) that may be reinforced by influential people in their lives. The extent to which male varsity athletes' actual-ideal discrepancy manifests in post-concussion weakness appraisals, the findings from this dissertation suggested that they could be at a greater at-risk to experience elevated depression symptoms.

Theoretical and Practical Implications of this Dissertation

Theoretical implications. In providing a framework to understand athletes' post-concussion psychological responses, this dissertation utilized Wiese-Bjnorstal et al.'s (1998) Integrated Model of Psychological Response to Sport Injury and Rehabilitation Process. The theoretical backing for Wiese-Bjnorstal et al.'s sport injury response model was Lazarus and Folkman's (1984) stress and cognitive appraisal theory. As such, one of the main premises of Wiese-Bjnorstal et al.'s (1998) model was that athletes' injury appraisal process impacted their post-injury psychological responses. Moreover, their model suggested that athletes' injury appraisals were influenced by personal and situational factors. The findings from this dissertation provided preliminary support for Wiese-Bjnorstal et al.'s (1998) sport injury response model being applicable to hypothetical sport concussion injuries. Specifically, the findings suggested that imagined sport concussion severity had an effect on male varsity athletes' anticipated post-concussion appraisals, which in turn, were related to their anticipated depression and anxiety symptoms.

Focusing on Lazarus and Folkman's (1984) stress and cognitive appraisal theory, this dissertation found preliminary support for the relationship between anticipated post-concussion loss appraisals (e.g., loss of social support) and depression symptoms.

Interestingly, anticipated loss appraisals were also associated with anxiety symptoms. According to Lazarus (1966; 1999) the experience of anxiety signals that an event has been appraised as being threatening. In this case, imagining a sport concussion could have represented a transition scenario where their appraised losses were not viewed as being permanent. Athletes recovering from their sport concussion may have less contact with their previous supports (e.g., teammates), but they may not view their decreased social support as being permanent (i.e., they will recover and re-join their team). However, given that sport concussion recovery has been associated with uncertainty about the future (Caron et al., 2013), athletes may be threatened by the possibility that their losses could become permanent. Understanding athletes' appraisals of permanency may then be an important factor in understanding whether athletes perceived losses due to a sport concussion will pull for greater feelings of depression or mixed feelings of depression and anxiety.

Practical implications. There are a number of practical implications that can be gleaned from this dissertation's findings. Echoing the existing sport concussion literature (Mainwaring, Hutchison, et al., 2012), the findings from this dissertation are in support of incorporating psychological assessment and treatment into male varsity athletes' rehabilitation and recovery process. Moreover, the findings suggested that the assessment and monitoring of male varsity athletes' psychological symptoms would be most crucial when they have suffered a career ending sport concussion. Based on their work with athletes who retired due to sport concussions, Caron et al. (2013) suggested that psychological counselling should be made available to athletes during their sport concussion rehabilitation and their transition into their post-athletic careers. In this sense,

counselling can provide concussed male varsity athletes with psychological rehabilitation.

Inline with the existing sport concussion literature (Mainwaring, 2011), the findings from this dissertation provided further support for the need to consider psychological factors when assessing and managing male varsity athletes' post-concussion symptoms. The present concussion management practices have tended to focus on athletes' physical and neurocognitive symptoms, yet their psychological responses have not been considered in their rehabilitation process (Mainwaring, Hutchison, et al., 2012). Failing to assess and manage athletes' psychological reactions could have detrimental effects, such as returning the athlete to play too early and increasing their chance of reinjury. Considering that this dissertation found that an anticipated fear of reinjury was positively related to anxiety symptoms and that previous research (e.g., Petrie, 1993) has found a link between athletes' anxiety and being injured, overlooking male varsity athletes' anxiety symptoms may leave them at a greater risk to experience a subsequent concussion or non-concussion sport injury.

Given the preliminary support for the positive association between male varsity athletes' anticipated post-concussion injury appraisals and their depression and anxiety symptoms, there may be some therapeutic value in exploring and working through male varsity athletes' post-concussion injury appraisals. In particular, cognitive therapy (Beck, 1979) is based on the belief that how people think about and interpret events can influence the onset of emotional disturbances. Exploring male varsity athletes' post-concussion appraisals and helping them understand how their thoughts are negatively impacting their psychological mindset or rehabilitation behaviour may be beneficial.

However, in situations where male varsity athletes have experienced a career ending sport concussion, their appraisals may reflect larger existential struggles (e.g., how to have meaning in life) as they transition away from being an athlete. In turn, counselling modalities that focus on existential concerns (Yalom, 1980) and values exploration (Hayes, Strosahl, & Wilson, K. G., 2012) may help male varsity athletes' with their post-concussion and retirement adjustment.

Limitations of this Dissertation

The findings from this dissertation were limited in several ways. The first limitation was that scenarios were used as a proxy for actual sport concussion events. Although using sport concussion scenarios had several advantages (e.g., allowed for the sampling of a large number of participants in a short timeframe), they were limited by the selective context depicted in them. For example, the sport concussion scenarios were constrained by the timing (i.e., during the season) of the sport concussion, the athlete's status on the team, the post-concussion symptoms that the athlete experienced, and when the RTP feedback was received. As a result, the sport concussion scenarios may not have captured the various dynamic factors that are a part of athletes' 'real life' sport concussion experiences and responses. To the extent that this was the case, male varsity athletes' responses to the sport concussion scenarios may not have been an accurate reflection of how they would have responded to an actual sport concussion.

Another limitation related to the use of sport concussion scenarios was that there was no direct measurement of how well male varsity athletes' engaged with the scenarios when anticipating their post-concussion responses. While indirect measures were used (e.g., sample only included male varsity athletes with a history of medically diagnosed

sport concussions) to increase the chance that the male varsity athletes were able to connect with the sport concussion scenarios, there were no measures of how well they immersed themselves in the sport concussion scenarios, how confident they were in anticipating their responses to the sport concussion scenarios, or how closely the scenarios mapped on to their own sport concussion experiences. Moreover, there was no check for whether the male varsity athletes' based their responses solely on the their own sport concussion history or the presented scenario versus their experiences with a non-concussion injury. Having a number of measurement checks for the sport concussion scenarios would have enhanced the validity of the inferences that were made about the analyzed data.

The generalizability of the findings are also limited due factors related to the sample composition. Past research on sport concussions has been restricted due to the samples being largely composed of football players (Comper et al., 2010). While efforts were made to collect data from athletes who participated in four sports with higher sport concussion rates, the majority (58.6%) of the sample included football players. In contrast, a small proportion (5%) of the sample was composed of basketball players. The varied sport sample frequencies makes it difficult to make generalized inferences about male varsity athletes' post-concussion responses across the four sports examined in this dissertation. That is, inferences made about male varsity athletes' post-concussion responses are primarily representative of football players.

Another limitation of this dissertation was that anticipated secondary appraisals (i.e., coping resources) were not examined. Lazarus & Folkman (1984) suggested that secondary appraisals, along with primary appraisals, shaped individuals' emotional

responses to stressful events. In excluding measures of anticipated secondary appraisals, this dissertation did not obtain a broader picture of male varsity athletes' post-concussion psychological responses. As such, information about male varsity athletes' resources, strengths, or protective factors were not examined.

A related limitation was that male varsity athletes' anticipated post-concussion responses were only measured at one imagined timeframe (i.e., the week subsequent to the sport concussion). Wiese-Bjnorstal's et al.'s (1995) sport injury response model suggested that athletes' post-injury appraisals dynamically interacted (i.e., an opportunity for reappraisal process to occur) with their psychological responses over the course of their rehabilitation. Given that this dissertation measured male varsity athletes' psychological responses at one timeframe following the imagined sport concussion scenarios, there was not an opportunity to capture their injury reappraisal process and how their psychological responses may have shifted over time.

Future Research Directions

Given that research on the psychological impact of sport concussions is still in its infancy, there is a need for further studies so that the existing literature can be supported and built on. While support has been building for the short-term increase in post-concussion depression symptoms, there has been an absence of longitudinal studies that have tracked athletes' post-concussion symptoms over a longer period of time. Understanding the temporal nature of post-concussion depression and anxiety symptoms may have important value when it comes to predicting or preventing suicides among athletes. A related area of discovery is to further understand factors (e.g., competitive level of sport) that may be associated with elevated post-concussion psychological

responses. Past research (e.g., Mainwaring et al., 2004), along with the findings from this dissertation, have provided preliminary evidence for varsity athletes' experiencing variable post-concussion psychological responses. Future examination of factors related to varsity athletes' post-concussion psychological responses could allow for a better understanding of which athletes are at-risk for post-concussion psychological disturbances.

While a few studies (Covassin et al., 2014; Mainwaring et al., 2010) have examined how psychological reactions to sport concussions may differ from non-concussion sport injuries, there remains a number of unanswered questions. For example, should sport concussions, versus other types of sport injuries, be viewed as a risk factor for greater post-injury psychological adjustment difficulties? If so, does sport concussions unique injury localization (i.e., the brain) and associated characteristics (e.g., invisible symptoms) contribute to athletes' differential post-injury psychological responses? Another important research question is whether athletes' struggling with persistent and ongoing post-concussion difficulties display a similar psychological profile to athletes' recovering from non-concussion sport injury. Answering these questions would be important for understanding whether medical, rehabilitation, and health professionals need to assess and treat athletes differently if they have suffered a sport concussion (versus non-concussion) injury.

Based on the preliminary findings from the sport injury literature (Ruddock-Hudson et al., 2012) and this dissertation, there is reason to examine athletes' post-concussion injury appraisals within a prospective research design. Understanding whether athletes' post-concussion injury appraisals play a role in their short-term

psychological disturbances would be informative in terms of moving beyond reductionist neurobiological explanations towards a biopsychosocial causal framework. Given that existing sport injury models (Wiese-Bjnorstal et al., 1998) have suggested that injury appraisals are dynamically related to athletes' feelings and rehabilitation behaviour, it would be important to examine whether rehabilitation progress or changes in psychological mindset interact with how athletes' appraise their sport concussion.

A final recommendation for future research would be to examine whether male athletes' respond to hypothetical sport concussion scenarios in a way that it is congruent with how they actually respond to a real life sport concussion. Past research (Ferguson, Mittenberg, Barone, & Schneider, 1999) has found that male athletes with a history of no head injuries were more likely to overestimate their anticipated post-concussion symptoms. However, this expectancy pattern was not examined for male athletes who had a history of sport concussions. Understanding whether male varsity athletes show a similar expectancy symptom pattern, and whether their expectations are different from their actual post-concussion symptoms, would help delineate whether sport concussion scenarios are a useful measurement tool. That is, this research would help address whether sport concussion scenarios allow for valid inferences to be made about male varsity athletes' post-concussion psychological responses.

Conclusion

The findings form this dissertation provided support for the existing literature that has shown that sport concussions can have a negative and short-term impact on athletes' psychological mindset. As well, the findings broadened the existing sport injury literature by providing preliminary support for using existing sport injury models (Wiese-

Bjnorstal et al., 1995) to understand male varsity athletes' post-concussion psychological responses. In particular, concussion severity, in terms of RTP timelines, may be one risk factor to consider when assessing and managing male varsity athletes' post-concussion psychological adjustment. Similarly, exploring how male varsity athletes' appraise their sport concussion may help medical, rehabilitation, and mental health professionals understand some of the factors related to changes in male varsity athletes' post-concussion psychological difficulties. Considering the limitations of this dissertation and that research on post-concussion psychological disturbances is still in its infancy, further research is need to continue to build and expand on the existing preliminary findings. In doing so, the scientific community would continue to acknowledge the sentiment sent by hardened athletes that their sport concussions are associated with psychological vulnerabilities that can be easily missed or dismissed given their status as warriors within the culture and arenas of sport.

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Appendix A

Study Information Page

Exploring Reactions to Sport Concussions Study: Information Page

Principle Investigators: Tom Pearson, PhD Student and Dr. Martin Mrazik, PhD

Study Purpose:

- To examine factors that can help predict varsity athletes' psychological responses to sports concussions.

Participation:

- You **do not** need to be concussed or have a history of concussions to participate in this study.
- This study involves answering 72 questions and should take approximately 15 minutes. You will be asked to respond to questions about your sports participation, views on being an athlete, current feelings, and beliefs and feelings about receiving a sports concussion.

Confidentiality and Anonymity:

- As a participant, you **will not** be asked to provide any personal identifiers (e.g., name or contact information) besides the type of sport that you currently participate in.
- The collected responses will be kept in a secure storage space for a minimum of 5 years after the study is completed. Only the principle investigator and Dr. Mrazik will have access to the raw data. As such, coaches and team staff **will not** have access to the collected participant responses. Participant responses will be combined and analyzed and the results will be presented during the primary investigator's PhD dissertation defense. Study findings may be presented at academic or professional conferences and published in research journals.

Right to Withdraw Participation:

- Your participation in this study is completely voluntary. If you choose to participate in this study, you are free to withdraw at any time before you hand in the survey. Withdrawing your participation will not result in any negative consequences.

Potential Benefits and Risks:

- You may find answering the survey questions interesting and are relatable to yours or teammates' experiences.
- There are no foreseeable risks in participating in this study. If your participation results in unsettling feelings, thoughts, or behaviours the following campus resources are available for University of Alberta students: Clinical Services (780) 492-3746 or Wellness Services: (780) 492-5205. For University of Calgary students that following resource is available: Wellness Centre (403) 210-9355.

Compensation:

- If you choose to participate in this study you will receive a $5.00 Subway gift card as compensation for your time. You will receive one gift card when you hand in your survey package.

Contact Persons:

- At any point, if you have any comments, questions, or concerns about this survey or your participation, you may contact the principle investigator at **tpearson@ualberta.ca** or Dr. Marty Mrazik at **mrazik@ualberta.ca**.

If you have any questions or concerns about this study, please ask the study investigators before moving on to the Study Consent Form.

Appendix B

Consent Form

UNIVERSITY OF ALBERTA

CONSENT FORM

Project Title: Exploring Reactions to Sports Concussions

Principle Investigators: Tom Pearson, Department of Educational Psychology, University of Alberta, (tpearson@ualberta.ca); Dr. Martin Mrazik, Department of Educational Psychology, University of Alberta (780) 492-8052, (mrazik@ualberta.ca)

Please answer the following questions with a ☑.

	Yes	**No**
Have you received and read a copy of an attached information sheet?	☐	☐
Do you understand the benefits and risks in taking part in this research study?	☐	☐
Have you had an opportunity to ask questions related to this study?	☐	☐
Do you understand that your participation is voluntary?	☐	☐
Do you understand that you can withdraw your consent without penalty?	☐	☐
Do you understand that your responses will remain confidential?	☐	☐
I agree to take part in this study:	☐	☐

Signature of Participant_____ Date_____

Printed name of Participant_____

Appendix C

Sport and Concussion Questionnaire

Sport and Concussion Questions

1. What is the main varsity sport that you currently play:

☐ Hockey
☐ Football
☐ Soccer

A **sport concussion** is defined as a blow to the head or body that results in an alteration in mental status and includes one or more of the following symptoms: headache, nausea, vomiting, dizziness/balance problems, fatigue, trouble sleeping, drowsiness, sensitivity to light or noise, blurred vision, and difficulty remembering and concentrating.

2. How many sports concussions have you received that were **diagnosed** by a **medical team professional**?

☐ 0
☐ 1-2
☐ 3 or more

3. When did you receive your last **diagnosed** sports concussion?

☐ Not applicable
☐ Last playing season
☐ Two playing seasons ago
☐ Three or more playing seasons ago

4. How stressful was it to receive a **diagnosed** sports concussion? If you have not received a diagnosed sports concussion, image how stressful it would be for you.

☐ Not at all stressful
☐ A little bit stressful
☐ Moderately stressful
☐ Very stressful
☐ Extremely stressful

5. During your last playing season, how many times did you experience any of the **sports concussion symptoms** (see definition box) after receiving a blow to your head or your body, but you were **not diagnosed** with a concussion by a medical team professional.

☐ 0 times
☐ 1-3 times
☐ 4-6 times
☐ 7-9 times
☐ 10 or more times

Appendix D

Two week Sport Concussion Scenario with Anticipated Injury Appraisal, Depression and Anxiety Items

Reactions to a Sport Concussion

Please think of the main sport that you participate in. Let some of the experiences you have had in your sport come to mind. Focus on what participating in your sport means to you. Now imagine the following scenario:

You are halfway through your playing season and you are playing an important role in your team's success. While playing in a game you receive a hard hit that knocks you down. Immediately you experience a headache, dizziness, and confusion. You are removed from the game and assessed by the team's medical staff. You are told that you have received a concussion and that you can't return to the game.

The next day you meet with the team's medical staff. The medical staff informs you that you will **not** be able to participate (practice or game play) in your sport for the **next two weeks**. What you would think or feel while you were sidelined from participating in your sport (take 20 seconds to image your thoughts or feelings)? Fill out the following questions as if you are currently experiencing this scenario.

A. Please read the following statements and circle **one** number that **best** represents your beliefs. Use the provided scale when responding to the following questions:

Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	**2**	**3**	**4**	**5**

While sidelined for **two weeks** with my sports concussion:

1. I am in a lot of pain.	1	2	3	4	5
2. Some people think I am mentally weak.	1	2	3	4	5
3. I am letting my coaches down.	1	2	3	4	5
4. I feel anxious about how my body looks.	1	2	3	4	5
5. I lose self-esteem.	1	2	3	4	5
6. I experience throbbing pain.	1	2	3	4	5
7. Some people turn away from me.	1	2	3	4	5
8. I lose some social support.	1	2	3	4	5
9. I (physically) hurt a lot.	1	2	3	4	5
10. I am losing athletic ability.	1	2	3	4	5
11. Some people stop calling me.	1	2	3	4	5
12. I lose my competitive advantage.	1	2	3	4	5
13. I am anxious about how my body feels.	1	2	3	4	5

Continue to the next page

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

While sidelined for **two weeks** with my sports concussion:

14. I am letting my family down.	1	2	3	4	5
15. I feel socially disconnected from my teammates.	1	2	3	4	5
16. I lose some of my athletic skill.	1	2	3	4	5
17. I doubt that I will be healthy in the future.	1	2	3	4	5
18. I lose the opportunity to improve in my sport.	1	2	3	4	5
19. I believe that I will get injured more easily in the future.	1	2	3	4	5
20. I am letting my teammates down.	1	2	3	4	5
21. Some people think I'm just being a baby.	1	2	3	4	5
22. I think I am more likely to get injured again.	1	2	3	4	5
23. I am letting my friends down.	1	2	3	4	5
24. I experience a lot of physical discomfort.	1	2	3	4	5
25. I am losing my athletic potential.	1	2	3	4	5
26. I am worried about getting fat.	1	2	3	4	5
27. Some people think I am just being lazy.	1	2	3	4	5
28. I worry that the same injury will happen again.	1	2	3	4	5
29. Some people think I am faking it.	1	2	3	4	5

B. Please read the following statements and circle **one** number that **best** represents the extent of your feelings. Use the provided scale when responding to the questions:

0 = Does not apply to me at all
1 = Applies to me some of the time
2 = Applies to me a good part of the time
3 = Applies to me most of the time

While sidelined for **two weeks** with my sports concussion:

1. I find it hard to wind down.	0	1	2	3
2. I can't seem to experience any positive feelings at all.	0	1	2	3

Continue to the next page

0 = Does not apply to me at all
1 = Applies to me some of the time
2 = Applies to me a good part of the time
3 = Applies to me very much, or most of the time

While sidelined for **two weeks** with my sports concussion:

3. I find it difficult to work up the initiative to do things.	0	1	2	3
4. I tend to overreact to situations.	0	1	2	3
5. I feel that I am using up a lot of nervous energy.	0	1	2	3
6. I feel that I have nothing to look forward to.	0	1	2	3
7. I find myself getting agitated.	0	1	2	3
8. I am intolerant of anything that keeps me from getting on with what I am doing.	0	1	2	3
9. I am unable to become enthusiastic about anything.	0	1	2	3
10. I feel I am not worth much as a person.	0	1	2	3
11. I find it difficult to relax.	0	1	2	3
12. I feel I am rather touchy (moody).	0	1	2	3
13. I feel my life is meaningless.	0	1	2	3
14. I feel downhearted and blue.	0	1	2	3

Appendix E

Season Ending Sport Concussion Scenario with Anticipated Injury Appraisal, Depression and Anxiety Items

Reactions to a Sport Concussion

Please think of the main sport that you participate in. Let some of the experiences you have had in your sport come to mind. Focus on what participating in your sport means to you. Now imagine the following scenario:

You are halfway through your playing season and you are playing an important role in your team's success. While playing in a game you receive a hard hit that knocks you down. Immediately you experience a headache, dizziness, and confusion. You are removed from the game and assessed by the team's medical staff. You are told that you have received a concussion and that you can't return to the game.

The next day you meet with the team's medical staff. The medical staff informs you that you will **not** be able to participate (practice or game play) in your sport for the **remainder of the playing season**. What you would think or feel while you were sidelined from participating in your sport (take 20 seconds to image your thoughts or feelings)? Fill out the following questions as if you are currently experiencing this scenario.

A. Please read the following statements and circle **one** number that **best** represents your beliefs. Use the provided scale when responding to the questions:

Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	**2**	**3**	**4**	**5**

While sidelined for the **remainder of the playing season** with my sports concussion:

1. I am in a lot of pain.	1	2	3	4	5
2. Some people think I am mentally weak.	1	2	3	4	5
3. I am letting my coaches down.	1	2	3	4	5
4. I feel anxious about how my body looks.	1	2	3	4	5
5. I lose self-esteem.	1	2	3	4	5
6. I experience throbbing pain.	1	2	3	4	5
7. Some people turn away from me.	1	2	3	4	5
8. I lose some social support.	1	2	3	4	5
9. I (physically) hurt a lot.	1	2	3	4	5
10. I am losing athletic ability.	1	2	3	4	5
11. Some people stop calling me.	1	2	3	4	5
12. I lose my competitive advantage.	1	2	3	4	5
13. I am anxious about how my body feels.	1	2	3	4	5

Continue to the next page

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

While sidelined for the **remainder of the playing season** with my sports concussion:

14. I am letting my family down.	1	2	3	4	5
15. I feel socially disconnected from my teammates.	1	2	3	4	5
16. I lose some of my athletic skill.	1	2	3	4	5
17. I doubt that I will be healthy in the future.	1	2	3	4	5
18. I lose the opportunity to improve in my sport.	1	2	3	4	5
19. I believe that I will get injured more easily in the future.	1	2	3	4	5
20. I am letting my teammates down.	1	2	3	4	5
21. Some people think I'm just being a baby.	1	2	3	4	5
22. I think I am more likely to get injured again.	1	2	3	4	5
23. I am letting my friends down.	1	2	3	4	5
24. I experience a lot of physical discomfort.	1	2	3	4	5
25. I am losing my athletic potential.	1	2	3	4	5
26. I am worried about getting fat.	1	2	3	4	5
27. Some people think I am just being lazy.	1	2	3	4	5
28. I worry that the same injury will happen again.	1	2	3	4	5
29. Some people think I am faking it.	1	2	3	4	5

B. Please read the following statements and circle **one** number that **best** represents the extent of your feelings. Use the provided scale when responding to the questions:

0 = Does not apply to me at all
1 = Applies to me some of the time
2 = Applies to me a good part of the time
3 = Applies to me most of the time

While sidelined for the **remainder of the playing season** with my sports concussion:

1. I find it hard to wind down.	0	1	2	3
2. I can't seem to experience any positive feelings at all.	0	1	2	3

Continue to the next page

0 = Does not apply to me at all
1 = Applies to me some of the time
2 = Applies to me a good part of the time
3 = Applies to me very much, or most of the time

While sidelined for the **remainder of the playing season** with my sports concussion:

3. I find it difficult to work up the initiative to do things.	0	1	2	3
4. I tend to overreact to situations.	0	1	2	3
5. I feel that I am using up a lot of nervous energy.	0	1	2	3
6. I feel that I have nothing to look forward to.	0	1	2	3
7. I find myself getting agitated.	0	1	2	3
8. I am intolerant of anything that keeps me from getting on with what I am doing.	0	1	2	3
9. I am unable to become enthusiastic about anything.	0	1	2	3
10. I feel I am not worth much as a person.	0	1	2	3
11. I find it difficult to relax.	0	1	2	3
12. I feel I am rather touchy (moody).	0	1	2	3
13. I feel my life is meaningless.	0	1	2	3
14. I feel downhearted and blue.	0	1	2	3

Appendix F

Career Ending Sport Concussion Scenario with Anticipated Injury Appraisal, Depression and Anxiety Items

Reactions to a Sport Concussion

Please think of the main sport that you participate in. Let some of the experiences you have had in your sport come to mind. Focus on what participating in your sport means to you. Now imagine the following scenario:

You are halfway through your playing season and you are playing an important role in your team's success. While playing in a game you receive a hard hit that knocks you down. Immediately you experience a headache, dizziness, and confusion. You are removed from the game and assessed by the team's medical staff. You are told that you have received a concussion and that you can't return to the game.

The next day you meet with the team's medical staff. The medical staff informs you that you have suffered a **career-ending** concussion. What you would think or feel knowing that your athletic career had come to an end (take 20 seconds to image your thoughts or feelings)? Fill out the following questions as if you are currently experiencing this scenario.

A. Please read the following statements and circle **one** number that **best** represents your beliefs. Use the provided scale when responding to the questions:

Strongly Disagree	**Disagree**	**Neutral**	**Agree**	**Strongly Agree**
1	**2**	**3**	**4**	**5**

After suffering my **career-ending** sports concussion:

1. I am in a lot of pain.	1	2	3	4	5
2. Some people think I am mentally weak.	1	2	3	4	5
3. I am letting my coaches down.	1	2	3	4	5
4. I feel anxious about how my body looks.	1	2	3	4	5
5. I lose self-esteem.	1	2	3	4	5
6. I experience throbbing pain.	1	2	3	4	5
7. Some people turn away from me.	1	2	3	4	5
8. I lose some social support.	1	2	3	4	5
9. I (physically) hurt a lot.	1	2	3	4	5
10. I am losing athletic ability.	1	2	3	4	5
11. Some people stop calling me.	1	2	3	4	5
12. I lose my competitive advantage.	1	2	3	4	5
13. I am anxious about how my body feels.	1	2	3	4	5

Continue to the next page

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

After suffering my **career-ending** sports concussion:

14. I am letting my family down.	1	2	3	4	5
15. I feel socially disconnected from my teammates.	1	2	3	4	5
16. I lose some of my athletic skill.	1	2	3	4	5
17. I doubt that I will be healthy in the future.	1	2	3	4	5
18. I lose the opportunity to improve in my sport.	1	2	3	4	5
19. I believe that I will get injured more easily in the future.	1	2	3	4	5
20. I am letting my teammates down.	1	2	3	4	5
21. Some people think I'm just being a baby.	1	2	3	4	5
22. I think I am more likely to get injured again.	1	2	3	4	5
23. I am letting my friends down.	1	2	3	4	5
24. I experience a lot of physical discomfort.	1	2	3	4	5
25. I am losing my athletic potential.	1	2	3	4	5
26. I am worried about getting fat.	1	2	3	4	5
27. Some people think I am just being lazy.	1	2	3	4	5
28. I worry that the same injury will happen again.	1	2	3	4	5
29. Some people think I am faking it.	1	2	3	4	5

B. Please read the following statements and circle **one** number that **best** represents the extent of your feelings. Use the provided scale when responding to the questions:

0 = Does not apply to me at all
1 = Applies to me some of the time
2 = Applies to me a good part of the time
3 = Applies to me most of the time

After experiencing my **career-ending** sports concussion:

1. I find it hard to wind down.	0	1	2	3
2. I can't seem to experience any positive feelings at all.	0	1	2	3

Continue to the next page

0 = Does not apply to me at all
1 = Applies to me some of the time
2 = Applies to me a good part of the time
3 = Applies to me very much, or most of the time

After experiencing my **career-ending** sports concussion:

3. I find it difficult to work up the initiative to do things.	0	1	2	3
4. I tend to overreact to situations.	0	1	2	3
5. I feel that I am using up a lot of nervous energy.	0	1	2	3
6. I feel that I have nothing to look forward to.	0	1	2	3
7. I find myself getting agitated.	0	1	2	3
8. I am intolerant of anything that keeps me from getting on with what I am doing.	0	1	2	3
9. I am unable to become enthusiastic about anything.	0	1	2	3
10. I feel I am not worth much as a person.	0	1	2	3
11. I find it difficult to relax.	0	1	2	3
12. I feel I am rather touchy (moody).	0	1	2	3
13. I feel my life is meaningless.	0	1	2	3
14. I feel downhearted and blue.	0	1	2	3

Appendix G

Current Depression and Anxiety Symptoms

Current Feelings and Beliefs

Please read the following statements and circle **one** number that **best** represents the extent of your feelings **over the past week**. Use the provided scale when responding to the questions:

0 = Did not apply to me at all
1 = Applied to me some of the time
2 = Applied to me a good part of the time
3 = Applied to me most of the time

1. I found it hard to wind down.	0	1	2	3
2. I couldn't seem to experience any positive feelings at all.	0	1	2	3
3. I found it difficult to work up the initiative to do things.	0	1	2	3
4. I tended to overreact to situations.	0	1	2	3
5. I felt that I was using up a lot of nervous energy.	0	1	2	3
6. I felt that I had nothing to look forward to.	0	1	2	3
7. I found myself getting agitated.	0	1	2	3
8. I was intolerant of anything that kept me from getting on with what I was doing.	0	1	2	3
9. I was unable to become enthusiastic about anything.	0	1	2	3
10. I felt I wasn't worth much as a person.	0	1	2	3
11. I found it difficult to relax.	0	1	2	3
12. I felt I was rather touchy (moody).	0	1	2	3
13. I felt my life was meaningless.	0	1	2	3
14. I felt downhearted and blue.	0	1	2	3