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The Role of Self-efficacy in Injury Avoidance and Fear of Injury among Elite Athletes

by

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Abstract

For athletes at the competitive level, injury due to the sport is highly probable. Athletes must continually deal with existing injuries and fears of new injuries throughout the season, which can cause considerable stress. Self-efficacy has been shown to influence how people feel, think and motivate themselves through personal judgements and perceptions made about their abilities. Self-efficacy theory shows us that the act of agency within our own lives can help us to deal with controlling how to act and behave in our lives. In turn, this agency manifests in a feeling of confidence to control the external world and has been shown to increase the probability of achieving intended goals. This survey study explored the relation between self-efficacy in the domain of injury avoidance with elite football players in the Canadian Football League. Data collection spanned over 5 years and across 317 players on measures of the effects that past injury had on current self-efficacy beliefs, as well as how self-efficacy could predict future behaviors towards injury avoidance. Our analysis of the variance showed a significant relation of injury frequency, severity and type to current self-efficacy to avoid injury. Our results showed a reciprocal and cumulative nature of self-efficacy with injury. Specifically, self-efficacy can affect future injury avoidance and injury can have the effect to lower an athlete's confidence in future injury avoidance. The results have important implications for theory, research, and practice regarding sports psychology, counselling, and injury avoidance and recovery literature.

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Chapter I: Introduction

"If I have the belief that I can do it, I shall surely acquire the capacity to do it even if I may not have it at the beginning." – Gandhi

Context of the Problem

Injury within sports is a constant problem (Hootman, Dick, & Agel, 2007). Considering that elite athletes' careers depend upon being able to continually perform at a high level within the game, injury can come with much anxiety (Wiese-Bjornstal, Smith, Shaffer & Morrey, 1998). Research has shown that competitive athletes can suffer from a great deal of injuries throughout their careers (Nicholas, Rosenthal, & Gleim, 1988; Herbenick, King, Altobelli, Nguyen & Podesta, 2008; Hootman et al., 2007). Some statistics estimate as high as 111.3 injuries per athlete for 1000 exposure game minutes (Herbenick, et al., 2008). It has been suggested that for any athlete to reach an elite level, they must accumulate thousands of hours of practice with estimates of around 10, 000 hours to achieve an expert level (Ericsson, Krampe, & Tesch-Romer, 1993). For an athlete to become an expert and perform at an elite level, they must train with more intensity and enter into a higher risk of injury. Researchers have begun to see not only the physical complications of injuries but the emotional and motivational aspects of injuries (Wiese-Bjornstal, et al., 1998). Research shows that athletes deal with emotional (anxiety, depression), and motivational (self-efficacy and confidence) aspects alongside the physical injury that can have a lasting effect on the athlete (Wiese-Bjornstal, et al., 1998; Feltz, Short & Sullivan, 2008). However this emerging research is relatively

new and there is much to be researched on exactly how injuries affect athletes psychologically (Verhagen, & Mechelen, 2010).

Self-Efficacy and Sports Injury

Self-efficacy in sports has been studied since the 1980's and much of the research has focused on performance goals (wins, effort, game points etc.; Feltz, et al., 2008). While there has been much research on self-efficacy with sports, there is little research that looks at the relation between self-efficacy of injury avoidance and injury occurrence. Based on the Social Cognitive Theory, there is a strong reason to believe that self-efficacy and injury would be related and can provide a level of predictability within this relation (Bandura, 1997). Research has shown that there is a link between self-efficacy and the appraisal of fear (Feltz, et al., 2008). Self-efficacy helps with the ability of an individual to deal with the stressors of the environment and thus have lowered anxiety and fears (Feltz, et al., 2008). There are even some suggestions that the fear response to injury may actually due to a lack of confidence in a person's ability to cope with the stressor. These areas of inquiry have not been studied exclusively in sports research and require some attention.

Purpose of the Present Study

This is an exploratory study in the field of how injury relates to self-efficacy to avoid injury and the fears of injury. The aim of the study is to examine whether there is a relationship between self-efficacy for injury avoidance, fear of injury, and the severity and frequency of injury.

Furthermore, if there is a relation, the study will examine whether this relation is reciprocal and cumulative as self-efficacy theory postulates. This research was developed to further understand how injury affects the motivational aspects of athletes and can build on the few studies in the area on self-efficacy of injury avoidance and fear of injury. The present study involves collecting self-reports from athletes during the pre-season training and asking them questions based on the previous season. The specific aim of this study is to examine the hypothetical relationship between self-efficacy, fear of injury and the frequency and severity of injuries.

Summary of Chapters

Chapter II will present a background on the theoretical underpinnings of self-efficacy and how Albert Bandura came to explain it. This review of the literature on self-efficacy will go over many studies from other fields such as academics, workplace and laboratory experiments to gain a better awareness of self-efficacy as a construct. The first part of the literature review looks at self-efficacy as a theory and explores the main components to understanding the development and measurement of the construct. The second part looks at injury in sports and the emotional toll it takes on athletes. The third part looks at past research and current research on self-efficacy in sports and sports injury. The literature review finishes off with our research questions and hypothesises.

Chapter III will describe the sample, measures, and the procedure of the present study. Chapter IV looks at a full descriptive of the participant sample and the analysis of the results based on this sample. Then in Chapter V will

relate the results from this study with past and future research making the link between our research and the theory of self-efficacy in sports.

Chapter II - Literature Review

Part 1: Historical Emergence of Self-Efficacy

The theory of self-efficacy came at a time when much of psychology relied heavily on unidirectional causation to explain human nature (Bandura, 2001). During the first half of the 20th century, radical behaviorism was becoming the most dominant in view in psychology (Lazarus, 1999). At this time in history, psychologists focused very little on the processes of the mind and relied on the observable behaviors presented in animal and human studies. Operationalization within the behaviorist model only recognized observable facts and viewed human behavior as a cause-and-effect relationship. Behaviorist theory placed the importance of behaviors on the external world, such that individuals are driven by reinforcements from the environment. Behaviorist principles believe that there is a simple input-output type model that makes up human behavior, and that there is little to no use in measuring or understanding the internal processes involved. The behaviorist philosophy compared human action to computers in which humans receive information and act automatically by pre-determined rules (Bandura, 2001). Early testing on animals showed how influential reinforcement and punishment was in controlling and creating behavior (Skinner, 1976).

After World War II, psychologists began to look into the cognitive processes that were involved in the study of psychology (Lazarus, 1999). It was at this point that the dominant view of psychology moved from the stimulus-response explanations of behavior to a stimulus-organism-response model. The

second half of the 20th century saw many of the cognitive and emotional theories come into the forefront (i.e. Social Cognitive Theory, Cognitive Behavioral theory and Stress Appraisal theory).

Social Cognitive theory was a movement away from this unidirectional model of human behaviors and saw human nature as the interplay between the personal, behavioral and environmental aspects (Lazarus, 1999). This theory saw humans as creators of their environment and not just the results of the environment (Bandura, 1997). The Social Cognitive theory focused on how humans process information and select, construct, and regulate their behaviors in purposeful ways (Cervone, 2000). The movement away from behaviorist theories stated that humans develop systems of belief that guide their behaviors through a world of challenges and hazards (Bandura, 2001). Humans therefore constantly analyze their capabilities and make judgements about their abilities. At this point, forethought (i.e., thinking about goals) and reflection became vital features of what made humans successful to adapting in this world (Cervone, 2000). Humans were not only driven by the reinforcements and punishments of the environment, but they also proactively shaped the world around them through the intermediate belief and thought processes. Bandura (1986) sums the complex understanding of human nature, "A theory that denies that thoughts can regulate actions does not lend itself readily to the explanation of complex human behavior" (p.15). Bandura was at the forefront of this cognitive revolution and developed the highly influential Social Cognitive Theory, which stated that individuals are responsible for their own self-regulation and self-

reflection in which they are active in shaping their realities (SCT; Bandura, 1986, 2001). Out of the Social Cognitive Theory came the concept of self-efficacy, which is considered to be one of the most influential constructs in motivational research today.

The success of the theory of self-efficacy was first demonstrated in the domain of analyzing avoidant behaviors and phobias (Bandura, 1977; Bandura, 1986). In conducting research in the area of modeling, Bandura found that mastery experience was the most powerful way for individuals to overcome their fears (Bandura, 1997). Modeling ways of coping with a fear created a source of learning for the phobic client to succeed in overcoming the fear (Bandura, 1997). Bandura found that modeling a positive behavior increased a person's perceptions of ability to cope with the threats of a fear that this would lessen the avoidant behaviors (Bandura, 1986). To create the conditions for a mastery experience, the therapist would break up the avoidant task into small steps at which the client can gain small successes, thus enabling the client to feel a sense of self-efficacy and become less fearful due to this mastery experience (Bandura, 1997). This modeling intervention proved very successful and gave way to a number of intervention techniques such as desensitization therapies and mastery experiences across many new fields of research such as work place performance (Locke & Latham, 1990), addictions (DiClemente, Fairhurst, & Piotrowski, 1995), learning in school (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996), and sports performance (Moritz, Feltz, Fahrbach

& Mach, 2000). Self-efficacy became one of the most powerful constructs in the study of motivation and intervention practices (Bandura, 1997).

Self-Efficacy: Definition of the Construct

The essence of self-efficacy postulates that within the individuals' belief is the capacity to implement control over the quality of their life (Bandura, 1997). Bandura (1997) defines self-efficacy as, "the belief in one's capabilities to organize and to execute the courses of actions required to produce given attainments" (p.3). Similarly, Stajkovic and Luthans (1998) define self-efficacy as, "an individual's convictions (or confidence) about his or her abilities to mobilize the motivation, cognitive resources, and courses of action needed to successfully execute a specific task within a given context" (p.66). The importance of self-efficacy theory can be placed on the positive or negative *judgements* an individual makes about utilizing their skill sets (Zulkosky, 2009). Whereas similar constructs such as self-confidence place importance on whether an individual feels they possess a certain level skills needed for the intended task, self-efficacy focuses on the judgements of using these skill sets efficiently (Bandura, 1997). An individual with high self-efficacy can take a limited skill set and achieve their goals regardless of the skills they initially possess (Bandura, 1997). Self-efficacy is the act of agency in one's life to take one's abilities and use them most effectively (Bandura, 1997). The definition of the word *self* refers to the identity of a person, whereas *efficacy* refers to the control one feels to produce effect (Zulkosky, 2009). The word efficacy relates closely and overlaps with words such as efficaciousness, productiveness and

effectiveness. In this sense self-efficacy is whether a person feels they can produce effect and control the outcome of a specific goal and that is closely linked to the identity of that person.

Self-Efficacy Explained: The Act of Agency

According to Bandura (1986), "people who regard themselves as highly efficacious act, think, and feel differently from those who perceive themselves as inefficacious. They produce their own future, rather than simply foretell it" (p. 395). The importance of self-efficacy can be placed on how an individual can feel that they are the product of their own change (Bandura, 1997). Past research has been quite successful in showing that people can be proactive changers of their conditions even when they seem uncontrollable (Bandura, 1997). Bandura explains that the importance of self-efficacy comes in the function of affecting our cognitive, motivational and affective processes (Bandura, 1988). For example self-efficacy does not change performance by itself, but instead, self-efficacy affects how the individual utilizes their resources such as setting goals, putting greater efforts towards their goals, finding supports, and resources and using better methods of coping (Bandura, 1997). Simply speaking people with high self-efficacy utilize the environment more effectively than a person with low self-efficacy (Bandura, 1997).

The research remains clear that when predicting performance, self-efficacy is the greatest predictor of success even above cognitive or physical skills (Bandura, 1997). Bandura (1986) states, "regression analysis show that self-efficacy contributes to achievement behavior beyond the effects of

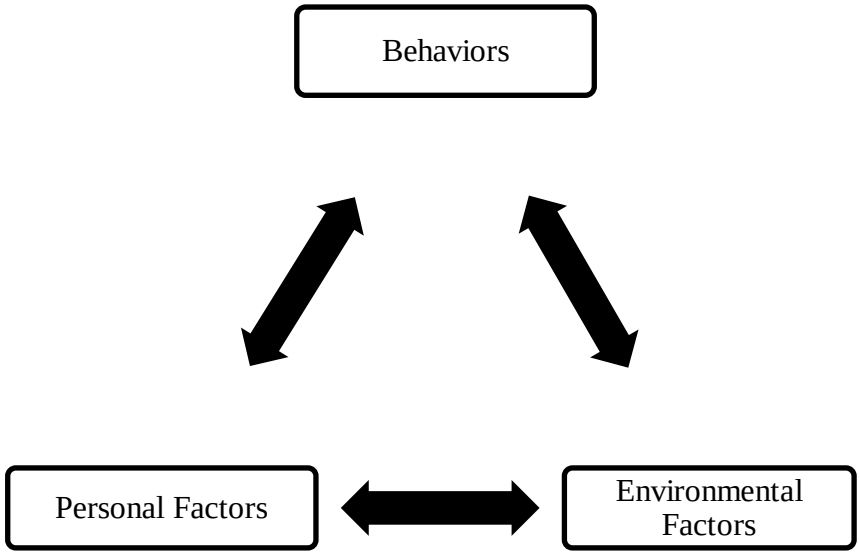
cognitive skills" (p. 431). Simply put, it is not the amount of ability one possesses, but how effectively one uses their abilities. Take for example a survey done by Collins (1982, cited in Bandura, 1986, p. 391) in which groups of students were formed based on their mathematical abilities. What they found within the groups that had students equal in abilities is that those with high self-efficacy engaged in attempting to solve more of the harder questions thus had more solutions at the end (Collins, 1982). That is, students with a higher self-efficacy were more proactive in their learning thus creating the conditions for achieving higher goals. This has also been seen in the physical realm such as in the early experiments by Weinberg (1979; 1981; 1985). In these experiments, participants engaged in a leg weight lifting task and were put into two groups in which self-efficacy was manipulated. In one group, the participants were told they were compared to someone with a disability (high self-efficacy group) and others were told they were being compared to an athlete (low self-efficacy). It was shown that those with high self-efficacy persisted longer, and tried harder with repeated trials, even when they were told they failed the previous ones. These early studies represent a few of the many studies across a wide range of domains to show similar results that people with higher self-efficacy utilize their skills more effectively, persist longer, and achieve higher goals (see Bandura, 1997 for review).

Triadic Reciprocal Causation Model

The Social Cognitive theory looks at three causes of determinism that are reciprocally influential (Bandura, 1997) (See Figure 1).

Figure 1.

Triadic Reciprocal Causation Model



Within the model, all of the factors (personal, environmental and behavioral factors) operate together and interact to change each other (Bandura, 1997). The link between personal factors to behavioral factors is seen as the cognitions that we have that can affect our behavior, or conversely, the behaviors that can affect our cognitions. For example, cognitive therapies look to change the automatic cognitions to alleviate some of a depression (personal factor) which can cause the individual to act differently in their behaviors (i.e. more open to friends and family). On the other hand, a person may change their behaviors such as taking on a new fitness routine and this can affect the personal factors such as feeling happier. The link of behavior and environmental factors also can as to affect each other. A behavior such as greeting more people can change the environmental factors of people being nicer to the individual, whereas an environment that is hostile (environmental) may cause the individual to behave

less friendly. The last link is how personal factors and environmental factors interact. Such that a grey day in the winter (environmental) can affect a person's mood (personal), or an individual who has a positive outlook on life will possibly inspire others around them thus changing the external environment around them. Bandura states that each of these factors is not equal in strength and depends upon the domain for which the model is being fitted (Bandura, 1997). In some areas personal factors may be more important, whereas others situation the behavioral or environmental may be stronger influences. The importance of the Triadic Model is that it shows that human nature is very complex and that there is not a single one determined cause to understanding human nature, but that all areas must be considered.

Self-efficacy in a Complex World

In understanding self-efficacy's impact on one's life, it is important to consider that there are a multitude of influences in our lives that cannot be accounted for in psychological research. From the Social Cognitive Theory, human development is seen to exist in a complex system that crosses a lifespan in which there are many events that affect the direction of a person's life (Bandura, 2001). Isolating psychological factors is increasingly difficult for researchers when considering the complexity of life events (i.e. societal changes, family changes, sudden life changing events) (Bandura, 2001). Researchers who attempt to isolate certain factors to say statistically that for the majority of participants, a certain independent variable accounts for a variance change in this other dependent variable cannot ever take into account the whole

range of influences within the complex lives of humans (Bandura, 1997). For example, the life event of the fortuitous encounter with a lifelong partner that changes the whole life path direction of the two individuals, or the freak accidents that can happen when someone is driving home. Bandura states that fortuity does not imply uncontrollability but instead that individuals can capitalize upon the fortuitous nature of life (Bandura, 1997). An individual who understands the unexpected nature of the world can appreciate the components that they can take more control of (Bandura, 1989). One who understands how they can be affected by the external world can start to foster a sense of control over some of the conditions that affect them (Bandura, 2001). For example, we cannot control when or where we meet our future significant partner but we can control the number of interactions we have with potential mates and how we go about meeting new people. Such an attempt by an individual looking for a future partner takes into account that they cannot control the outcome but can be proactive in fostering a potential outcome. Another example may be that an athlete who understands that they may experience an unplanned hit in a game may start to foster control over areas of the game that they do have control of, such as positioning within the game or pre-game stretching.

Self-efficacy theory fits well to understand human motivation within a complex and spontaneous world because it focuses on the internal processes of an individual to engage with producing their environment and outcomes regardless of the possible failures that can arise (Bandura, 1997). An individual with high self-efficacy realizes their abilities to be self-directed and intentional

with their actions, while at the same time understands, that they cannot completely control the world around them (Bandura, 1986). Such as an athlete who sets their intentions to win the game and considers that losing is still a possible outcome (Feltz et al, 2008). Highly self-efficacious individuals are more motivated by their act of agency and being proactive with their intentions, rather than being dependent upon the reinforcement of the future goal (Bandura, 1997). The individual with high self-efficacy will understand that they can develop the conditions of control in their own life such as exercising self-regulation, goal setting, persistence and effort towards the tasks in life (Bandura, 1997). It is in these motivations for intentions that high self-efficacious individuals capitalize on the opportunities that may or may not present themselves. Those with high self-efficacy place more importance on their efforts put forth rather than the actual outcomes which, ironically increases their chances of goal attainment.

Symbolizing Self Beliefs

Self-efficacy beliefs develop through the act of symbolizing and giving meaning to past experiences (Bandura, 1997). The judgement of one's abilities is largely based on the meanings given to past events either experienced or observed (Bandura, 1986). Past information is organized into a cognitive representation that gives meaning to what the individual has experienced (Bandura, 1986). Humans continually test their cognitive representations and constantly change their beliefs of self-efficacy (Bandura, 1997). For example, an athlete that has been a high goal scorer will have a high self-efficacy for

scoring, but with a few bad games, this cognitive representation may be questioned. A few bad games may be interpreted as simply a "fluke" (random occurrence), or an accurate representation of who they are. In understanding how self-efficacy manifests itself, it is important to understand more fully the core features that Bandura postulated. With self-efficacy found to be so effective in predicting performance, much of the research has focused on understanding what the core features of self-efficacy are and how it develops and is reinforced (Bandura, 1997).

Core Features of Self-Efficacy

Bandura suggested that human agency comes from four core features: intentionality, forward-directed planning, self-reactions, and self-reflections (Bandura, 1997). Acts of agency are done with intentionality (Bandura, 1997). That is, we have an intention that acts as a representation of our future action. Intentionality does not refer to an expectation we have, but instead, a proactive perseverance that we give to bring our future actions to effect. In this sense, the intentions we form act to motivate us towards a desired outcome. Visualizations can be formed of a future occurrence that motivates an individual towards that goal (Bandura, 1997). Forward-direct planning is when goals are set from the intention and the anticipation of consequences from actions (Bandura, 1997). Individuals will select actions that are probable to be successful in achieving the desired outcomes and avoiding failures. The foreseeable futures turn into the motivators for effort. By regulating one's personal behavior, an individual is able to plan their behaviors in accordance with what outcomes they wish. Self-

reactions are the actions taken from comparing current performance to progress towards the goal (Bandura, 1997).

Once the plan is in action, monitoring one's success towards the goal provides important information. The monitoring of goal progression can be seen as the constant testing of the self-efficacy belief (Bandura, 1997). If performance does not match with the current plan, then self-efficacy is re-interpreted and changes. As such, self-efficacy is not a fixed trait, but a fluid conception that a person has about the judgments of their abilities. Finally self-reflections are the conscious reflection that evaluates the values and meanings of life goals. Self-reflections give meaning to why we pursue what we pursue.

Determinants of the self-efficacy belief

Bandura suggested that one can maintain or acquire the sense of competence that reinforces self-efficacy through four means; mastery experience, vicarious experiences, verbal persuasion, and physiological and affective states (Bandura, 1997). Mastery experience is situations in which the person performs the task successfully (Bandura, 1997). This is a learned experience in which the person engaged in the task and mastered the task, building upon their self-efficacy to re-accomplish the goal at a later time. An example would be with a football player successfully making a touchdown, and this experience of mastery increases his/her self-efficacy for a later touchdown. On the other hand, unsuccessful attempts can compromise and lower self-efficacy. Vicarious experience is an observed learned process in which the individual views another performing the task successfully (Bandura, 1997).

When an individual views another individual of the same skill level completing a task successfully, this can cause the observer to have more self-efficacy that they too can achieve the goal. If the individual views others that are unsuccessful or those who have a much greater skill set completing a task, the observer can have resulting lower self-efficacy for being successful.

Verbal persuasion is feedback from others and is judged by the recipient as to whether it is authentic and a reasonable fit to one's capabilities (Bandura, 1997). This type of reinforcement of self-efficacy is most commonly used by coaches and athletes to enhance self-efficacy for sports (Fetlz, et al., 2008). For example a coach that gives feedback and praises a player's effort can increase the player's self-efficacy and performance. Physiological and affective states are the emotional reactions to situations (Bandura, 1997). When an individual feels symptoms of anxiety, such as sweatiness or higher heartbeat, there is an interpretation of these feelings. If the individual associates these anxiety symptoms to a lack of ability, then their self-efficacy can be lowered, whereas an individual that associates it with the feeling of excitement may increase their self-efficacy. That is, an athlete feeling anxiety during a shootout may associate this anxiety to a lack of ability to score and another player will associate this with feeling "pumped up" (Fetlz, et al., 2008).

Relevant Issues with Understanding Self-Efficacy

Bandura suggests that the relationship between self-efficacy and performance is both a long-term accumulation of one's past performance and a short-term temporal effect of the most recent experience (Bandura, 1977). It can

be seen that those who have repeated successes in the past will have high self-efficacy due to this cumulative effect. Yet, just as important is what is the most recent past experience that determines the level of self-efficacy (Feltz, et al., 2008). For example if a basketball player who has been successful in the past starts missing baskets, then this player may start doubting their capabilities which may lead to lowered self-efficacy (Feltz, et al., 2008). This is seen in sports as "a slump" and is common among sports. Since the judgement of one's abilities is constantly calibrated and tested by the individual, it can be seen that the most significant experiences are the most recent ones or big events that were highly meaningful in the past (Bandura, 1997). Self-efficacy is fluid and constantly changing as an individual re-adjusts their judgements of ability. With this in mind self-efficacy, is not simply a cumulating of experiences that can be measured to equal self-efficacy, but that rather is an interpretation of those events. Such that the best predictors of current self-efficacy are predictors that combine previous self-efficacy scores with past experiences (Bandura, 1997).

The issue of an individual having too much self-efficacy is debated in the literature (Vancouver & Kendall, 2006). Bandura states that studies that show that high-self-efficacy are actually harmful have many methodological problems (Bandura, 2011). The implications of these studies suggest that some people may have too much self-efficacy and an intervention to lower these beliefs. However, no evidence supports this intervention practice and Bandura warns against these implications (Bandura, 2011). Self-efficacy if measured correctly should measure the judgements they have of their ability to attain their

goals (Bandura, 1997). An individual with high self-efficacy that is above and beyond the probability of attaining their goal will have a high level of persistence and effort towards their goals and not be devastated by failures but may instead re-calibrate their self-efficacy to better fit (Bandura, 2011). With this research the underlying message seems to suggest that the higher the self-efficacy the better off the individual will be regardless of the outcome (Bandura, 1997).

Athletes must deal with many issues throughout their career including injury. Injury can be seen in Bandura's Social Cognitive theory as an environmental factors that can have effect upon the athlete's perceptions and behaviors. The next part of the literature review looks at how injury is defined, how prevalent is it in sports and what might be its relation to self-efficacy.

Part 2: The Physical and Emotional Toll of Injury in Sports.

"When you talk about an injury and the kind of depression you go through, it's not just because you're out of shape and you can't go out and play. You're missing a part of you. That's what's painful. That's what hurts." ---Jamila Wideman, Professional Female Basketball player

The Definition of Injury

The definition of 'injury' is still debated in the literature (Langley & Brenner, 2004). Many health professionals point to the "energy definition" as best to describe the pathology of injury. Under this definition, injury is defined as damage to the body that is initiated by the exchange of energy that causes sudden noticeable effects (Langley & Brenner, 2004). Most of the debate is within finding out where to draw the line in the medical field as to what is technically considered an injury (ex. does poisoning constitute an injury); however within sports it is most easily discernible because the causes of injury are more easily observed via coaches and medical professionals. Research with sports injury commonly look to a "reportable" injury which has to meet all the following criteria: a) injury occurred from participation in a sport, b) the injury required medical attention by the team certified athletic trainer, c) the athletes participation lasted for longer than one day after the date of injury (Hootman, at al., 2007).

A problem exists with reportable injuries in research since only injuries in which an insurance claim can be submitted or medical attention is needed will be documented (De Loes, 1995). The concern is that using only these

insurance claims and medical reports to describe injuries misses out on the large percentage of injuries that do not get recorded and has been called the "tip-of-the-iceberg" phenomenon (Backe & Andersson, 2008). Studies have been defining injury as the player being unable to participate in future games (Junge, & Dvorak, 2000). Another common method is to simply ask athletes if they sustained an injury which has been shown to be around 80% accurate to true injury rates analysed (Gabbe, Finch, Bennell, & Wajswelner, 2003). To date, researchers have not come to a consensus on how to measure injuries across different sports, however, some research suggests that the measure of an athlete missing time from their sport due to the injury is the best, most accurate, and most functional definition to capture most of the injuries that range from mild (less time off) to severe (more time off; Orchard & Hoskins, 2007). The National Athletic Injury Registration System categorizes injuries that are mild to severe based on the length of incapacity which is measured in days (Junge, & Dvorak, 2000). It is rated that 1 to 7 days is minor, 8 to 21 days is serious, and over 21 days is permanent (Junge, & Dvorak, 2000). However, other researchers define their cut-offs differently and this can vary for different sports (Junge, & Dvorak, 2000). Therefore, the debate of how to define and measure injuries in sports is still widely debated and there is no single consensus currently. Taken from past research, the best estimates are ones that look at the amount of time off, the frequency of injuries, and when it is examined by a professional (Orchard & Hoskins, 2007).

Most Common Areas of Injury

Research has shown that the majority of injuries across most sports come from physical contact, or overuse of muscles causing muscle tears and strains (Hootman, et al., 2007). The most common injuries in sports come from lower body injuries (knees, ankles, legs etc.). (Hootman, et al., 2007). Murray, Murray, MacKenzie & Coleman (2005) found that the most common sites of injury within sports rehabilitation clinics were the knees (29%) and the ankles (23%). A 5 year study of the West Division of Canadian Intercollegiate Athletic Union found that 53 to 60 percent of athletes analysed had injuries (Meeuwisse, Hagel, Mohtadi, Butterwick, Fick, 2000). Of those injuries, knee injuries were found to be the most frequent and resulted in the greatest loss of time from the sport (Meeuwisse, et al., 2000). Sprains and strains accounted for half of the methods of injury and 65% was from contact with other players. Within this study, they also found that 6% of the injuries involved concussions. Meeuwisse, Hagel, Mohtadi, Butterwick & Fick, (2000) suggest that football may represent the most frequent reports of injury due to sports at a competitive level. They suggest that the percentage of football players injured per team is second only to hockey at the university/college level.

Herbenick et al. (2008) recorded 1199 injuries in arena football (similar to American football but inside an arena with boards) over 4 years of the AFL. They found that there were 14.6 injuries per 1000 practice hours, and 111.3 injures per 1000 games hours. This suggests that there is a 7.6 times greater chance that a player will be injured during a game versus a practice. Of the

injuries reported, 56% of players took no time off, and 17 % took one to seven days off to heal. The most common methods of injuries in this study were 38.5% from sprains, 29.5% from strains and 16.32% from contusions. The most common location of injury was the knee (15.8%) and the ankle (12.7%).

A large study with 110 high school football teams in the State of Texas during a single season found a rate of .506 injuries per athlete per year (DeLee, Farney, 1992). This result suggests that half of the football players will sustain at least one injury due to the sport in a season. Similar to other studies, this study showed again that the knee and ankle were most common areas of injury (20% knee, 18% ankle), followed by shoulders, back, and hands (8% shoulder, 8% back, 8% hand and 5% involved the head). Similar to other studies, the most common methods of injury were from sprains 21%, contusions 16% and concussions showed a 5%. In a study by Bradley, Klimkiewicz, Rytel & Powell, (2002) they found that of the 600, 000 injuries reported from football in America at all levels of competitiveness, 20% were related to the knee, and within the knee injuries, 16% were ACL (anterior cruciate ligament) injuries.

The National Collegiate Athletic Association (NCAA) Injury Surveillance System (ISS) has collected injury rates since 1988 and found that there was an average annual increase of 7% for concussions related injuries (Hootman, et al., 2007). Casson, Viano, Powell & Pellman, (2010) looked at concussion in the NFL in a 12 year study. They found that the rate of concussion ranges from .38 to .42 per team per game. This suggests that approximately every 2nd to 3rd game a player will sustain a concussion. In

83.5% of concussions reported, the player returned to play with no missed games or missed practices. Similarly Pellman & Viano (2006) found that in 41% of the games they sampled from the NFL from 1996 to 2001 there was a game related case of concussion. Therefore, though lower body injuries dominate what is currently being reported, there is an increase in concerns of head injuries in sports that has gained media and medical attention.

Injury as a Form of Distress.

Injury affects not only the physical nature of an athlete but also their psychological nature. Wiese-Bjornstal, et al., (1998) proposes an integrative model to understanding injury that is receiving some attention. This model uses the basic stress process theory (Selye, 1974) has been identified as an appropriate basis for understanding sports injury (Wiese-Bjornstal, et al. 1998). The integrative model of sports injury is grounded within the Lazarus and Folkman's (1984) theory on cognitive appraisals of stress and coping. In this model, injury acts as a means of stress on the athlete and it is the athlete's appraisal of the stress that determines whether they are able to cope. The psychological subcomponents to post-sports injury recovery has been seen with cognitive appraisals, emotional responses and behavioral responses (Wiese-Bjornstal, et al. 1998). The cognitive appraisals can have the effect to influence emotional and behavioral responses (Wiese-Bjornstal, et al. 1998). Early work in the area of sports injury suggests that athletes suffer from grief after an injury and that cognitive-behavioral approaches are useful in sports injury therapies (Evans & Hardy, 1995). Although the model for the sports injury process is that

cognitive appraisal affects emotions and behaviors, the reverse direction of the model is also seen a possible (Wiese-Bjornstal, et al. 1998). Cognitive appraisals in post injury are seen as perceptions about the cause of injury and their ability to cope recovery status (Wiese-Bjornstal, et al. 1998).

Several studies have found that injury affects the emotional response of athletes, though a small minority of athletes can develop depression due to their injury (Brewer, Petitpas, Van Rilalte, Sklar & Ditmar, 1995; Leddy, Lambert & Ogles, 1994; Smith & Milliner, 1994; Smith, Stuan, Wiese-Bjornstal, Milliner, Fallon & Crowson., 1993). As well, athletes can suffer from mood disturbances which have been seen to relate to the severity of the injury, with serious injuries causing the most significant mood disturbances (Smith, Scott, O'Fallon & Young, 1990). Leddy. Lambert, & Ogles, (1994) found that 88 percent of NCAA Division I athletes had normal to mild ranges in depression post injury. Morrey (1997) found support for the hypothesis that competitive athletes experience greater mood disturbances than non-competitive athletes due to the return to game attitude.

It is important to note that studies have shown that the majority of athletes can cope with injuries and mildly suffer from emotional distress. Yet, it is possible that the frequency and severity of injuries can affect athletes differently in terms of self-efficacy and emotional distress. Smith et al. (1990 & 1993) found that severity of injury (based on time loss) was a key determinant of the psychological response. Kvist, Ek, Sporrstedt and Good (2005) found that there was an anxiety of re-injury that represented an obstacle for athletes to

return to sports following surgery. Cicerone & Azulay (2007) found that the greatest predictor of life satisfaction after traumatic brain injury was perceived self-efficacy for the management of the cognitive symptoms. The research is starting to paint a clear picture that injuries have an enormous impact on athletes, both emotionally and motivationally. However, the impact injuries can have on individual athletes psychologically is very complex and may be different as determined by the type, location and frequency of injuries, the sports, and the athlete themselves. It appears that future research is starting this narrowing process to understanding more about the psychological impact injuries can have.

Part 3: Self-Efficacy in Sports.

"Champions aren't made in the gyms. Champions are made from something they have deep inside them - a desire, a dream, a vision."- Muhammed Ali, Boxing Champion

Within sports research there has been over 200 published studies on self-efficacy over the past 30 years (Feltz et al., 2008). The popular focus of these studies relates self-efficacy to performance factors such as increasing an athlete's performance to obtain goals, effort during a game and number of wins a team accomplishes. In fact, a meta-analysis by Moritz et al. (2000) revealed that self-efficacy correlates with a wide range of performance variables in sports at a range of .79 to .01 with very few studies finding insignificant results. It has been suggested that the studies that have found no significant results were using non-traditional measures of self-efficacy, had methodical errors or that

the measure of self-efficacy did not match the performance variable of interest (Feltz, et al. 2008). Self-efficacy is not limited to any sport but has been applied to most sports such as gymnastics, diving, weightlifting, wrestling, baseball, volleyball, hockey and football (Feltz, 1982; Feltz & Mugno, 1983; Fitzsimmons, Landers, Thomas, & Van Der Mars, 1991; George, 1994; Kane, Marks, Zaccaro, & Blair, 1996; McAuley, 1985; Spink, 1990). In one of the earliest experimental studies conducted by Weinberg and colleagues (1979, 1980, 1981), the authors found that they could manipulate the self-efficacy of their participants which affected the performance of participants on an athletic endurance task. Specifically, they found that high self-efficacy caused an increased effort and ultimately increased their performance against those with low self-efficacy. In another early study by Weinberg and Colleagues (1985), the researchers split participants randomly into two groups that manipulated self-efficacy to either high or low self-efficacy, but they were also assigned to a cognition strategy condition group (positive self-talk, dissociation). There results showed that the high self-efficacy group outperformed the low self-efficacy group, but also that the cognitive strategy employed was ineffective in affecting performance.

Considerable research has looked at how past experiences can affect self-efficacy beliefs (Feltz et al. 2008). The primary method of testing past experiences has come from performance measures predicting the strength and level of self-efficacy afterwards, and the most common statistical methods for testing this assertion has come from regression, path analyses, and repeated

measures ANOVA testing with self-efficacy as the dependent variable (Feltz et al. 2008). Research for the past 30 years has shown that across a wide range of performance measures that the performance-self-efficacy relationship yields a correlation of r= 0.39, whereas self-efficacy before performance measures r= 0.36 (Feltz et al. 2008). This conclusion is true even when considering many control variables and shows that past performance is a strong predictor of self-efficacy (Feltz et al. 2008). According to self-efficacy, successes will increase self-efficacy while failures will lower them (Feltz et al. 2008). Such as a study by Treasure, Monson and Lox (1996) that found that the only variable that differentiated the successful high school wrestlers from the unsuccessful was their self-efficacy beliefs. Similarly Lane, Jones & Stevens (2002) found that tennis players experienced a decrease in self-efficacy following a tie-break loss. Thus athletes appraise success and failures throughout their careers and this appraisal can affect their future performance.

Bandura states that the strongest source of self-efficacy comes from past performances (Bandura, 1997). In sports the repeated successes tend to increases an athlete's self-efficacy while repeated failures tend to lower self-efficacy (Feltz, et al., 2008). Interesting findings came from a study by Eyal, Bar-Eli, Tenenbaum and Pie (1995), in which they found that moderate levels of self-efficacy beliefs in the preparatory stages were predictive of better performance versus those with high self-efficacy. This result suggests that some uncertainty in the outcome of performance actually may help to motivate the athlete. Attributions of success and failure made by the athlete can affect self-

efficacy and vice versa. Bandura states that attributions and self-efficacy work in a bidirectional relationship (Bandura, 1997). This means that those with high self-efficacy have been found to attribute failures to situational factors such as a lack of effort or a fluke, whereas those with low self-efficacy tend to attribute failures to global features about themselves such as a perceived lack of ability (Feltz, et al., 2008). This theory can be seen in the study done by Shaw, Dzewaltowski and McElroy (1992), in which they found that failure did not lower the self-efficacy of the athlete if the failures were ones that were associated with unstable and situational factors. In any study of self-efficacy and the relationships to other variables it is important to consider how the sample is split up in terms of attributions of the past performances that can influence the current self-efficacy.

New Avenues of Research: Self-Efficacy of Injury Avoidance

Success for athletes is dependent on more than just physical skills. It is becoming more widely recognized that cognitive factors play a great role in how an athlete develops and functions (Bandura, 1997). Athletes must use their cognitions to find the relevant sub skills, coordinate and sequence their behaviors and actions for the task (Feltz, et al. 2008). It is clear that elite athletes possess greater skills in their sport but also that they depend upon utilizing these skills to the fullest (Bandura, 1997). Bandura (1997) hypothesises that athletes that are low in self-efficacy will be fearful of the sports environment and lack the confidence for a positive outcome (i.e. avoiding injury). An athlete that lacks confidence avoiding injury has been seen

to have a greater probability of being injured than the athletes with higher confidence (Reuter & Short, 2005). With injury rates increasing for the past decade, there are very few studies that look directly at how athlete self-efficacy relates to injury prevention and avoidance (Wiese-Bjornstal, et al. 1998). Heil (1993) states that injury to athletes has an impact upon the athlete's psychological well-being and that this can affect the athlete's performance and probability of future injury. Connelly (1991 as cited in Wiese-Bjornstal, et al. 1998) found that football skills efficacy measured pre-injury and post-injury resulted in a dramatic drop in football skills efficacy due to injury. This study suggests that even when the athlete has fully recovered that they still suffer from a drop in self-efficacy. As well other studies have found that athletes change their performance after an injury and some theorize that this is an over compensation of the injured area (e.g., a runner that sustains a knee injury will use the other leg more often in response and that this pattern of over compensation can follow after recovery).

Much of the research in injury stems from the positive effect self-efficacy has on decreasing injury rehabilitation times. Shaffer (1991) found that the history of injury related to rehabilitation efficacy of the current injury. They also found that those who had had previous success in rehabilitation had higher self-efficacy then those who were first time injured. This research suggests that injury can affect the cognitive appraisal of one's confidence in their capabilities which can influence emotional and behavioral responses (Wiese-Bjornstal, et al. 1998). In a study by Taylor & May (1996) they found that the greater beliefs

of self-efficacy patients had about their rehabilitation of sports injury treatment plan had a greater compliance to the treatment plan. The Taylor & May study shows that confidence in the patient's ability to be proactive for the rehabilitation was crucially important to the success of overcoming an injury and returning to sports. Other studies have found this same effect with athletes to compliance and adherence to interventions with injuries (Flint, 1991).

Studies have pointed towards self-efficacy being able to predict future probability of injures and that injures can lower self-efficacy. Such that the earlier triadic reciprocal causation model shows self-efficacy as the cognitive factor, injury as the environmental factor and behaviors as the compliance to injury prevention tactics (Short, Reuter, Brandt, Short, & Kontos 2004). Short, Reuter, Brandt and Short (2004) found that self-efficacy to avoid injury had a negative significant relation to the probability of the athlete being injured again. Reuter and Short (2005) went further and split up injured athletes into two groups, first being athletes that had only one injury and second being athletes that had more than one injury. Their results found that the athletes with more than one injury had less confidence to avoid future injuries, and a greater perceived risk of re-injury.

Fear of Injury as a Lack of Confidence

Fear is defined as an apprehension towards a potential danger (Short, et al. 2004). When an athlete sustains an injury there is often a fear around the severity of the injury and hesitation to return to the game (Reuter & Short 2005). In a 5-year review of patients that had ACL surgeries, Lee, Karim, &

Chang (2008) found that 20% of patients did not return to previous levels of sports activities due to a fear of re-injury. Fear of re-injury has been theorized as a factor of a loss of confidence that occurs from the injury (Reuter & Short 2005). Such that fear exists because self-efficacy is low and that this fear may have a negative effect on performance. Bandura suggests that self-efficacy to cope acts to mediate the relation between the external stressor and the fear response (Bandura, 1988). The early work to provide evidence for this theory came from research with people who have phobias and anxiety troubles and coping self-efficacy was found to control the responses (Bandura, 1988; Kent & Gibbons, 1987). In a study by Kent and Gibbons (1987) they measured the cognitive, behavioral and physiological symptoms of anxiety of patients that had a fear of a dental appointment. They found that those with high self-efficacy coped better with the anxiety of the fearful stimulus of the dental appointment thus showing a relation between the fear response and self-efficacy as a means of coping.

Many researchers in sports psychology see the close connections between a fear of re-injury and an athlete's self-efficacy to avoid injury. Magyar & Chase (1996) posits that fear of injury occurs because an athlete lacks the confidence to be successful in the threatening situation. Typical emotional reactions related to low self-efficacy has been anxiety, worry, fear and depressive moods (Feltz et al., 2008). Recent work in fear and worry in sports has found associations between self-efficacy and fear of injury. Short, Reuter, Brandt, Short, and Kontos (2004) found that confidence to avoid injury

was negatively related to the worry and concern for injury. As well, fear can have the debilitative effect to change an athlete's performance and thus increasing risk of injury (Short, et al. 2004). Such is that case that an athlete that sustains a shoulder injury may fear re-injury and use their other shoulder more often for contact thus increasing the probability of injury (Short, et al., 2004). However, currently there is little research in how this injury, fear of injury and self-efficacy dynamic relates.

Research Questions and Hypotheses.

Within sports injury, athletes who have high self-efficacy for injury avoidance would theoretically be willing to put more effort into what they can control such as stretching more often or seeking out methods to reduce injuries. It is these actions that we believe is the result of an athlete having a proactive agency in sports and is what would contribute to lower injury rates. Conversely, an athlete that has low self-efficacy for injury avoidance is likely to take a passive approach with respect to preventing injuries. Thus, athletes with lower self-efficacy to avoid injury will be less proactive and therefore more prone to sustaining injuries. Given the theory of self-efficacy, the past research on injury as a form of distress, and the fear response associated with injury, we have put forth 6 hypotheses that are exploratory to this theoretical link from the literature.

Hypothesis 1: A higher frequency of injures during one season will result in a lower self-efficacy to avoid injury at the end of the season.

Hypothesis 2: The greater the severity of injuries during one season will result in a lower self-efficacy to avoid injury at the end of the season.

Hypothesis 3: The injuries that are less prevalent (as based on location) will have a greater affect in lowering self-efficacy to avoid injury.

Hypothesis 4: Self-efficacy to avoid injury will significantly impact fear of injury even when controlling for frequency and severity of injuries.

Hypothesis 5: Frequency, severity, and self-efficacy to avoid injuries can predict future levels of these same variables within the next season.

Hypothesis 6: Self-Efficacy to avoid injury is best predicted by an accumulation of experiences as measured from two seasons worth of injuries frequencies, and severity as well as previous levels of self-efficacy to avoid injuries.

Chapter III - Methodology

Participants

Participants were 317 football players in the Canadian Football League. Participants were chosen via convenience sampling for which we had access to the Edmonton Eskimos pre-season training camp testing. Forty-nine of the participants were from the Toronto Argonauts collected in June 24th 2009, 45 were from the Winnipeg Blue Bombers collected in June 24th 2009, with the rest of the participants as individual players collected from the Edmonton Eskimos pre-seasoning training camp from June 2008 to June 2012. There was a total 342 survey entries collected over the 5 years in which only record initials, position and team as the identifiers. From 342 we identified 25 players that matched accurately in terms of position, initials and team from one season to the next with a 1 year gap. These 25 follow-up responses were used for the repeated measures analysis (i.e. Time 1 and Time 2) and were not included in the total analysis (n=317). The 317 survey responses were assessed and we found no matches with previous responses (i.e. no identifiers matched completely from 2008 to 2012) and therefore suggests that the sample of 317 contains individual football players, or at least the vast majority is individual players. To increase the effect size of the repeated measures a document provided by the CFL with the 2012 injury reports was added to Time 2 data bringing the Time 2 sample for measures of injury frequency and severity up to a sample of 78 individuals.

Procedure

The surveys from the Edmonton Eskimos were administered via paper and pencil during the pre-season training camps at Commonwealth Stadium in Edmonton, Alberta. During the day the athletes underwent a series of pre-season medical screening evaluations on a date mandated by the Canadian Football League. This survey was embedded in the activities completed by each player. For this study, each participant was given a brief description and asked if they understood the parameters of the study. Informed consent was provided from all athletes to administration of the surveys. The survey took on average seven minutes to complete. Surveys collected from other teams were collected in the same manner, at the start of the season, as part of initial medical screening evaluations, and with an explanation of the study with informed consent. The executive committee from the Canadian Football League reviewed the proposed study and gave final approval in May, 2008. All data was collected by the primary researchers (Dr. Martin Mrazik and Adam McCaffrey) and kept in a locked cabinet in Dr. Mrazik's office at the University of Alberta as per Ethics Review Board policy.

Measures

Self-Efficacy to Avoid Injury. Self-efficacy to avoid injury considers all the set parameters that Bandura suggests for constructing a self-efficacy measure; domain specification, gradations of challenge, content relevance, response scale and validity (Feltz, et al., 2008). The scale considers the self-

efficacy to avoid or persist with injuries throughout the next season and offers a level of specificity necessary to tap into what we want to measure. Since it is with football players before the training camp it is assumed that the self-efficacy to avoid injury pertains purely to the sport of football. Bandura states that self-efficacy measures must use a "can do" type of questioning as oppose to a "will do" which this measure provides (Bandura, 2006). The scale also includes a range of scores from 1 to 7 and thus offers a level of self-efficacy or the magnitude for which the athlete can express their expected performance attainments (Feltz et al., 2008). The number of items also offers a degree of generality for which the players can judge their injury avoidance across more than one area within the game (Feltz et al., 2008). The scale is not hierarchical which means to say that the scale does not range the self-efficacy for specific levels of injury, such as "I feel confident I can avoid one injury, two injuries or all injuries". Bandura suggests that for any non-hierarchical scales reliability testing must be completed because there may be a gap in the interpretation of the generality of the questions (Bandura, 2006). In this study we found the Cronbach's alpha coefficient was .789. Literature suggests a minimum acceptable criterion for Cronbach's alpha is .70, providing support that the measure of self-efficacy to avoid injury is reliable for this study (Nunnally, 1978).

Fear of Injury. This scale comes three items from the Injury/Illness Sensitivity Index by Taylor (1993). The original scale of the ISI was an 11-item scale designed to measure the fear of illness and injury. Taylor (1993) reported

the internal consistency for the ISI to be acceptable ($\alpha > .80$). Our study used three items that pertained to injury on a 1 to 7 likert scale. Cronbach alpha coefficient was found to be .821 which provides support that the measure of a fear of injury is reliable.

Injury Reports (Severity, frequency and type). Severity of injury measures how much time from the season the athlete lost due to the injury. This was rated on 5 categories: Less than 1 week, 1-2 weeks, 3-4 weeks, 5-6 weeks, and more than 6 weeks. For athletes who did not sustain an injury simply wrote no injuries on the survey. For frequency of injury was rated in five categories: 1, 2, 3, 4, 5 or more. Athletes who did not have any injuries wrote zero injuries on the survey. The definition of a reportable injury was any injury that the athlete missed at least 3 days during the season which Stuart (2005) describes injuries less than 3 days off as mild. The location was split into six categories: Lower extremity (hip, knee, ankle and foot), upper extremity (shoulder, elbow, hand and wrist), head/face (not concussion), head (concussion), neck and back. These groups were based on the anatomical injury distribution from Baltzer et al., 1997.

Description of the Data

Of the 317 athletes over 5 years there was a mean injury rate of .79 per season. One hundred and eleven athletes that recorded no injuries for the past season, 178 recorded 1 injury in the past season, 20 athletes recorded 2 injuries, 4 athletes recorded 3 injuries, and 4 recorded 5 injuries in the past season. This data shows that 64% of players reported that they sustained at least 1 injury

during the past season of play, while 36% did not report any injury. According to this frequency measure there was a total of 250 injuries for the 5 years of data for 317 individual players. For this location measure there was a total of 257 injuries as per location described for the 5 years of data with the extra 7 injuries recorded due to participates that reported no injuries on the frequency measure but instead reported a location of an injury. This increase in 7 injuries was possibly the cause of the athlete having an injury but not one that fit the criteria of a reportable injury as outlined in the frequency scale (missed at least 3 days). 53% of the players (168) reported a lower body injury during the past season, 18.9% (60) of the players reported an upper body injury during the past season, 0.6% (2) for face injuries, 3.2% (10) for head injuries, 1.6% (5) for neck injuries and 3.8% (12) for back injuries. The measure of injury severity asked "How much total time did you lose to injury last season?" In the severity of injury 15.1% (48) took no time off due to injuries, 50.8% (161) took less than 1 week off due to injuries, 12.3% (39) took 1 to 2 weeks off, 8.2% (26) took 3 to 4 weeks off, 4.4% (12) took 5 to 6 weeks off and 9.1 % (29) took more than 6 weeks off. The mean time taken off due to injury centers from less than 1 week to 1 to 2 weeks (Mean of 2.63 on the ordinal scale).

The injury reports from this sample are similar to that of finding from other studies with other football leagues. Herbenick et al. (2008) recorded the most common location of injury was the knee (15.8%) and the ankle (12.7%) with a rate of .506 injuries per athlete per year. This result suggests that half of the football players will sustain at least one injury due to the sport in a season.

Our data suggests a slightly higher rate but is similar in terms of the most dominate area of injury being lower body injuries. Similar to other studies this study showed again that the knee and ankle were most common areas of injury (20% knee, 18% ankle), followed by shoulders, back, and hands (8% shoulder, 8% back, 8% hand and 5% involved the head) (Hootman, et al., 2007; Baltzer, Ghadamgahi, Granrath & Possel, 1997; Bradley et al., 2002; Chomiak, Junge, Peterson & Dvorak, 2000; DeLee & Farney, 1992) . Similar to our data we report injuries of the head to be close to other estimates. Therefore relatively speaking, our data reflects similar sources of injury locations and rates from previous studies.

Self-efficacy and Injury Descriptive

Overall the data suggests that the CFL players in our sample had high self-efficacy to avoid injury with sum score means ranging from 26.00 to 31.75 with a scale maximum set at 35. Generally it was found that CFL players had a low fear of injury with mean scores ranging from 5.00 to 8.8 with a scale limit at 21.

Table 1.

Means of Self-Efficacy and Fear of Injury

	Mean of Self-Efficacy	Mean of Fear of Injury
No Injury (111)	31.06	6.42
1 Injury (178)	29.34	8.01
2 injuries (20)	27.40	8.80
3 injuries (4)	31.75	8.00
More than 4 Injuries (4)	26.00	5.00
Total of all	29.81	7.46

*Numbers in brackets are the number of participants

Chapter IV - Results

Assumptions for ANOVA

Independence of Errors. Within this sample each participant was recorded at once. However, the combining of the whole data set required putting all the participants into one group that represents 5 different time periods (2008-2012). Each survey reflected a relation between the previous season and the current self-efficacy and fear of injury scores. To ensure independence of errors, we ran a one way analysis of variance with time x self-efficacy and time x fear of injury. There was no significant main effect of group, F (4, 312) = 1.43, p = .223 for the time by self-efficacy analysis. There was no significant main effect of group, F (4, 312) = .911, p = .458 for the time by fear of injury analysis. These results provide us with support to say that there was no difference in the time that the participants filled out the survey and therefore we can combine the sample and keep the assumption of independence of errors.

The sample used convenience sampling methods which included three different CFL teams with the majority of the participants coming from one team. To assess whether there was a relation between the membership of a participant to a team, we ran a one way analysis of variance on the relation between team with self-efficacy and fear of injury. Results indicated no significant main effect for group, F (2, 314) = 1.40, p = .249 for the team by self-efficacy analysis or for fear of injury, F (2, 314) = .899, p = .408. These results provide support to say that the sample was independent of errors that may be

due to the membership to a team and therefore allows us to combine the sample.

Normality. As Winer, Brown & Michels, (1991) suggests "A reasonable statement is that the analysis of variance F statistic is robust with regard to moderate departures from normality when sample sizes are reasonably large" (p.104), and "once the samples become as large as a dozen or so, we need not worry much about the assumption of normality" (p.145). As well it is stated that the F statistic in procedures of analysis of variance is very robust to even extreme differences from normality (Gamst, Meyers & Guarino, 2008). Outliers were viewed as any score that exceeds 2.5 standard deviations from the mean. We turned all the self-efficacy scores into z-scores and removed any score that went beyond ±2.5. From this we removed eight scores from the analysis with self-efficacy. All of these scores were in the negative direction indicating a negative skewness and with the majority of the sample ceiling out at the top of the self-efficacy scale. From the analysis involving fear of injury we removed five scores from the analysis, all of which were in the negative direction indicating a negative skewness. Some outliers were also selected out as per analysis throughout.

Normality of the Frequency of Injury and Self-efficacy to Avoid Injury. All of the groups for frequency of injury to self-efficacy were within the ±2 range of skewness and most being below ±1. These same groups also had a kurtosis between ±1. The Kolmogorov-Smirnov test of normality was significant for groups with no injuries and 1 injury, meaning that the

assumption for normality was not meet for this test. However, it is important to note that assumptions of normality are not as important to be met with the sample size is large, and the Kolmogorov-Smirnov test of normality is considered a very sensitive test of normality (Gamst, Mayers, & Guarino, 2008). Looking at the histograms for each group, each group generally fits within a normal curve, with some having a negative skewed tail.

Normality of Severity Due to Injury to Self-efficacy. All of the groups for severity of injury to self-efficacy were within the ±2 range of skewness and most being below ±1. These same groups also had a kurtosis between ±2 with the majority being at the ±1 range. The Kolmogorov-Smirnov test of normality was significant for groups 1, 2, and group 6, and non-significant for groups 3-5. This means that some of the groups did not met the test for normality with the Kolmogorov-Smirnov test but with a large sample size this condition does not necessarily need to be met. Looking at the histograms for each group, each group generally fits within a normal curve, with some having a negative skewed tail.

Homogeneity of Variance. For the frequency of injury groups to self-efficacy the Levene statistic reported was not significant therefore showing that the assumption for the homogeneity of variance was not violated. For the severity of injury groups to self-efficacy the Levene statistic reported was not significant across all groups therefore showing that the assumption for the homogeneity of variance was not violated.

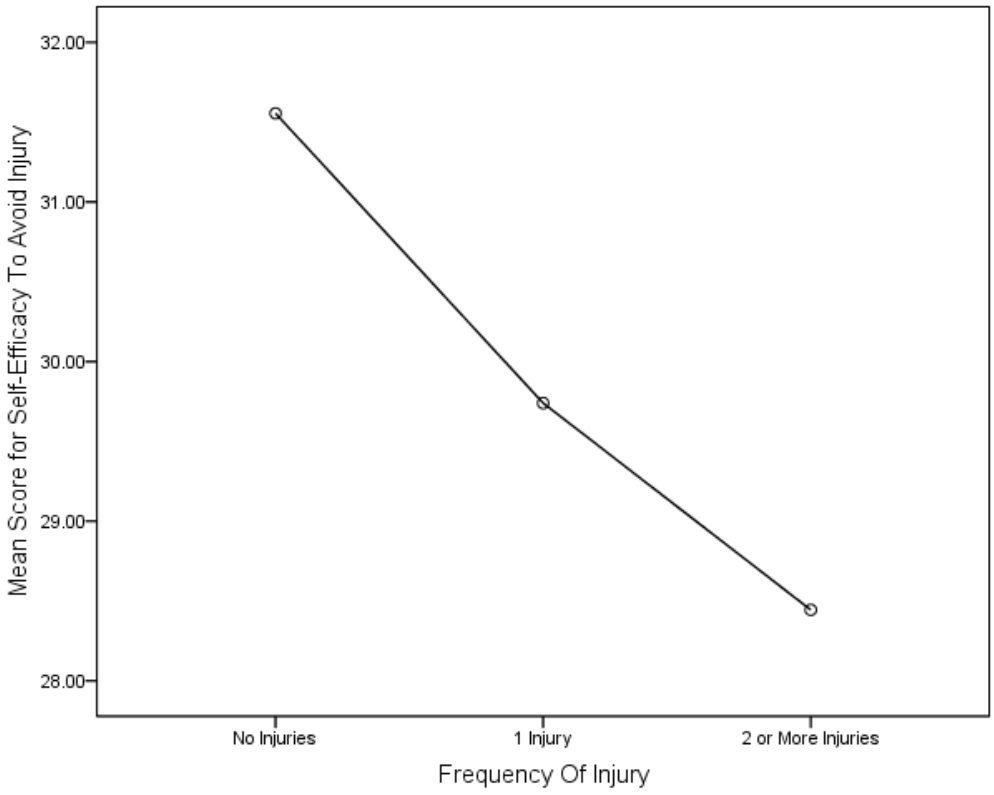
Hypothesis Testing and Analysis

Hypothesis 1: ***A higher frequency of injures during one season will result in a lower self-efficacy to avoid injury at the end of the season.***

To assess this hypothesis one one-way analysis of variance test was performed. Due to the low numbers of participants from the 2 to 5 injuries levels, we combined this group to represent 25 individuals that had 2 or more injuries. Therefore we had three groups of injury levels: 0 injuries (108 participants), 1 injury (174 participants) and 2 or more injuries (27 participants). The One Way ANOVA revealed that there was a statistically significant difference between the injuries frequencies and means for self-efficacy F (2, 306) = 8.82, $p < .01$, $\eta_2 = .05$. This result shows that five percent of the variance is accounted for by the effect of the frequency of injuries. Bonferroni Post Hoc analysis showed that there is a significant relation between the 0 injuries group to both 1 and 2 or more injuries groups (p= 0.002). There was no significant difference between the 1 injury group and the 2 or more injury group. This shows that athletes who sustain at least 1 injury in a season will have significantly lower self-efficacy to avoid injury. Looking further at the graph (Figure 2), the there is a linear relation, therefore suggesting that there is a pattern of the more injuries an athlete sustains the lower their self-efficacy will be for that season. This suggests that injuries do have an influence on an athlete's perceptions in their abilities to avoid future injuries and in this case they become less confident. The theoretical implications of these results are discussion further in the discussion of the results in chapter 5.

Figure 2.

Means Self-Efficacy to Avoid Injury and Frequency of Injuries



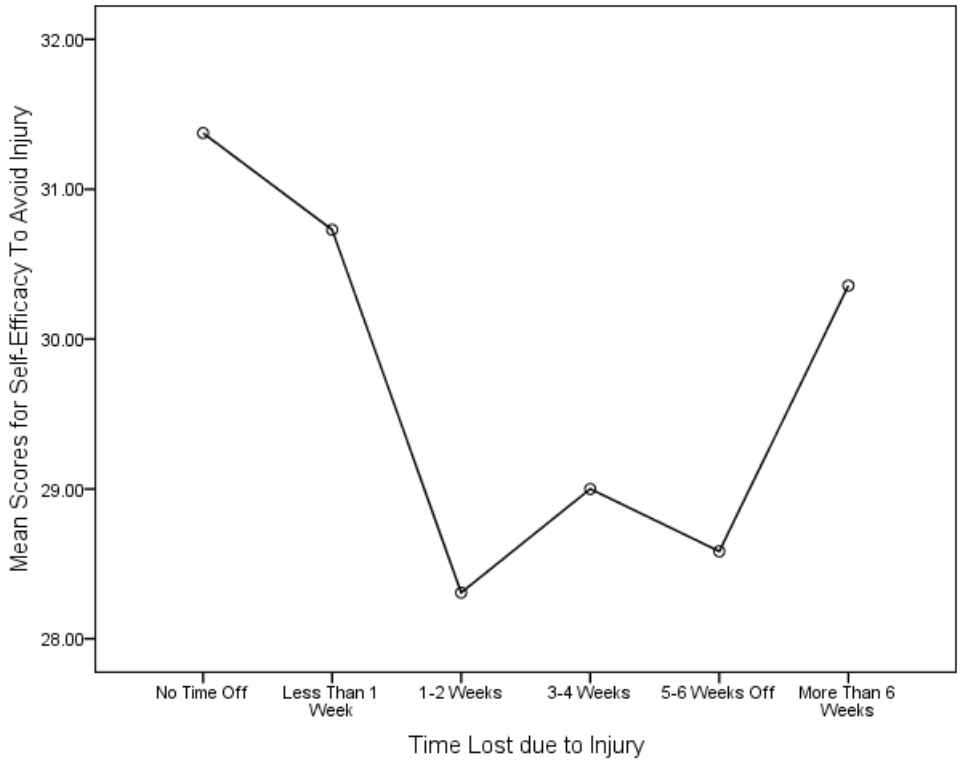
Hypothesis 2: ***The greater the severity of injuries during one season will result in a lower self-efficacy to avoid injury at the end of the season.***

To assess this hypothesis one one-way analysis of variance test was performed. Severity of injury was measured by the amount of time taken off due to the injuries. Six groups were used which included No Time Off (48 participants), Less Than 1 Week (156 participants), 1-2 Weeks (39 participants), 3-4 Weeks (26 participants), 5-6 Weeks (12 participants) and More Than 6 Weeks (28 participants). The one way ANOVA revealed that

there was a statistically significant difference between severity of injury and self-efficacy: F (5, 303) = 3.50, p = .004, η^2 = .06. This result shows that six percent of the variance is accounted for by the effect of the frequency of injuries. Bonferroni Post Hoc analysis showed that there is a significant relation between No Time Off and Less Than 1 Week to the 1-2 Weeks off group. None of the other groups were significantly different. This suggests that there is a drop in self-efficacy at the severity of injuries that requires 1-2 weeks off. The graph (Figure 3) shows a complex relation, which starts off on the high left, dips down at around 1-2 weeks to 5 weeks and then goes back up at week 6. This relation possibly suggests that athletes lose self-efficacy for injuries that require a severity of needing 1-2 weeks off while minor injuries cause less of an effect. At 6 or more weeks off due to injury it appears that self-efficacy starts to approach back to levels of the more minor injuries. This result may suggest that athletes that are given amply amount of time to recovery from injuries do start to recovery their self-efficacy. This relationship is discussed further in Chapter 5.

Figure 3.

Means of Self-Efficacy to Avoid Injury and Severity



Hypothesis 3: ***The injuries that are less prevalent (as based on location) will have a greater affect in lowering self-efficacy to avoid injury.***

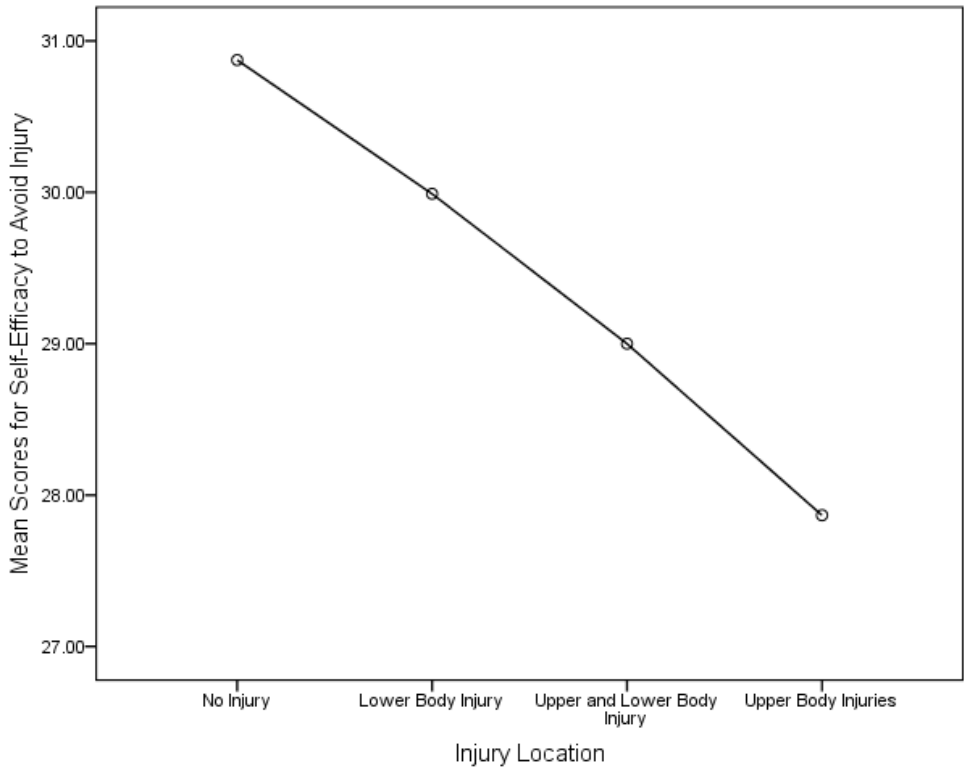
There were a few analyses chosen to assess the relationship between self-efficacy and injury location. First is an ANOVA with locations as the independent variable and self-efficacy to avoid injury as the dependent. Next there is two way ANOVAs performed to assess if there is a relationship between frequency and severity with location as independent variables. Then a number of correlational analyses on each location separately to view how these locations may be different from each other in direction and strength.

Analysis of variance of the location of injury to the self-efficacy to avoid injury

Due to low sample sizes within a few of the injury groups some groups were combined to provide a more general variable of all injuries. The locations of shoulders, head, neck and back were combined to assess the group of upper body injuries. There is four groups represented by 95 participants who had no injury location, 146 who had a lower body injury, 18 who had an injury that involved upper and lower body injury, and 58 were injuries that involved the solely of an upper body area only including the neck, back, shoulders, and head. The One Way ANOVA showed significant main effect F (3, 312) = 4.44, p = .004, η^2 = .04. This results shows that four percent of the variance is accounted for by the effect of the frequency of injuries. Bonferroni Post Hoc analysis showed that there is a significant relation between the no injury group and the lower body injury group with those of the upper body injuries. This suggests that upper body injuries appear to cause more of a decrease in self-efficacy then all other locations see (Figure 4). According to our results upper body injuries were far less common than those athlete with no injuries and lower body injuries but upper body injuries accounts for a significant decrease in self-efficacy. These results are discussed further in chapter 5.

Figure 4.

Means of Self-Efficacy to Avoid Injury and Location of Injury

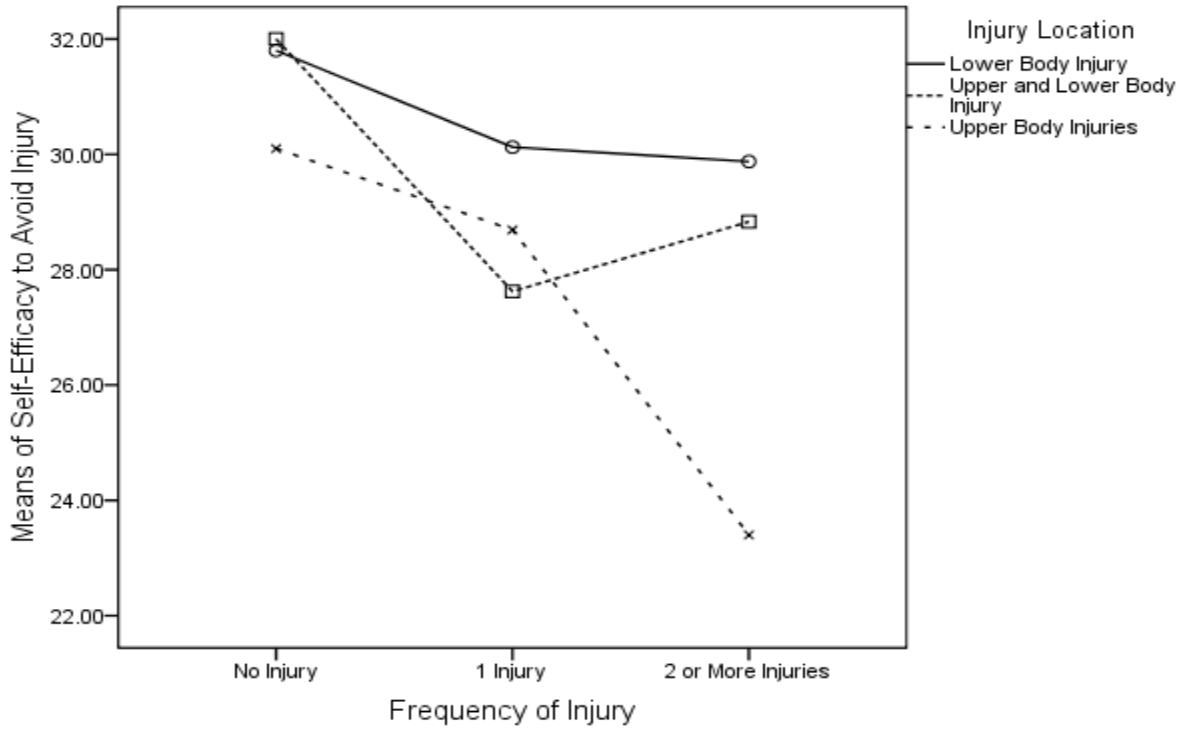


Two-Way ANOVA with Frequency of Injury, Location and Self-Efficacy

To look even further we assessed how the frequency and location of injuries may play a role in the influence of self-efficacy together. A two-way ANOVA was performed using frequency of injury and location as independent variables and self-efficacy as the dependent variable. The no injury group represented the participants that selected that they had no injuries throughout the season but also selected that they had a past injury in one of the locations prior to the season. Such that the no injury group had either a previous injury before the season or that the injury was deemed not severe enough to be called

an injury. The results shows a significant main effects with self-efficacy to avoid injury from the frequency of injuries F (2, 208) = 4.8, p = .009, η^2 = .04, and the location of injury F (2, 208) = 5.66, p = .004, η^2 = .05. The interaction between injury location and injury frequency was not significant F (4, 208) = 1.57, p = .184. The graph below (Figure 5) reveals that there is a constant trend with no injuries, lower body injuries and upper and lower body injuries combined. However, injuries that involved just the upper body (head, neck, shoulder, back) showed a large drop in self-efficacy at 2 or more injuries and represents a main difference. It appears that upper body injuries are affected more by the frequency of injuries and have the lowest means for self-efficacy to avoid injury. These results suggests that upper body injuries appear to cause the greatest drop in self-efficacy especially when there is a greater frequency of this type of injury.

Figure 5. Means of Self-Efficacy to Avoid Injury, Frequency and Location of Injury

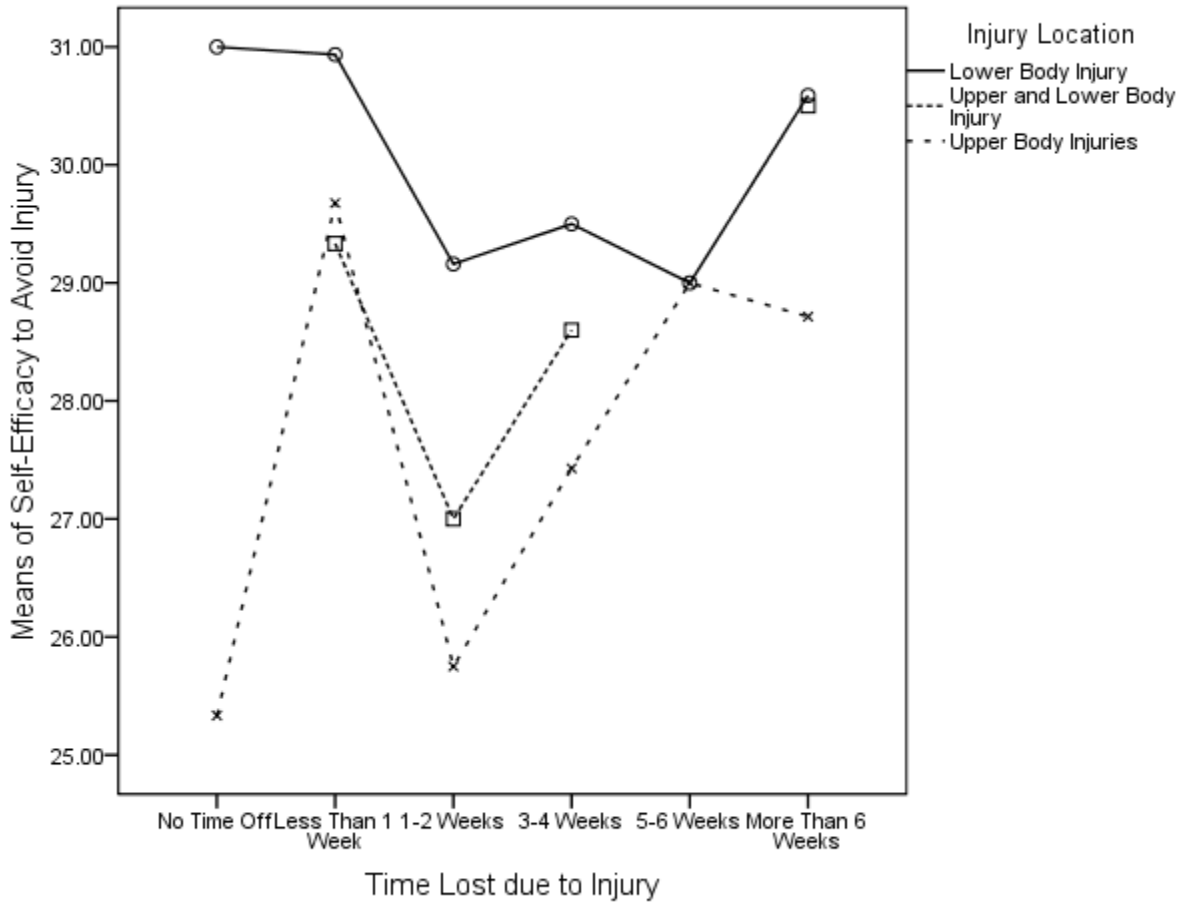


Two-Way ANOVA with Severity of Injury

A two-way ANOVA was performed with using severity of injury and location as independent variables. The two way ANOVA showed a non-significant result for both severity of injury F (5, 201) = 1.13, p = .348 and location of injury F (2, 201) = 2.49, p = .086. These results suggest that there is no difference in self-efficacy in terms of location with severity of injury being considered. Figure 6 shows a fairly constant trend with each injury location plotted out across the severity of time needed off from injury.

Figure 6.

Means of Self-Efficacy to Avoid Injury, Time Lost and Location of Injury



Selected Cases Correlational Analysis

Looking closer into each location of injuries we performed a number of correlational analyses for each specific area. Correlational analysis provides us with a direct association between the variables within each case. Doing this can reveal which injury location areas provides stronger relationships among variables and the directions. Such that one location may yield a non-significant result, while another may have a very strong relation and combining groups can

miss this specific relation. First we performed a total location correlational analysis (table 2). The table shows that severity (as measured by time off due to injury) and frequency of injury are both significantly and negatively related to self-efficacy to avoid injury. This means that the higher in severity and frequency of injuries the lower self-efficacy to avoid injury is. Self-efficacy to avoid injury shows a significant negative significant relationship to a fear of injury. This suggests that with an increase in self-efficacy to avoid injury there is a corresponding reduction in fear of injury.

Table 2.

All Locations Correlational Analysis

	Severity of Injury	Frequency of Injury	Self-Efficacy to Avoid Injury	Fear of Injury
Severity of Injury		.555** (317)	-.128* (309)	.062 (311)
Frequency of Injury			-.232** (309)	.132* (311)
Self-Efficacy to Avoid Injury				-.279** (303)

** 0.01, *0.05, Pearson

Next, we selected only the cases where athletes sustained a lower body injury (n=146) (table 3). Lower body injuries shows a non-significant relationship with severity and frequency of injuries to self-efficacy to avoid injury. Lower body injuries have a significant relation between self-efficacy to avoid injury and fear of injury.

Table 3.

Lower Body Correlational Analysis

	Severity of Injury	Frequency of Injury	Self-Efficacy to Avoid Injury	Fear of Injury
Severity of Injury		.403 (146)	-.084 (143)	.042 (143)
Frequency of Injury			-.116 (143)	.060 (143)
Self-Efficacy to Avoid Injury				-.270** (140)

** 0.01, *0.05, N=146 Pearson

Next, we selected only the cases where athletes sustained an upper and lower body injury (n=18) (table 4). The only important significant relations were between self-efficacy to avoid injury and fear of injury in the negative direction.

Table 4.

Upper and Lower Body Correlational Analysis

	Severity of Injury	Frequency of Injury	Self-Efficacy to Avoid Injury	Fear of Injury
Severity of Injury		.725** (18)	.044 (18)	-.138 (17)
Frequency of Injury			-.260 (18)	.262 (17)
Self-Efficacy to Avoid Injury				-.523* (17)

** 0.01, *0.05, number of participants in brackets, Pearson

Next, we selected only the cases where athletes sustained an upper body injury (n=56) (table 5). Upper body injuries showed only significant negative relation between frequencies of injuries to self-efficacy to avoid injury.

Table 5.

Upper Body Correlational Analysis

	Severity of Injury	Frequency of Injury	Self-Efficacy to Avoid Injury	Fear of Injury
Severity of Injury		.431** (58)	-.054 (56)	-.130 (56)
Frequency of Injury			-.340*	.071 (56)
Self-Efficacy to Avoid Injury				-.088 (54)

** 0.01, *0.05, number of participants in brackets, Pearson

Next, we selected only the cases where athletes sustained a head injury (n=10) (table 6). Self-efficacy to avoid injury is significantly and highly related to frequency of injuries in the negative direction. Frequency of injury is negatively and significantly related to self-efficacy to avoid injuries. What appears peculiar is that the fear of injury is negatively related to injuries. These suggests that when a player is injured more often and with greater severity that they have less of a fear of injury. It is important to note that the sample size was small and therefore we must have extreme caution with these findings and further research on this is required.

Table 6.

Head Only Correlational Analysis

	Severity of Injury	Frequency of Injury	Self-Efficacy to Avoid Injury	Fear of Injury
Severity of Injury		.626 (10)	-.298 (10)	-.650* (10)
Frequency of Injury			-.850** (10)	-.510 (10)
Self-Efficacy to Avoid Injury				.371 (10)

** 0.01, *0.05, number of participants in brackets , Pearson

Summary of Results for Correlational Analysis

The correlational analysis suggests that each location can yield slightly different strengths, and in some cases directions of the relationships between variables. First off, frequency of injury had the highest relation with self-efficacy to avoid injury in the head injury group (r= -.850), then the upper body injuries (r= -.340), then upper and lower injury group (r= -.260ns), then all locations (r= -.232) and then lower body injuries (r= -.116ns). Severity of injury had the highest relation with self-efficacy to avoid injury in the head injury group (r= -.298ns), then all locations (r= -.126), then lower body injuries (r= -.084ns), then upper body only (r= -.054ns). Self-efficacy to avoid injury's relation with fear of injury was strongest with the upper and lower body injury group (r= -.523) head injury group (r= .371ns), then all locations (r= -.279), then lower body (r= -.270), and then upper body (r= -.088ns).

Unexpected results of the head injury group shows a positive directional relation with self-efficacy and fear of injury which is different form the other

locations. Frequency of injury showed significant relations to fear of injury in the all locations group (r= .157), but a high non-significant relation with the head injury group (r= -.510). Only one significant result came from the severity of injury to fear of injury relation which was within the head injury group (r= -.650). Given these results it appears that head and upper body injuries yields the highest relations of the frequency of injuries. This suggests that upper body and head injuries may represent the most influential of injury locations to affect self-efficacy.

Hypothesis 4: ***Self-efficacy to avoid injury will significantly impact fear of injury even when controlling for frequency and severity of injuries.***

To assess this hypothesis a regression analysis was performed. First with frequency of injury and severity of injury entered in to their associated level that represents the number of injuries and the time off from the injuries, and then entering in self-efficacy to see if there is an effect above and beyond the controlling of the severity and frequency of injury.

Regression Analysis of Self-Efficacy to Fear of Injury

Looking at the regression for how self-efficacy to avoid injury relates to fear of injury we entered the relation of severity and frequency of injury to predict fear of injury into the first model and then self-efficacy to avoid injury in the second model. The model of frequency and severity of injuries to fear of injury was significant with an $F(2,314)= 4.00$, $p=0.02$, $r^2= .025$. Entering self-efficacy to avoid injury into the model accounted for 5% of the variance. A

summary of the results is provided in table 7. Therefore, with controlling for the effects of frequency and severity of injuries, self-efficacy has the strongest impact on fear of injury.

Table 7.

Hierarchical Regression Analysis for Variables Predicting Fear of Injury

	Model 1			Model 2		
Variable	*B*	*SE B*	*β*	*B*	*SE B*	*β*
Frequency of Injury	1.1	.471	.15*	.899	.472	.122
Severity of Injury	.031	.149	.013	.018	.148	.008
Self-efficacy to Avoid				-.134	.049	-.155**
R^2		.025			.048	
F for change in R^2		4.00			7.56	

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

These results suggest that frequency and severity of injuries can play a role in the athlete`s response to a fear of re-injury. However, it is seen that a fear of re-injury is better accounted for as a lack of confidence to avoid future injuries. This result is consistent with the previous correlational analysis. The relationship between self-efficacy to avoid injury and fear of injury is further explored in chapter 5.

Hypothesis 5: ***Frequency, severity, and self-efficacy to avoid injuries can predict future levels of these same variables within the next season.***

To assess this we gathered the same participants from the data that completed the survey within a one year gap. These participants were screened out of the previous analysis and were included in this repeated measures data. As well, some follow-up data included reports on injury frequency and time off

due to injury was provided. First we performed a correlational analysis to assess which variables correlate with each other from time one to time two. Then we run select regression analyses to see if time one variables could predict time two variables. The analysis is looking at two different ways of seeing how self-efficacy and injury affect each other. First is the theory that self-efficacy can affect the future behaviors and cognitions that an athlete has. In this study self-efficacy to avoid injury may affect the athlete's self-efficacy to avoid next season injuries in terms of frequency and severity. Then we look at the converse side of the theory that injury frequency and severity can also affect the next seasons level of self-efficacy to avoid injury, thus showing the reciprocal nature that self-efficacy not only contributes to future self-efficacy and injury be is caused by past self-efficacy and injuries. This theory of reciprocity reflects how self-efficacy is seen as not simply being a cause and effect relationship but instead is a part of a larger dynamic of influences. Lastly, working with the theory that self-efficacy can come from a cumulating of past experiences we combine time one and time two variables of frequency and severity to represent two variables: first variable being two seasons worth of frequency of injuries, and the second being two seasons worth of severity of injuries. These two cumulative variables as well as past self-efficacy are entered into a multiple regression to see if this combined linear relation can represent the best predictor of future self-efficacy to avoid injury.

Correlations Over Time

Table 8 shows that there is no a significant relation between time 1 to time 2 between frequency and severity inclusively. This suggests that the frequency and severity of injuries in the first season did not relate to the pattern of frequency and severity of injuries in the second season. There were significant correlations between frequencies of injuries at time 1 to self-efficacy to avoid injuries at time 2 in the negative direction. This suggests that the more injuries in the previous season the less self-efficacy to avoid injury the athlete has at the end of the second season. Frequency of injury in time 1 had a significant positive correlation with fear of injury at time 2. This suggests that the greater the frequency of injuries in the first season related to more fear of injury in the second season. Severity of injuries at time one had a significant positive relation with time two fear of injury and a significant negative relation to time 2 fear of injury. Fear of injury at time one was significantly related to fear at time two. These results suggest that there is a relation from a players injury frequency and severity from season one to self-efficacy to avoid injury and fear of injury rates.

Table 8.

Correlations Over Time Matrix

	Time 2 Frequency of Injury	Time 2 Severity of Injury	Time 2 Self-Efficacy to Avoid Injury	Time 2 Fear of Injury
Time 1 Frequency of Injury	.197 (76)	.206 (76)	-.513* (23)	.434* (23)
Time 1 Severity of Injury	.139 (76)	.140 (76)	-.371 (23)	.427* (23)
Time 1 Self-Efficacy to Avoid Injury	-.073 (76)	-.239* (76)	.454* (23)	-.481* (23)
Time 1 Fear of Injury	.002 (76)	.061 (76)	.007 (23)	.424* (23)

** 0.01, *0.05, number of participants in brackets, Pearson

Regression of Time Series

Previous Self-efficacy Predicting Future Self-efficacy

A regression analysis was used to predict which variables best predicted the next season's self-efficacy to avoid injury. Self-efficacy to avoid injury explained a significant proportion of the variance in time 2 self-efficacy to avoid injury, $R^2 = .206$, $F(1,21) = 5.46$, $p = .029$. This analysis shows that the self-efficacy at one season can predict a significant proportion of the self-efficacy to avoid injury at a second season.

Previous Frequency Predicting Future Self-Efficacy

Time one frequency of injuries was used to predict the time two self-efficacy to avoid injury. The analysis produced an $r = .513$ with an $r^2 = .263$ meaning that the previous frequency of injuries accounted for 26.3% of the

variance of the time two self-efficacy to avoid injury. This regression model created an $F(1,21)= 7.48$, $p= .012$. This analysis shows that the previous frequency of injuries accounts for a significant portion of the future self-efficacy.

Previous Severity of Injury Predicting Future Self-Efficacy

Time one severity of injury was used to predict the time two self-efficacy to avoid injury. The results show an $R^2=.138$, $F(1, 21)= 3.353$, $p=.081$. This analysis shows that the previous severity of injury does not account for a significant portion of the future self-efficacy to avoid injury.

Previous Self-Efficacy Predicting the Future Severity of Injuries

Time one self-efficacy to avoid injury was used to predict the time two severity of injury. This regression model created an $R^2= .057$, $F(1, 74)= 4.469$, $p=0.038$. This analysis shows that the previous self-efficacy to avoid injury accounts for a significant portion of the future severity of injuries.

Previous Self-efficacy Predicting for Future Frequency of Injury

Time one self-efficacy to avoid injury was used to predict the time two frequency of injuries. This regression model created a $R^2=.005$, $F(1, 74)=.393$ $p=0.533$. This analysis shows that the previous self-efficacy to avoid injury does not account for a significant portion of the future frequency of self-efficacy.

Hypothesis 6: ***Self-Efficacy to avoid injury is best predicted by an accumulation of experiences as measured from two seasons worth of injuries frequencies, and severity as well as previous levels of self-efficacy to avoid injuries.***

When considering the theory of self-efficacy, it is stated that accumulation of past performance is what creates and builds self-efficacy. Therefore looking at the data we would assume a small effect size for one single season. However, if we combine the 2 seasons into total scores for frequency of injuries and severity of injuries we would theoretically have a better predictor of future self-efficacy. The first analysis of this is of the correlations of the sum of the two season's frequency and severity scores as related to the end of the second season self-efficacy. The results (see table 9) reveal a much higher correlation then the previous single season, therefore supporting the theory that self-efficacy is best understood as an accumulation of experiences.

Table 9.
Cumulative Scores of Frequency and Severity Correlational Analysis

	Self-efficacy Time Two	Fear of Injury Time Two	Cumulative Frequency Injuries	Cumulative Severity of Injuries
Self-efficacy to Avoid Injury Time Two		-.380 (25)	-.577** (24)	-.408* (24)
Fear of Injury Time Two			.443* (24)	.506* (24)
Cumulative Frequency of Injuries				.715** (76)

** 0.01, *0.05, N in brackets Pearson

Multiple Regression to Predict Self-Efficacy

To see if the past sum frequency, severity and self-efficacy can predict self-efficacy to avoid injury we ran a multiple regression. We used the cumulative frequency, the cumulative severity and time one self-efficacy to predict the time two self-efficacy to avoid injury. The analysis showed a significant proportion of the variance was accounted by these variables to predict self-efficacy to avoid injury at season 2: R^2= .427, $F(3,19)$= 4.73, p= 0.013. These results (Table 10) show that the variance accounted for future self-efficacy can be increased when factoring more experiences of injuries and past beliefs of avoidance. The implications of these results are discussed further in chapter 5.

Table 10.

Multiple Regression of Cumulative Scores Predicting Future Self-Efficacy

Variable	*B*	*SE B*	*β*
Constant	24.94	5.53	
Cumulative Frequency of Injury	-2.28	1.39	-.362
Cumulative Severity of Injuries	-.300	.575	-.115
Previous Self-efficacy to Avoid Injury	.256	.154	.325
R^2			.427
F			4.73*

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

Chapter V – Discussion

Our study is based on Bandura's (1986) theory of self-efficacy which has been shown to influence how people think, feel and act in their world through the personal judgements and perceptions they make about their abilities. Self-efficacy manifests in a feeling of confidence to exert some sense of control on the external world and accomplish goals set out in life. The present study investigated a specific area of self-efficacy which involves the perceptions of future injury avoidance and how this relates to different types of injuries sustained during a season. We looked at self-reports from athletes for the number of injuries they sustained, how long they had to take off due to these injuries, and where the injuries were located. Based on Bandura's Social Cognitive Theory, injuries may represent environmental events that can affect an athlete's motivational engagement. Based on this Social Cognitive Theory, we proposed six hypotheses on the relation between injuries and the athletes' self-efficacy to avoid future injuries as well as a fear of injury. This chapter will review each of the hypotheses we set forth and will examine how these results relate to the literature and research in the area. We then examine how these results can help with intervention practices and inform practitioners in the field. This is followed by a description of the limitations, areas of future research and concludes with some final reflections of this preliminary exploratory study.

Discussion of Results

The first hypothesis was that frequency of injuries in one season can affect the athlete's perceptions of self-efficacy to avoid future injuries at the end of the season. This hypothesis is based on Bandura's theory that individuals create appraisals of their abilities as grounded in their past experiences with successes and failures. Athletes may be influenced by the number of injuries they sustain and change in self-efficacy. Similarly, self-efficacy is seen as being maintained by mastery of their experiences. From our results, we found that the players who sustained more injuries throughout a season had significantly less self-efficacy to avoid future injuries. These results support Bandura's theory and may suggest that players suffer not only from injury, but also from a motivational loss such as the loss of self-efficacy. A closer look at the data suggests that a player suffers from significantly less self-efficacy when having at least 1 injury, a correlational trend of that appears to result in further reduced self-efficacy with repeated injuries. Therefore, with even one injury within one season, an athlete has reduced self-efficacy. It is important to note that there was no pre or post testing for this effect, so it remains unclear whether the athletes who had an injury dropped in self-efficacy or whether they already had low self-efficacy and this may have been in relation to a greater probability of injury. Given that the athletes retrospectively reported past injuries and reported current self-efficacy, it is a stronger case that self-efficacy was at least partially lowered by the injury within that season. This pre- and post- testing limitation

to the study is further explored later in the discussion as well as discussed as a potential future area of research.

Our second hypothesis was that the severity of injury, as measured by the time taken off for injury, would be related to self-efficacy. This is based on the theory that it is not only the frequency of events that can effect ones perceptions of their abilities, but also the magnitude and intensity of an experience (Bandura, 1997). Our results showed a significant difference between the amount of time the players had to recover from the injury to the level of self-efficacy reported. Specifically, there was significantly less self-efficacy from players who endured less than one week off from an injury, compared against players who took one or more weeks off. However, it was seen that at 6 or more weeks, these injuries did not result in a significantly decrease in self-efficacy. This result may suggest that with injuries that were of that severity (6 weeks off needed), these players may have had time to recover fully and feel confident in their abilities to avoid future injuries. It may also suggest that players who have low self-efficacy to avoid injuries may need more time off to recover from severe injuries and may recover when given a longer time to recover. Past research shows that at around one or more weeks off due to injury the injury is considered as in the severe range (Junge, & Dvorak, 2000). This relation may suggest that some injured athletes may have not received enough time off for their self-efficacy to avoid injury to recover, whereas those who received more time had time to recover psychologically as well as physically. This relation may also be the result of the difficulty in

measuring severity of injuries and the great diversity of injuries an athlete can have. Therefore, the relationship of injury severity as measured by time off does not consider a great number of other personal and environmental factors that may contribute to the outcome. These may include when in the season the injury occurred, whether the player needs to go back into the game sooner versus later, whether the athlete has different resources to recovery than others. This may also be an artifact of this sample set and therefore more research is needed to determine this relationship as it is more complicated than previously hypothesised.

Our third hypothesis was that the experience of injury could be dependent on the location of the injury. This comes the understanding that some injuries, such as lower body injuries, are more common and that the player would have more experience with recovering from them, whereas other injuries that are less common may be more influential in one's perceptions of recovery. Our results support this hypothesis with upper body injuries having more of an impact to lower self-efficacy to avoid future injuries, whereas other types of injuries show less of an effect. Upper body injuries are comprised of a number of different injuries that occur above the shoulders including non-concussion head injuries and may represent the most influential of injuries to affect athletes. The relation of head injuries to self-efficacy, as seen in the correlational analysis, showed some surprising results. Though the sample of reported concussion-related head injuries was small (n=10), these athletes showed the largest correlation to the relation of frequency and severity

negatively relating to self-efficacy. There was also a moderate-to-high negative correlation between severity of injury and fear of injury. This suggests that the more severe a concussion-like injury is, the less fear of re-injury the athlete has. However, since the measure is the time off from an injury, this relationship may suggest that those who take an adequate amount of time off for a head injury recover more self-efficacy. Head injuries may represent an injury that affects the athlete in a complex way such that other injuries do not. Shaw and Colleagues (1992) found that failure did not lower the self-efficacy of the athlete if it was appraised as a failure that was unstable and situational. This may suggest that lower body injuries are seen as more unstable and common to happen and a type of injury that the athlete has experience with in terms of recovering, whereas upper body injuries are seen as more global, permanent and an area that is less common. Future research in further discovering this relation is discussed later on.

Our fourth hypothesis is that fear of re-injury is largely determined by self-efficacy to avoid injury rather than by the effects of the injury. This comes from the theory that fear of re-injury is the response determined by our perceptions of confidence, or lack of confidence, to avoid future injury (Feltz, et al., 2008).Simply speaking, the more confident we are that we can avoid injury, the less fear we will have. Our results show that when we control for frequency and severity of injury, self-efficacy has the most significant effect on the athlete's level of fear of re-injury. These results are similar to findings from other studies that show that there is an association between self-efficacy and

fear and worries in sports (Short, et al., 2004). Our results fit well with the theory that a fear of injury is actually due to a lack of self-efficacy (Magyar & Chase, 1996). Although injuries can increase fears and worries for athletes, it seems as if the meditating step is a lack of confidence to avoid injuries. It is seen from previous research that fear can have a debilitating effect on an athlete's performance and can increase the risk of injury (Short, et al., 2004). Taken together, fear of injury is an important issue but is linked to self-efficacy.

Our fifth hypothesis was that frequency of injury, severity of injury, and self-efficacy can predict future levels of these same variables within the next season. That is that self-efficacy is both affected by past experiences and can also influence future cognitions and behaviors. The results suggest that there is a link between some variables in one season to the next. Specifically, it is seen that the number of injuries and self-efficacy to avoid injury from the first season can predict the next season's level of self-efficacy to avoid injuries. This supports to notion that self-efficacy is fluid across seasons and can be lowered due to the frequency of new injuries. In this sense, it is a possibility that athletes have a level of self-efficacy that is highly consistent throughout their career but that over time the number of injuries an athlete will lower their self-efficacy. Self-efficacy to avoid injury could predict next season's severity of injury. Conversely, severity of injury could not predict next seasons' self-efficacy to avoid injury. This may suggest that athletes with more self-efficacy will be able to recover faster or that they are able to avoid more severe injuries. For example, an athlete cannot avoid being hit during a play and becoming injured,

but self-efficacy can help them to take control of their recovery and return to the game quicker. Frequency, severity and self-efficacy to avoid injuries all showed significant correlations with season two fear of injury, suggesting that fear of injury is maintained from one season to the next.

The sixth hypothesis predicted that having an athlete's past history of injuries can allow us to determine the future levels of self-efficacy. Our results support this hypothesis, showing that two seasons worth of injuries paired with previous ratings of self-efficacy gives us a higher level of predictability of future self-efficacy. In this analysis, two seasons worth of injury frequencies and severity were collected to create two variables; cumulative frequency of injuries, and cumulative severity of injuries. Then we compared these two variables to the second season self-efficacy, which showed higher correlations then the previous single season data. An analysis by regression showed that 42 % of the variance was accounted for by the variables of cumulative frequency, cumulative severity and season one self-efficacy. These results suggest that future studies could look into strengthening this regression equation and that there is a high level of predictability in determining a player's future self-efficacy. In understanding a player's self-efficacy to avoid injuries, practitioners, coaches, and researchers can better screen for players that may meet criteria for being at-risk for low self-efficacy. This implication for future research is discussed later on in this chapter.

Implications of Research Findings

Implications for the Theory

It is important to note that the essence of self-efficacy lies within the beliefs an athlete has about their capacity to implement control over their surroundings (Bandura, 1997). Self-efficacy refers to the judgements of what one can do given their resources and skills. Whether the analysis is looking for how injuries can lower self-efficacy or how self-efficacy can decrease recovery times and probabilities of future injuries, the underlying theory looks at how athletes who exhibit low self-efficacy are at risk of having lower beliefs in their abilities to accomplish their goals. Simply speaking, athletes need to maintain their self-efficacy across a number of domains (one of which is injury avoidance) to continue to be successful in their career. Injury can affect self-efficacy through loss of an athlete's sense of mastery experience. Mastery experience comes from an athlete's history of being successful and thus helps the athlete to feel a sense of competence. Over time, if an athlete experiences more success, they will start to gain self-efficacy and be more confident in their abilities and engage more in proactive ways to continue to achieve this success. Conversely, if an athlete starts to experience failures, over time, these failures can reduce self-efficacy and the athlete can start to feel helpless and lacking control. It is through this lack of perceived control that the athlete may start to engage in less proactive behaviors and therefore increase their chances of future failures. This study was one of the first to show that injury can be seen as a form of failure that can lead to less self-efficacy for the athlete. Based on these

results, those with lower self-efficacy will tend have an increase in future injuries based on the athletes perceptions and motivations. This study was limited in finding this direct link, but this can be pursued for future research.

Implications for Practice

Injuries are defined by a physical force that causes damage to one's body. The focus on athletes recovering physically is of priority with physical rehabilitation practices. However, based on these results and other similar studies (Feltz, et al., 2008) athletes struggle with the emotional and motivation aspects due to the injury and may need sufficient time for this to recover. Simply speaking athletes who recover physically may not have recovered psychologically from their injuries and are at a higher probability for future injuries. Future intervention practices would look at the psychological markers that would determine whether an athlete is deemed able to return to play psychologically. In this sense, interventions to consider could include psychological practices such as cognitive behavioral therapy alongside physical interventions. Another area of practical implications from this research is to understand more fully the types of injuries that most influence self-efficacy. This study suggests that athletes who have more of a history of injuries and have injuries in the upper body area are prone to less self-efficacy, and this perceptual change can affect their behaviors and performance. Practical knowledge of the "at-risk" types of injuries for the lowest drop in self-efficacy can help to target possible psychological interventions.

Our study mainly looked at how self-efficacy can be a key factor in athlete's motivational well-being. We focused on how injuries can affect self-efficacy and lower it with the implications that self-efficacy is a key component in an athlete's ability to recover and avoid future injuries. Past research has made the argument that those who recover the fastest in rehabilitation are the athletes that feel they are in control of recovering (Bandura, 1997). Approaches to interventions for athletes with physical injuries may benefit from understanding that athletes go through a motivational loss along with the physical and intervention can include more practices that aim to increase self-efficacy (Feltz, et al., 2008). Bandura suggests that athletes can maintain or acquire self-efficacy through the four means: mastery experience, vicarious experience, verbal persuasion and physiological and affective states (Bandura, 1997). In intervention practices, mastery experiences could come in the form of talking about their injuries and reframing their experiences of the injury. Such that the injury is not internalized as a random event that they had no control over, but instead is a lesson on how they can possibly avoid future injuries of a similar nature. This may be why the relation for lower body injuries was the lowest to reducing self-efficacy, because athletes have had more experience recovering from these sorts of injuries in the past and have access to others who have recovered providing feedback. Observational learning can come in the form of athletes observing others who have recovered and in visualizing the steps to recovery. Other practices could include verbal persuasion as helping athletes to feel more confident about their capabilities to recover (Bandura,

1997). This type of reinforcement of self-efficacy can be used by coaches to enhance self-efficacy for avoiding injuries (Fetlz, et al., 2008). The last component would be for the athlete to focus on the physiological and affective states they go through when they are faced with injury. Therefore interventions to help athletes deal with low self-efficacy due to their experiences with injuries can come in many forms that have been shown to be effective in other areas such as sports performance, school performance and phobia treatments (Bandura, 1997).

Limitations of the Study

There were a number of limitations from this study which leads into the future areas for research. The first limitation was that the effect size was fairly small across most of the analysis. The effect size represents what is the true strength of our data beyond the statistical significance. The effect size was small due to a number of reasons that in fact strengthens the understandings of the results for future research. First is the measure of self-efficacy captures a fairly specific area of injury. Past research in the area of self-efficacy and performance has yielded a moderate and positive relationship from a variety of sports tasks and different research designs (Moritz et al., 2000). It is suggested in the research that self-efficacy should not be considered to explain all the variance of sports performance since the dynamic of sports performance is very complex in nature (i.e. personality factors, different sports teams, different perceptions etc) (Feltz, et al., 2008). Self-efficacy should not be seen to describe all the variance especially when researchers consider that self-efficacy

is very narrowly assessed with the measures and scales that they can provide (Self-efficacy in sports, 2008). Feltz (1992) suggests that where self-efficacy is found to not relate to performance may in fact be due more to the inefficient measurement of self-efficacy. As well Bandura (1997) says "performance is rarely, if ever, measured with complete accuracy" and states that correlational analysis should consider that performance is rarely ever fully explained (p. 64).

This data set also has its limitations in the fact that we did not ask players their complete history on injuries in sports. Having taken a more in depth assessment of the players past performances in injury avoidance would theoretically yield stronger predictions (Feltz, et al., 2008). Yet, with this data we see the recent temporal effect that injuries in the past 12 months can have on self-efficacy. Due to the nature of correlational analysis we cannot link causation of injury to self-efficacy. Since injury was asked in a retrospective manner "In the past season how many injuries did you sustain?" and self-efficacy was measured at the point when the survey was administrated, the data is leaning towards two possible conclusions. 1. Self-efficacy decreases due to injuries sustained during the season, or 2. Self-efficacy was already low and injuries relate significantly to those who are injured more, or possibly a third conclusion that is a mixture of both 1 and 2.

Within our sample the majority of response for injury frequency fit within the 0 to 1 range with most of the injuries being single injuries. As well the severity (time off due to injury) mostly ranged from 0 weeks to 2.5 weeks off. Taking this injury data into consideration the linear relations from the

correlations and regressions come from small ranges thus possibly creating smaller relations. When considering the data, those with even single injuries that may be minor have shown significant results to effect self-efficacy and fear of injury. This result although low but significant shows us that even small effects across small temporal periods can cause a significant change in self-efficacy. Whereas future research would be aimed at collecting more data on past injury reports to find the cumulative effects of past performance and would theoretically be stronger predictors.

Within our sample we showed a small but significant relation between self-efficacy to injury and fear of injury. It is likely that this correlation and relation would be stronger if the sample had more information concerning how athletes attribute the injuries they sustain during a season. For example, in a study by Gernigon and Delloye (2003) they found that attributions of success or failure meditated the relationship between success and failure feedback to self-efficacy midst elite sprinters. This result has been found in other studies (Bond, Biddle, & Ntoumanis, 2001; Shaw, Dzewaltowski, & McElroy, 1992) and suggests that future research should consider not only the relationship between self-efficacy and performance variables but look at the conditional relations with attributes and perceptions of success and failure within the sample. Since our sample did not include this then we could not control for attributes and therefore it is theorized that the relationships between self-efficacy and other variables would be lower.

Our study did not vary the difficulty for the athletes in terms of the performance. An example of this would be to ask the athletes whether they have more confidence in avoiding one versus many injuries and which injuries they felt more confident avoiding. In the literature self-efficacy is most affected by failures that are not considered situational but due to the athletes perceived lack of ability (Bandura, 1997). In this case athletes who sustain and perceive injuries that convinces them that it is actually a part of their perceived lack of ability or that they are "injury prone" athletes then they would suffer the most from low self-efficacy (Feltz, et al., 2008). Whereas those athletes with high self-efficacy may attribute injuries as due to a lack of effort or a situational factor and thus would not suffer from a lowered self-efficacy and a fear of injury.

Some of the locations and injury groups produced low sample sizes. However, even though we had only 10 athletes that reported head injuries, we found that those with head injuries had the highest correlations with self-efficacy. Any conclusion with such a small sample should be taken lightly, but the results suggest that possibly those with head injuries suffer from a loss of perceived control to avoid future injuries and thus have lowered self-efficacy.

This study does account for the diversity of issues that are related to whether an athlete has strong social supports. Wiese-Bjornstal, et al., (1998) model of the psychological effects of injury places a large importance on the social resources (friends, family, teammates, coaches etc.) and how they interpret their ability to recovery from injury. In the case of athletes making a

professional team, often they must move to a new city or country and lose much of their social and family supports. In this case athletes who have less social supports may suffer more from injuries and this study has the limitation that it does not account for these important factors.

Suggestions for Future Research

Longitudinal research is needed for looking at how self-efficacy to avoid injury changes across injuries and interventions. This may include single or large sample participant baseline studies that could track an individual over a large period of time and measure how self-efficacy changes due to injury and interventions. This study would help researchers to understand when self-efficacy is at its lowest, whether self-efficacy replenishes itself after interventions, and trends across time in how past injuries effects current self-efficacy.

Our study looked at elite athletes who had high levels of self-efficacy to avoid injuries. This high level may be due to the fact that one of the key strengths these athletes have is cope and recover from injuries and be able to continue to perform. This study could be replicated with less competitive teams in universities or high schools to examine a greater range of self-efficacy beliefs. It could be that the athletes from out sample got to the level of being a professional athlete as based on their self-efficacy beliefs across a number of domains within their sport, while others did not make it. Therefore our sample considered that there is even a significant drop in self-efficacy at the highest of elite levels in sports athletes who are considered to already be highly self-

efficacious. It is hypothesized that athletes who are not able to reframe their past failures because of limited experience could suffer more changes to self-efficacy from injuries.

One avenue of exploration would be to look at athletes who are prone to injuries and assess whether these individuals suffer from the emotional and motivational problems related. Specifically we could look at the athletes that are injured more often than other athletes and assess whether they suffer from the greatest drop in self-efficacy to avoid injuries and how this may affect their motivations. With repeated injuries this can be seen to them as failures of their experiences to overcome injuries and could lower their self-efficacy. These players may represent those who have the lowest of self-efficacy to avoid injuries and this may result in passivity towards their perceived control of future injuries. This perceived lack of control of injuries may manifest itself in reductions in behaviors that can reduce injuries such as stretching, playing more cautious, allowing for sufficient recovery times etc. To our knowledge, there is no research in this area and self-efficacy to avoid injury may be an area of high importance in interventions for players that are injured often.

Future research and practice may be able to develop a strong equation for predicting the future self-efficacy to avoid injuries amongst players. In this study the variables that were included were two seasons worth of injury data as well as the previous self-efficacy and this could predict around 50% of the variance for future self-efficacy. Future research could go into exploring a

stronger equation of predictability for the emotional affects and future possibility to avoid injuries.

Future research should look to build a better construct of self-efficacy to avoid injury. The current measure is a new measure to explore a relatively new area of research. Future studies should look to create a more multiple dimensional view of self-efficacy and how it manifests in different areas of injury. A multi-dimensional measure of self-efficacy to avoid injury could include confidence to avoid injuries as based on location, frequency and intensity. For example it would measure the athlete's self-efficacy to avoid minor versus severe injuries or injuries in the lower body versus those in the upper body. It appears from these results that different types of injuries have different relations to the athletes and some areas are more damaging to ones self-efficacy and fear of injury than others. This future construct could be used as a good way to screen athletes based on the types of injuries that they struggle with the most and signal areas of future help. For example, this study shows that head injuries had the strongest relation to a drop in self-efficacy and screened out the athletes with these concerns and helping them may provide a preventative measure. There is emerging research that shows that head injuries can significantly affect an athlete's psychological health (depression, anxiety, suicide) and the passivity and learned helplessness that is reflected by those who have less self-efficacy may pose as a marker for preventative mental health interventions. For example, in this study we had only 10 participants that mentioned head injuries but this injury showed the highest correlations with

self-efficacy being very low in those with more severe head injuries. Whereas athletes with lower body injuries showed low correlations meaning that athletes expect to sustain some injuries but feel they can deal with them. Head injuries appeared to have the greatest relation to a lower self-efficacy to avoid injury, alongside with upper body injuries. In this case the athletes may have suffered from an upper body injury but instead claimed it was an upper body injury. Given that the location of upper body and head injuries represents the most influential to self-efficacy further research could look at the effects self-efficacy has on other symptoms associated with head injuries (depression, anxiety).

Conclusion

This research was an exploratory and preliminary study to an area untouched within the sports psychology world. Our study found significant results that injury frequency and severity relates to self-efficacy to avoid injury and fear of injury. This study opens the doors to future research that can further look into the relationship between sports injury and self-efficacy in the area of avoidance and recovery form injury.

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Appendix A: Survey

Injury Avoidance Survey

This questionnaire is designed to improve understanding about some of the things that are related to injury avoidance.

1. What are your Initials?	
2. What team do you play for?	
3. What position do you play?	

1	2	3	4	5	6	7
Not very true			Somewhat true			Very true

1. Please place an "X" in the box that best describes you	1	2	3	4	5	6	7
1. I am confident I can avoid injuries this season							
2. I am nervous about being injured							
3. I am confident that my physical fitness can help me avoid injuries							
4. I am confident that I have the skills to avoid injuries							
5. The thought of injury concerns me							
6. If I am injured, I am confident I can recover quickly							
7. I have the power to avoid getting injured							
8. I worry about being injured							
9. I have control over whether I get injured or not							
10. I am confident I can play through minor injuries this season							

2. How much total time did you lose to injury last season?
(Check one)

Less than 1 week	
1 – 2 weeks	
3 – 4 weeks	
5 – 6 weeks	
More than 6 weeks	

3. How many injuries (missed at least 3 days) did you have last season?
(Check one)

1	
2	

3	
4	
5 or more	

4. What was the location of your injuries in the last 12 months?
(Check as many as necessary)

Lower extremity (hip, knee, ankle, foot)	
Upper extremity (shoulder, elbow, hand, wrist)	
Head/face (not concussion)	
Head (concussion)	
Neck	
Back	

Appendix B: Free and Informed Consent

Dear Player,

We are requesting your consent to participate in a research project entitled "Football injury avoidance study." As a player in the CFL, you are being asked to volunteer for this project.

If you choose to take part in the study, you will complete three brief surveys (~5 minutes each) over the season that will ask you about a variety of motivation beliefs (like confidence) and injury avoidance. The survey results will be collated and analyzed; only the research team (primary investigators and research assistants) will have access to the raw data collected in the project. Your name or your individual results will not be released to trainers/coaching staff and will not appear in any reports of this research, and you will not be identified in any way.
Your participation in this project is completely voluntary. You have the right to withdraw from participation at any time, without penalty. Participants will be guaranteed confidentiality, and only the research team will have access to raw survey results. The data collected will be kept in a secured storage space for a minimum of 5 years after the study is completed. Other research personnel (e.g., graduate research assistants) will sign a confidentiality agreement before working on this project. Although there may be no direct benefit for you, the results from this study will help researchers and trainers to better understand how motivation beliefs influence injury avoidance. The results from this study may be presented at academic conferences, published in research journals, and presented at CFLPA events. For further information about this project, you may contact us or call Dr. Robin Everall, Chair, Department of Educational Psychology at the University of Alberta at 780-492-2389. The plan for this study has been reviewed for its adherence to ethical guidelines and approved by the Faculties of Education and Extension Research Ethics Board (EE REB) at the University of Alberta. For questions regarding participant rights and ethical conduct of research, contact the Chair of the EE REB at 780-492-3751.
As a player on this team I agree to participate in the "*Football injury avoidance study.*"

I understand that the researchers will:

- **Ask me to complete a brief questionnaire**
- **Access my playing status from publicly available websites**

I understand that:

- **I may withdraw from the assessment at any time without penalty and that my participation is voluntary**
- **My completion of this survey will indicate my consent**
- **All information gathered will be treated confidentially and used for the sole purpose of this study**
- **All survey information will be destroyed 5 years after completion of the study**

Your completion of the survey will be considered to reflect your consent. Feel free to detach this top sheet for your own information.

Sincerely,

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