

**Psychology of sport injury:
Prediction, prevention and rehabilitation
in Swedish team sport athletes**



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**PSYCHOLOGY OF SPORT INJURY:
PREDICTION, PREVENTION
AND REHABILITATION
IN SWEDISH TEAM SPORT ATHLETES**

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LINNAEUS UNIVERSITY PRESS

**Psychology of sport injury: Prediction, prevention and rehabilitation in
Swedish team sport athletes**

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Abstract

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The dissertation consists of five separate studies that all have focused on different aspects of the relationship between psychological factors and sport injuries.

In the first study the aim was to investigate female elite soccer players' experiences of the time prior to the occurrence of an ACL injury. In the result three themes of player experiences was identified: fatigue, life stress, and worry. The players interpreted these three themes as risk factors for ACL-injury.

The second study aimed to investigate whether personality, stress, and coping predicted injury occurrence in an elite soccer population. The result showed that an interaction between psychological variables (i.e. trait anxiety, negative life event stress and daily hassles, ineffective coping) could explain 24 % of the variance in injury occurrence. Moreover, the result showed that negative life event stress was found to have an indirect effect on injury occurrence through daily hassles.

In the third study the aim was to investigate whether individual level and changes in hassle and uplift levels over a 10-week period could predict injury outcome in an elite junior soccer population. The results showed that both initial level as well as change in hassle influenced injury risk. More specific, both high initial level as well as slow decrease in hassle was associated with an increased risk of injury.

The fourth study aimed to investigate the extent to which a mindfulness and acceptance based intervention program could reduce the number of sports injuries in a sample of soccer players. The result showed no statistically significant differences in injury rates between the two groups, but there was a medium effect size (adjusted Cohen's $d = -0.59$).

In the fifth study the aim was to investigate an athletic injury as a career transition through the narrative expression of successful and less successful injury experiences of a former elite handball player. The participant's narratives made possible to identify four phases (i.e., pre-injury, injury and first reactions, diagnosis and treatment, rehabilitation and consequences) in the injury transition with distinct psychological content (e.g., demands, resources, barriers, and coping strategies) relevant to each phase.

Key words: Athletic injury, prediction, prevention, psychology, rehabilitation



SAMMANFATTNING

Avhandlingen består av fem separata studier som alla behandlar olika aspekter av relationen mellan psykologiska faktorer och idrottsskador.

Syftet med den första studien var att undersöka kvinnliga elitfotbollsspelares upplevelser av perioden innan de blev korsbandsskadade. Resultatet visade att spelarnas upplevelser kunde kategoriseras in i tre teman: utmattningssymptom, stress, samt oro. Dessa tre teman beskrevs av spelarna som möjliga riskfaktorer för skada.

Syftet med den andra studien var att undersöka om personlighet, stress, och coping variabler kunde predicera idrottsskada i en grupp av manliga och kvinnliga elitfotbollsspelare. Resultatet visade att en interaktion mellan de psykologiska variablerna ångestbenägenhet, negativ livsstress, ineffektiv coping, samt vardagskrångel (eng. daily hassles) kunde förklara 24 % av variansen i variabeln skador. Vidare visade resultatet att negativ livsstress hade en indirekt effekt på antalet skador genom variabeln vardagskrångel.

Syftet med den tredje studien var att undersöka om startvärde vid studiens början samt förändring i nivån av upplevt vardagskrångel under en 10 veckors period kunde predicera idrottsskador i en grupp av yngre manliga och kvinnliga elitfotbollsspelare. Resultatet visade att höga ingångsvärden samt en svag förändring i upplevd nivå av vardagskrångel ökade risken för skada.

Syftet med den fjärde studien var att undersöka om ett interventionsprogram, baserat på ett koncept som inkluderade mindfulness, acceptans och hängivenhet, kunde minska antalet skador i en grupp av fotbollsspelare. Resultatet visade ingen statistisk signifikant skillnad mellan grupperna. Dock fanns det en medium effekt storlek (adjusted Cohen's $d = -0.59$).

Syftet med den femte studien var att undersöka idrottsskada som en karriärövergång genom en före detta elithandbollsspelares upplevelser av en lyckad respektive en problemfylld skaderehabilitering. I deltagarens berättelse identifierades fyra faser. Dessa var: a) före skada, b) skada och första reaktioner, c) diagnos och behandling, samt d) rehabilitering och konsekvenser. De fyra faserna karakteriserades alla av specifika psykologiska utmaningar.

Key words: Idrottsskada, prediktion, prevention, psykologi, rehabilitering

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LIST OF SCIENTIFIC PAPERS

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V. Ivarsson, A., Stambulova, N., & Johnson, U. (2015). *Injury as a career transition: Experiences of a Swedish elite handball player*. Manuscript submitted for publication.

CONTENTS

INTRODUCTION.....	9
Theoretical frameworks guiding the dissertation project.....	12
The model of stress and athletic injury.	12
The biopsychosocial model of sport injury rehabilitation.	13
The athletic career transition model.....	13
Injury definitions.	14
Literature review.....	15
Psychological factors influencing injury risk.	15
Personality.	17
History of stressors.	18
Coping.	21
Stress response.....	22
Intervention studies.....	22
Psychological variables not included in the model of stress and athletic injury.....	23
Conceptual, Methodological and Statistical issues in pre-injury research.....	23
Conceptual issues.....	23
Methodological issues.	24
Statistical issues.....	26
Psychological factors influencing the rehabilitation process after sport injuries.	26
Summary, structure and aims of the dissertation project	28
METHOD.....	30
Study I.....	30
Participants.	30
Interview.	30
Procedure.....	31
Data analysis.....	31
Study II.....	32
Participants.	32
Instruments.	32

Swedish Universities Scales of Personality (SSP).....	32
Life Events Survey for Collegiate Athletes (LESCA).....	32
The Hassle and Uplift scale.....	33
Brief COPE.....	33
Injury recording.....	33
Procedure.....	33
Data analysis.....	34
Study III.....	36
Participants.....	36
Instruments.....	36
Injury recording.....	37
Procedure.....	37
Data analysis.....	37
Study IV.....	39
Participants.....	39
Instrument.....	39
Injury recording.....	39
Procedure.....	39
Intervention programs.....	40
Treatment group (mindfulness and acceptance practice).....	40
Control group (sport psychology work-shops).....	41
Data analysis.....	41
Study V.....	42
Participant.....	42
Interview.....	42
Procedure.....	42
Data analysis.....	43
Ethical considerations for all studies.....	44
RESULTS.....	48
Study I.....	48
Study II.....	49
Study III.....	49
Study IV.....	52
Study V.....	52
Rob's Handball Career.....	52
The injury processes.....	53
DISCUSSION.....	56
Sport injuries as a systemic phenomenon.....	56
Methodological reflections.....	61
Studies I & V.....	62
Study II.....	62
Study III.....	63
Study IV.....	63
Practical implications.....	64

Theoretical implications for future research	66
Conclusions and future studies.....	67
References	69
Appendix 1	87
Appendix 2	91



INTRODUCTION

Sport injuries are a major problem closely associated with sport participation. To participate in sports sets high demands on the athlete. Example of such demands are: being physically fit (Arnason, Sigurdsson, Gudmundsson, Holme, Engebretsen, & Bahr, 2004), performing complex movements (Drust, Atkinson, & Reilly, 2007), performing adequate decision making (Baker, Horton, Robertson-Wilson, & Wall, 2003), and successfully coping with stressors (Nicholls & Polman, 2007). The inability to cope with these demands is related to rather high injury rates among athletes; it has been estimated that more than 8 million sport injuries are treated in Europe per year (Bauer & Steiner, 2009).

Research into rates of traumatic injuries in specific sports has found that contact sports, such as soccer, have higher injury rates compared to sports without physical contact (e.g., track and field). Hägglund, Waldén, and Ekstrand (2009) found, in a sample of Swedish elite soccer players (both men and women), that 65% to 95% of the players reported at least one time-loss injury (i.e., an injury that takes the athlete out of training or competition for at least one session) per year. Similar findings were also reported in a sample of Swedish handball players where 64% of the players reported at least one time-loss injury per year (Salman, 2014). In comparison, the percentage of injured athletes in track and field was found to be 13.3 % (Tyflidis, Kipreos, Tripolitsioti, & Stergioulas, 2012).

To experience a sport injury can affect different aspects within the sport context. Research has shown that injuries can have consequences on not only an individual and team/club levels, but also on a community level as well. In regards to the individual athlete, research has found that injury has an impact on the athlete's career development both in a short term as well as a long-term perspective (e.g., Stambulova, 2010).

In a short-term perspective, a number of different cognitive reactions (e.g., perceived high stress level, perceptions of pain, and a sense of loss), as well as emotional reactions (e.g., sadness, anger, fear, grief, frustration) that injured athletes could experience, have been found (Wiese-Bjornstal, 2010). The

participant in Study V in this dissertation project expressed his reaction after an ACL injury had occurred as, “At that point it was extremely hard for me since I was supposed to miss the full season. Usually, I am very restrictive in showing emotions but this was one of the times in my life when I cried.”

In a long-term perspective, several studies have shown that sport injuries, in a substantial number of cases, will decrease the athlete’s perceived psychological (e.g., Hagger, Chatzisarantis, Griffin, & Thatcher, 2005), as well as physiological (e.g., Drawer & Fuller, 2001; Lohmander, Englund, Dahl, & Roos, 2007) well-being.

One reason for the decrease in well-being could be that severe sport injuries is a non-normative transition that, in many cases, may lead to career termination (e.g., Park, Lavalley, & Tod, 2013; Stambulova, Stephan, & Järphag, 2007). Forced termination of an athletic career has been found to negatively influence former athletes’ life satisfaction in comparison to former athletes who terminated from sports due to other reasons (Kleiber & Brock, 1992). One of the major problems with the non-normative termination from sport is that the athlete may not have sufficient coping resources to deal with the new situation. Stambulova (2003) has suggested that an athlete has to use appropriate coping strategies to deal successfully with different types of transitions—that is, the athlete needs to be able to mobilize resources such as motivation and social support. This need for social support can be a major problem because it has been shown that during the athlete’s adjustment to the injury, his/her relationship to the social network will often, consequently, change (Ford & Gordon, 1999). For example, an athlete who has experienced a career-ending injury often isolates himself/herself from the social environment. This isolation, in combination with other reactions to the injury (e.g., anger, fear) can negatively influence not only the person’s functioning, but also well-being.

As mentioned earlier, injuries can have an impact on the team/club level. In one case, Ekstrand (2013) reported that one month’s time-loss due to injury, for a starting player in an international elite soccer team, was estimated to cause a financial loss of approximately €500,000 for the club. Research has also shown that injuries may influence performance within elite soccer. More specifically, Hägglund, Waldén, Magnusson, Kristenson, Bengtsson, and Ekstrand (2013) showed that higher injury rates in European elite soccer were associated with poorer team performance (i.e., lower place on the table at the end of season).

The treatment of sport injuries has also been associated with major costs to the health care system (see Frisch, Croisier, Urhausen, Seil, & Theisen, 2009). In one example, the Swedish Civil Contingencies Agency (2010) estimated the cost associated with treatment for all sport injuries, in Sweden alone to be €300 to €400 million per year.

Given the high injury rates that are associated with sport participation, together with the negatively associated consequences both at individual and team/club, as well as community levels, preventive strategies for sport injuries are of great interest. To develop functional preventive strategies and programs, it is important to, first, single out risk factors that will increase the likelihood of sport injuries. In the history of sport injury prediction and prevention, the dominant perspectives have been physiological and/or biomechanical (e.g., Almeida, Olmedilla, Rubio, & Palou, 2014). Nevertheless, during the last two decades, the role of psychological factors in sport injury prevention and prediction has been more frequently discussed and researched. Wiese-Bjornstal (2010) emphasized the importance of combining biological and behavioral, as well as social sciences, together into a biopsychosocial perspective, to advance the knowledge of sport injury prevention, prediction and rehabilitation.

In line with the suggestion of a biopsychosocial perspective on sport injury prediction, different theoretical models have been developed (e.g., Hackfort & Kleinert, 2007; Wiese-Bjornstal, 2010) where biological, physiological, and psychological as well as sociocultural risk factors are included. One example of such model is the *biopsychosocial sport injury risk profile* (Wiese-Bjornstal, 2010). In this theoretical model it is suggested that internal/personal variables, such as biological (e.g., allostatic load, body composition, nutrition and hydration, fatigue, recovery status, health status) as well as psychological (e.g., perfectionism, coping, attitudes, attentional focus, life event stress, mood state, risk behaviors) factors will influence the injury risk that an athlete is exposed to. Complementary to the internal/personal risk variables are external/environmental variables, such as physical (e.g., weather, medical care, sport type, opponent size and skill, intensity of play) and sociocultural (e.g., social resources, rules, organizational stress, sport norms, coaching quality) factors that may also influence the likelihood for an athlete to become injured. The complex interaction of the internal/personal and external/environmental factors may, in turn, influence the athlete's behaviour and risk vulnerability based on the resultant exposures, choices, and hazards. An actual injury normally occurs as a product of an inciting event, which may then be influenced by "controllable behaviours and uncontrollable risks inherent in sport training and competition and the specific risk vulnerabilities of the involved athlete" (Wiese-Bjornstal, 2010, p. 105).

The area of interest for this dissertation project was to investigate the challenges that are associated with different phases in the injury process (e.g., pre-injury, rehabilitation). Additionally, an investigation of a psychologically-based intervention's capacity to reduce injury risk is included as a part of the project.

Theoretical frameworks guiding the dissertation project

A few theoretical frameworks have been used as foundations for the dissertation project. Those frameworks are: the *model of stress and athletic injury* (Andersen & Williams, 1988; modified in Williams & Andersen, 1998), the *biopsychosocial model of sport injury rehabilitation* (Brewer, Andersen, & Van Raalte, 2002), and the *athletic career transition model* (Stambulova, 2003; Stambulova & Wylleman, 2014). These theoretical frameworks will be described in more detail below.

The model of stress and athletic injury.

The *model of stress and athletic injury* is the most cited model in the area of psychology and injury prediction/injury prevention (Johnson, Tranaeus, & Ivarsson, 2014). According to the model injury risk may be influenced by the athlete's stress responses that may be suggested to have a bidirectional relationship with the athlete's appraisal of a potential stressful situation (e.g., game, competition). Both the magnitude of the stress reaction and the athlete's appraisal of the situation are suggested to be influenced by the interplay between various psychosocial factors, which are divided into three categories: personality factors, history of stressors, and coping resources. In the early version of the model (Andersen & Williams, 1988), the authors suggested that only the history-of-stressors variable directly influenced the stress response, whereas both personality and coping variables had an indirect effect on stress responses through history-of-stressors. Ten years later, however, the authors argued that an athlete's history of stressors could influence the development of both an athlete's traits and coping mechanisms, and, therefore, placed bidirectional arrows between the three psychosocial categories (Williams & Andersen, 1998). Also, intervention approaches are, in the model, suggested to influence/buffer the stress response. This buffering effect could probably, in turn, decrease the injury risk an athlete is exposed to.

When discussing the model, there are two conceptual aspects that are important to address. First, the model is developed as a framework for traumatic injuries. The definition of traumatic injuries is that the injury has a sudden onset in association with a known trauma (Olsen, Myklebust, Engebretsen, Holme, & Bahr, 2005). Second, the model is aimed to predict injury rates. In several prediction studies, "the number of days missed due to injury" has been used as the outcome variable but this variable is not necessarily related to the suggestions in the model of stress and athletic injury, which are about incidence or likelihood of an injury, not about injury severity (e.g., measured by time loss). Only studies that have used injury frequency as their main outcome will, therefore, be discussed in this dissertation.

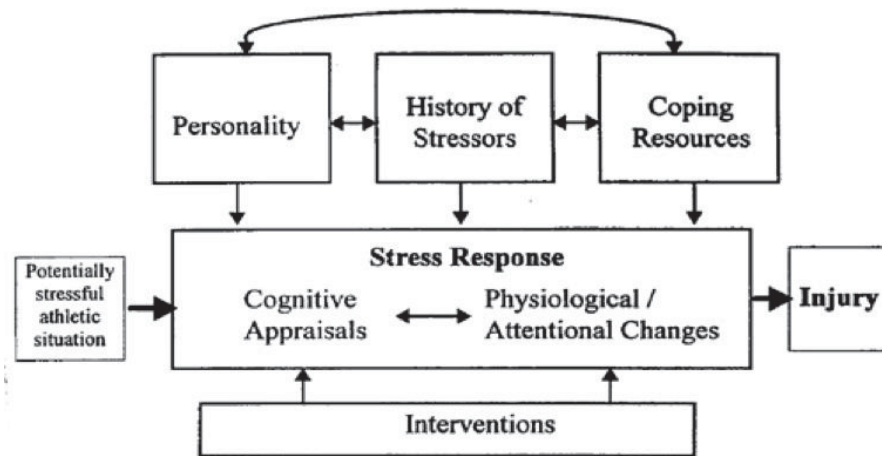


Figure 1. The model of stress and athletic injury (Williams & Andersen, 1998). Re-printed with permission.

The biopsychosocial model of sport injury rehabilitation.

One of the most recognized theoretical frameworks, developed to explain psychological reactions to sport injuries, is the *biopsychosocial model of sport injury rehabilitation* (Brewer et al., 2002). In the model it is suggested that injury characteristics (e.g., type, location, severity) and socio-demographic characteristics (e.g., age, gender) will influence biological (e.g., tissue repair, nutrition, immune functioning), psychological (e.g., personality, affect, behavior), as well as social/contextual factors (e.g., social network, life stress). These three categories of biopsychosocial factors will, in turn, have an indirect effect on sport injury rehabilitation outcome (e.g., functional performance, quality of life, readiness to return to sport) through biopsychological intermediate outcomes (e.g., range of motion, pain). Also, a direct path between the psychological factors and sport injury rehabilitation outcome is suggested.

The athletic career transition model.

In the *athletic career transition model* (Stambulova, 2003; Stambulova & Wylleman, 2014), a transition is considered to be a process of coping with a set of transition demands/challenges. In the coping process, athletes use various strategies (e.g., planning, practicing more than opponents, searching for professional support) to deal with the transition demands. The effectiveness of coping is seen as dependent on a dynamic balance between

coping resources and barriers. Resources refer to the various internal and external factors that facilitate the transition (e.g., previous athletic and personal experiences, social and professional support availability), and barriers involve the various internal and external factors that interfere with the coping process (e.g., low self-efficacy, limited professional or financial support). The model entails two primary transition outcomes: a successful transition and a crisis transition. A successful transition is the result of effective coping or a good fit between transition demands, on the one hand, and the athlete's coping resources and strategies, on the other hand. Crisis transition is a result of ineffective coping because of the athlete being low in resources, and/or high in barriers, and/or using ineffective coping strategies. Crisis can also be conceptualized as a transition the athlete has to make but is not able to cope with independently and perceives a need for transition intervention. Further, according to the model, the crisis transition can have two possible secondary outcomes: delayed successful transition (effective intervention) or unsuccessful transition (no or ineffective intervention), which can be associated with negative consequences (e.g., premature dropout, neuroses, overtraining, eating disorders, substance abuse). Career transition interventions outlined by the model include: crisis prevention, crisis coping, and negative consequences coping interventions.

Injury definitions.

In sport injury research a number of different definitions have been used (Knowles, Marshall, & Guskiewicz, 2006). One of the more commonly used in soccer (i.e., football) was suggested by Fuller et al. (2006), who defined sport injury as:

Any physical complaint sustained by a player that results from a football match or football training, irrespective of the need for medical attention or time loss from football activities ... and an injury that results in a player being unable to take a full part in future football training or match play as a "time loss" injury (p. 193).

Injuries could also be classified into two different types: traumatic injury and overuse injury. A traumatic injury refers to an injury that has an identifiable onset compared to an overuse injury, which is caused by repeated micro-traumas, and, therefore, does not have an identifiable onset (Fuller et al., 2006).

The focus for this dissertation project is traumatic time-loss injuries. A traumatic time-loss injury is an injury which: (a) has an identifiable onset, and (b) takes the athlete out of training or competition for at least one session. For more specific definitions of injuries for each study see the method part of the dissertation.

Literature review

Traditionally there have been two different perspectives within sport injury research: pre-injury and post-injury. In the pre-injury perspective studies have focused on investigating: (a) psychological factors relationship with injury risk, and (b) if intervention programs based on psychological training could decrease the injury risk. Studies in the post-injury perspective have focused on: (a) psychological reactions to sport injuries and the impact of those reactions on both psychological and physiological health and well-being, and (b) factors as well as intervention programs that facilitate the rehabilitation process and increase the odds of a successful comeback to sport. Even if the pre-injury perspective is the main focus of this dissertation, it is also important to present a brief overview of the post-injury research. The reason for presenting research from both perspectives is that it is needed to in an adequate way discuss the results in relation to the full injury process (i.e., from pre-injury to injury consequences). Research from the two perspectives is, therefore, presented below.

Psychological factors influencing injury risk.

The first studies that focused on pre-injury psychology were published more than three decades ago (e.g., Coddington & Troxell, 1980; Cryan & Alles, 1983). Most of the early studies targeted personality traits (e.g., Bond, Miller, & Chirsfield, 1988) or life event stress (e.g., Coddington & Troxell, 1980; Cryan & Alles, 1983; Schafer & McKenna, 1985; Williams; Tonymon, & Wadsworth, 1986) as predictor variables for sport injury occurrence. One of the limitations of the early studies was that they did not offer any theoretical explanation for the mechanisms between the psychological variables and injury occurrence (Williams & Andersen, 2007). To provide a theoretical framework aimed at offering a potential explanation for the relationship between psychological variables and injury occurrence, the model of stress and athletic injury was developed (Andersen & Williams, 1988; modified in Williams & Andersen, 1998). Since the model of stress and athletic injury was developed a few other theoretical frameworks have been suggested. Some examples of those frameworks are the *model of the influence of psychological factors on sports injury* (Junge, 2000), and the *overtraining risks and outcomes model* (Richardson, Andersen, & Morris, 2008). These two models will briefly be presenter below.

In the *model of the influence of psychological factors on sports injury* (Junge, 2000) an athletic situation that is associated with an injury risk for the athlete may cause a bio-psychological reaction. The reaction to this particular situation may, according to the model, influence the injury risk that the athletes are exposed to in a specific situation, and the severity of the potential injury. The reaction that is suggested to be the link between the situation and injury occurrence may be influenced by a number of different psychological

factors and were divided into three categories: (a) psychosocial stressors (i.e., life events, everyday problems), (b) emotional state (i.e., competitive anxiety, general well-being, fatigue) and, (c) coping resources (i.e., coping skills, health behaviour, social support). In the model, psychosocial stress is suggested to influence both the athletes' reactions to their situations and their emotional states. The athletes' coping resources may, except for its direct impact on the bio-psychological reactions, also influence the link between psychosocial stressors and the reaction. In the model it is also stated that psychological interventions could positively affect both athletes' coping resources and their emotional states.

In the *overtraining risks and outcome model* (Richardson, Andersen, & Morris, 2008) the authors suggested that there are a number of different risk factors for overtraining symptoms. These risk factors are divided into intrapersonal variables (e.g., motivation, personality traits), interpersonal influences (e.g., past and present relationships with coaches, parents, friends), situational factors (e.g., poor performance, transitions in sport, major sport and non-sport events), and socio-cultural context or environment (e.g., sport culture, societal influences). The last variable of risk factors is labeled as a super-factor in which the three other categories of risk factors are embedded. The interaction between those risk factors could lead to imbalance between stress and recovery. This imbalance between stress and recovery can, according to the model, generate several physical and physiological (e.g., increased fatigue level, decrease in performance, muscle pain) as well as psychological (e.g., emotional distress, increased anxiety, emotional reactivity) responses. In the third step of the model, the athlete could follow one of two different categories of behavioral responses to deal with the physical and/or psychological reactions. If athletes engage adaptive behavioral responses, such as increased recovery activities, decreases in other stressors, or adjustments in training load, it is likely that they will return to a balance between stress and recovery. The other category of behaviors that the athlete can engage in is a maladaptive one. Examples of maladaptive behaviors are: ignoring the physical and/or psychological reactions associated with the imbalance between stress and recovery, increasing training effort, or ignoring stressors and neglecting recovery. These types of behaviors are associated with both less and more severe outcomes, such as increased likelihood of becoming injured, developing overtraining syndrome, chronic fatigue and/or lowered motivation

During the last decades, a number of studies have been published to test different parts of *the model of stress and athletic injury*. The presentation of previous studies will, therefore, be structured based on this model. The reason for using the model of stress and athletic injury as an outline for the presentation of previous research is that, in principle, all studies have investigated variables that are included in this model (see Table 1). Another

reason for using this model is that it has been developed to explain psychological variables influence on the risk of traumatic sport injuries (which is the type of injury that is the variable of interest in this dissertation). Also, a few studies that have investigated variables that are not included in the model of stress and athletic injury will be presented under their own headings.

In the search for studies to include in the review of previous studies the electronic databases Cinahl, Web of Science, Pubmed, and PsycInfo were searched using combinations of the key words *sports injury*, *athletic injury*, *psychology*, and *prediction and prevention*. Also, the peer reviewed journals *Journal of Sport and Exercise Psychology*, *Journal of Sport Rehabilitation*, *Journal of Applied Sport Psychology*, *Scandinavian Journal of Medicine and Sport Science* and *Psychology of Sport and Exercise* were manually searched. The inclusion criteria was: (a) that the studies had prospective or experimental designs including continuously monitored the frequency of traumatic injuries during the study period, or (b) that the studies had a qualitative design that focused on the participants experiences prior to an traumatic sport injury,

For a summary of all studies found in the literature search, see table 1 (see appendix 1).

Personality.

In the model of stress and athletic injury, personality traits are one main category of psychosocial risk factors. The personality traits can be divided into traits that increase, and those that decrease, injury risk (Williams & Andersen, 1998). Examples of traits that have been found to increase the likelihood of becoming injured are anxiety (e.g., Devantier, 2012; Johnson & Ivarsson, 2011; Lavalley & Flint, 1996), worry (e.g., Noh, Morris, & Andersen, 2005) and stress susceptibility (Ivarsson & Johnson, 2010). These psychological traits have been suggested to increase the likelihood of an athlete perceiving situations as stressful, as well as increase the magnitude of the stress response (Williams & Andersen, 1998). To illustrate this link, research has found that humans reporting high levels of trait anxiety are more likely to respond to stimuli that are, in some way, perceived as emotional and are associated with enhanced amygdala activation in comparison to humans with lower levels of trait anxiety (Bishop, 2007). This increased amygdala activation in highly anxious humans is associated with experiencing fear and stress more frequently in comparison to other humans (Sandi & Richter-Levin, 2009). The other sub-group is adaptive personal traits, which have been suggested to influence a person in a positive way (e.g., increase well-being). In this category, athletes with traits such as hardiness (Wadey, Evans, Hanton, & Neil, 2012a), optimism (Wadey, Evans, Hanton, & Neil, 2013), and self-confidence (Kleinert, 2007) seem to be less injured than other athletes (for an extended summary see Wiese-Bjornstal, 2010). The literature has suggested that these positive traits should decrease the strength of the athlete's stress

responses and, in turn, decrease the injury risk that the athlete is exposed to (Williams & Andersen, 2007).

Even though a number of studies have found statistically significant relationships between different personality traits and injury risk, there are also studies that have showed inconsistent results (for summaries of these studies see Johnson et al., 2014; Junge, 2000; Udry & Andersen, 2002). One explanation for this inconsistency in results for both negative and positive traits' relationships with injuries is that that these factors do not seem to be in direct relation to injury occurrence. In the model of stress and athletic injury, the stress response is suggested to be the mediator between personality traits and injury, which means that there must be a change in the strength of the stress response in order to increase or decrease injury risk. This suggestion is supported by Ivarsson, Johnson, Andersen, Tranaeus, Stenling, and Lindwall (2015a), who, in a meta-analysis, showed that personality traits have an indirect effect on injury rates through stress response variables.

History of stressors.

Stress and stress responses have had central roles in previous research. According to Anisman (2014), stressors (variables that cause stress) could be divided into two broad categories: processive and systemic. The major difference between the two types is that stressors involving information processing are considered to be processive, compared to the systemic stressors that have a stronger direct link to human biological systems.

The stress process associated with processive stressors begins in the brain (cognitive appraisal) and affects both the brain and the body (McEwen, 2007). When a person interprets a situation as stressful, there are two systems in the brain that mediate the stress response (Fuchs & Flugge, 2003). These two systems are the limbic-hypothalamic-pituitary-adrenal (LHPA) system and the sympathico-adrenomedullary system (for more information about these systems see Fuchs & Flugge, 2003). High activation in these two systems has been found to be associated with changed activation in different parts of the brain, which could, for example, lead to impaired attentional control (Liston, McEwen, & Casey, 2009). This is significant because it aligns with previous research (i.e., Rogers & Landers, 2005) as well as the model of stress and athletic injury in that the stress response can mediate the relationship between stressors (e.g., history of stressors) and injury risk.

The stress process associated with systemic stressors can, unlike processive stressors, directly influence human's biological systems without any type of cognitive processing (Anisman, 2014). Examples of a systemic stressor could be the imbalance between physical load and recovery, which, in turn, could generate a number of psychophysiological symptoms such as neuromuscular overload, psychological overload, as well as sympathetic system overload. These symptoms are linked to an increased likelihood of, for example, altered

immune functioning, peripheral fatigue, altered mood state, and central fatigue (Lehman, Foster, Dickhunt, & Gastmann, 1998) as well as burnout (Maslach, 2003). All these states are associated with an increased injury risk (e.g., Richardson et al., 2008).

Most previous research has focused on processive stressors. In the model of stress and athletic injury, as well as in previous research, different types of processive stressors are categorized into three sub-categories: life event stress (i.e., total life event stress, negative and positive life event stress), previous injuries, and daily hassles. These sub-categories are presented in more detail below.

Life event stress.

The stressors that are contained in the life event stress category are total life event stress (TLES), negative life event stress (NLES), and positive life event stress (PLES). Common to the three types of stressors are that they are considered major life events that are perceived as stressful by a person. In this category, NLES is probably the sub-category that most studies have highlighted as influencing injury risk. For example, Rogers and Landers (2005) found that high levels of NLES increased injury risk among junior soccer players. Similar findings have been reported in other soccer samples, such as youth players (Gunnøe, Horodyski, Tennant, & Murphey, 2001; Steffen, Pensgaard, & Bahr, 2009), and junior players (Johnson & Ivarsson, 2011). Also, in other physical activities and sports such as dance (Noh, Morris, & Andersen, 2005; Patterson, Smith, Everett, & Ptacek, 1998) and college sports (Andersen & Williams, 1999), similar statistically significant relationships have been reported.

Concerning PLES, few studies have found any statistically significant relationships with injury risk (e.g., Blackwell & McCullagh, 1990; Rogers & Landers, 2005; Wadey et al., 2012a). That NLES seems to have a larger impact on injury rates was also shown in Ivarsson et al.'s (2015a) meta-analysis where the effect estimate (r) between negative life event stress and injury rates was .21 compared to the estimate for positive life events, which was .02. The findings from previous research that NLES might have a stronger impact on injury risk compared to PLES might have several explanations. One explanation is that the events which we perceive as negative have a greater impact on a broad range of psychological phenomena, such as mood, as well as perceived control, compared to events that are perceived as positive ones (Baumeister, Bratslavsky, Finkenauer, & Vohs, 2001). These changes in psychological states might increase the risk for injury occurrence.

Previous injuries.

The second sub-category in the history of stressors category is previous injuries. This category is probably the one that has gained the most attention in

sport medicine research. For example, Häggglund, Waldén, and Ekstrand (2006) found that soccer players with previous injury history had an increased risk for new injuries. Similar results have also been reported in other sports such as rugby (Maddison & Prapavessis, 2005) and mixed sports (Van Mechelen, Twisk, Molendijk, Blom, Snel, & Kemper, 1996). Previous injury experience might increase injury risk in, at least, two ways. First, if injured athletes return to sport before they are completely physically recovered, there is a high likelihood of re-injury. Another, less discussed, link between previous injuries and re-injury, is when athletes are not psychologically prepared even though they are physiologically recovered to return to sport. This might lead to greater stress responses, which, in turn, according to the model, could increase the likelihood of becoming injured (Andersen, 1988). An example illustrating this idea would be a previously injured soccer player who is not confident about his formerly injured body part. This player is probably more likely to focus on fear and feeling insecure instead of fully focusing on the important cues in the game. This could, in turn, lead to more frequent involvement in riskier situations because he does not have all the information needed to make the most accurate decisions, and he is distracted by his own anxiety and may miss important cues in the environment.

Hassles.

Hassles are often discussed as minor everyday life situations that people experience as stressful. The impact of hassles on injury occurrence has been investigated by only a few previous studies (e.g., Fawkner, McMurray, & Summers, 1999). The effect estimate for hassles' effect on injury risk has been found to be small to medium ($r = .12$; Ivarsson et al., 2015a). The lack of attention towards hassles is a bit surprising because a number of studies in other health-related areas have found relationships with several different health-related outcomes. In organizational psychology, several studies have found that minor everyday stressors (such as daily hassles) have a relationship with health behavior (Cassidy, 2000; Kanner, Coyne, Schaefer, & Lazarus, 1981), well-being (Repetti & Wood, 1997), physical illness (Steptoe & Ayers, 2004), and stress symptoms (Zohar, 1997). One important reason for investigating the relationship between minor everyday stressors and injury risk is that research has suggested that the impact of hassles over time could have a cumulative effect (Anisman, 2014), which may increase the risk of experiencing, for example, depressed mood (Felsten, 2002). Depressed mood could, in turn, increase the likelihood of becoming injured (Galambos, Terry, Moyle, & Locke, 2005).

Coping.

The last main category of psychosocial factors that, in the model, is suggested to influence injury risk is coping (e.g., Williams & Andersen, 1998). Coping strategies could be described as behavioral and/or cognitive attempts to deal with specific demands that a person interprets as mildly taxing to challenging (Lazarus & Folkman, 1984). These coping strategies can be classified into at least two broad sub-groups: problem-focused strategies and emotion-focused strategies. Problem-focused strategies direct the person's coping efforts at the demand itself, whereas emotion-focused strategies direct the effort towards the emotional reactions that are the product of the demand (Carver & Connor-Smith, 2010; Lazarus & Folkman, 1984).

In the model of stress and athletic injury coping is suggested to: (a) decrease the strength of the stress responses and, (b) influence the athlete's appraisal of situations. It is suggested that an athlete who has effective coping resources will appraise fewer situations as stressful compared to an athlete who has less effective coping resources. One of the studies that has investigated coping in relation to sport injury occurrence showed effective coping strategies to be a stress-buffering factor that decreased injury frequency in athletes (Rogers & Landers, 2005). Moreover, Andersen and Williams (1999) found that low levels of social support were associated with increased injury risk. The mechanism of social support as an effective coping resource suggests that positive interaction with family and friends will increase both self-confidence and reduce stress, which in turn, will decrease injury risk. In line with these findings, it has also been shown that athletes who use ineffective or maladaptive coping strategies are more likely to become injured than athletes who use more effective strategies (Johnson & Ivarsson, 2011). Similar conclusions have also been drawn based on qualitative studies (Johnson, 2011; Wadey, Evans, Hanton, & Neil, 2012b). Johnson (2011) suggested, based on interview data from injured athletes, that maladaptive coping strategies were a risk factor for injuries. In another study, it was found that how an athlete coped with NLES prior to injury occurrence differed between athletes who were high in self-reported hardiness and athletes who were low in self-reported hardiness (Wadey et al., 2012b).

Generally, players who reported a high level of hardiness used problem-focused coping strategies, whereas the group with participants low in hardiness most often used emotion-focused strategies (e.g., denial). Even if all athletes in the study, regardless of their level of hardiness, received an injury, Wadey et al. (2012b) speculated that athletes who predominantly used emotion-focused strategies to deal with negative life events stressors might be exposed to a greater injury risk compared to others.

Even though several studies have reported a negative relationship between coping and injury occurrence (i.e., lack of coping strategies are related to increased injury risk) there are also several studies that have reported opposite

findings. For example, Johnson and Ivarsson (2011), Noh, Morris, and Andersen (2005), Maddison and Prapavessis (2005), and Vassos (2009) have reported minimal or positive relationships between several coping strategies (e.g., concentration, problem-solving coping), as measured by different questionnaires and operational definitions of injury.

One potential explanation for these mixed results could be that coping is a concept that has been approached from different theoretical perspectives (Nicholls & Polman, 2007). Some studies have discussed coping as a trait whereas others have discussed it as a process. Nicholls and Polman (2007) found the process perspective to have the strongest support in their systematic review. This finding indicates that athletes' attempts to cope with different situations are based on their appraisals of the situations that could fluctuate over time. It may, therefore, be difficult to generalize the athlete's answer from a questionnaire that, for example, asks the athlete to "indicate what you generally do and feel when you experience stressful events." By using many different questionnaires (e.g., ACSI-28, Brief Cope) on the same occasion, researchers may assume that the situational aspect of the selection of coping strategies can be negligible (Schwarzer & Schwarzer, 1996) and that could give a poor match between the answers and the actual behavior.

Stress response.

Stress responses are, in the model of stress and athletic injury, suggested to be a mediator between psychosocial variables and injury occurrence. In that model, the athlete's interpretation and cognitive evaluation of inter- and intra-individual demands, personal resources, and the hypothesized consequences of a situation have a bidirectional link with physiological and attentional aspects of the stress response (Andersen & Williams, 1988). That is, there is no causal uni-directional relationship between muscle tension and cognition/emotions/attention, but rather, they could affect each other in both directions. Even though stress responses are at the core of the model, surprisingly few studies have been conducted in sport settings to study this link between psychosocial variables, stress responses, and injury outcome (Ivarsson et al., 2015a; Williams, 2001). The only variable associated with the stress response, which two studies have investigated is peripheral vision narrowing (Andersen & Williams, 1999; Rogers & Landers, 2005). Both these studies have found this stress response variable to be a statistically significant predictor of sport injuries. More specifically, the weighted overall effect size, based on these two studies was $r = -.22$ (Ivarsson et al., 2015a).

Intervention studies.

In the model of stress and athletic injury, interventions based on psychological training programs, are suggested to decrease injury risk among athletes through decreasing the magnitude of stress responses (Williams &

Andersen, 1998). At this time, at least seven intervention studies, based on psychological training programs, have been conducted in the research field of sport injury prevention (see table 1). Different approaches have been used in the studies, such as cognitive behavioral therapy interventions (Edvardsson, Ivarsson, & Johnson, 2012; Perna, Antoni, Baum, Gordon, & Schneiderman, 2003), and psychological skills training (Johnson, Ekengren, & Andersen, 2005; Kerr & Goss, 1996; Kolt, Hume, Smith, & Williams, 2004; Maddison & Prapavessis, 2005; Noh, Morris, & Andersen, 2007; Tranaeus, Johnson, Engström, Skillgate, & Werner, 2014b). Even though there have been different conceptual approaches, most of the studies have applied programs targeting stress management techniques (e.g., relaxation programs, critical incident diaries, goal setting programs). All intervention programs have shown positive results (i.e., fewer injuries in the experimental group compared to the control group) with Cohen's d effect sizes ranging from 0.12 to 1.28 (overall average Cohen's $d = .70$; Ivarsson et al., 2015a¹).

Psychological variables not included in the model of stress and athletic injury.

Even though most studies have investigated variables included in the model of stress and athletic injury, several studies have included other variables in their designs. One of the studies, performed on youth female soccer players, showed that players who perceived their team as having a mastery motivation climate were exposed to a higher injury risk than other players. One potential explanation for this somewhat surprising result, as suggested by the authors, was that players who practice in a mastery climate may be more likely to develop perfectionism, which in turn could increase the injury risk through involvement in more risk-related situations (Steffen et al., 2009).

Another factor that has gained some interest in prediction research is fatigue. Experiencing high levels of fatigue has been found to increase the risk of sport injuries (Liederbach & Compagno, 2001; Tranaeus, Johnson, Engström, Skillgate, & Werner, 2014a). Also Johnson (2011) found in a qualitative study, based on athletes from mixed sports, that psychophysiological fatigue was one potential predictor of sport injuries.

Conceptual, Methodological and Statistical issues in pre-injury research.

Conceptual issues.

Because the model of stress and athletic injury has been the most frequently used model in previous research its theoretical underpinning have

¹ One of the presented studies (Kolt et al., 2004) was not included into the meta-analysis due to lack of information about the effect size of the intervention (Ivarsson et al., 2015).

been guiding most of the studies performed within pre-injury research. It is, therefore, important to discuss some potential short-comings in relation to the model of stress and athletic injury. One of the aspects that have been discussed as a shortcoming is that the model does not fully consider either emotional or environmental factors to influence injury risk (Hackfort & Kleinert, 2007). More specific, the model does not explicitly address how interpersonal relationships, that in a number of studies have been found to influence individuals cognitive processes as well as behaviors (e.g., Kennedy & Kennedy, 2004; Reis, Collins, & Berscheid, 2000), could influence the injury risk athletes are exposed to. That behaviors (e.g., motor behavior) may influence the relationship between psychosocial factors and injury risk is not acknowledged in the model is also a potential shortcoming (Hackfort & Kleinert, 2007). Another potential shortcoming is that neuro-psychological changes, which in research have been found to mediate the relationship between stress and stress reactions (Cozolino, 2010), is not included into the model. Last, bio-psychological phenomenon, such as overtraining symptoms and fatigue, which have been suggested to increase the risk of becoming injured in sport is not included in the model.

Methodological issues.

One methodological issue, raised by researchers within the field, is that investigators should focus on the interactions between several different psychosocial factors and how these complex interactions may influence injury risk (Johnson, 2007; Williams & Andersen, 2007). Prospective designs with repeated measures over time may be some of the best ways to investigate such complex interactions (Johnson et al., 2014). To use a repeated-measure design allows one to explore and discuss how different variables are related to each other, and how the strengths of those relationships may change over time (e.g., from the start to the end of a season). Such time-related changes are important to measure and discuss in complex models (Roth & MacKinnon, 2012) and cannot be accomplished with cross-sectional or even simple pre-post test designs research, but rather data are needed over multiple time periods to discover how different variables could influence each other at different time points (e.g., Gollob & Reichardt, 1987; Selig & Preacher, 2009). In previous research (e.g., Johnson & Ivarsson, 2011) a couple of independent variables (e.g., Anxiety, NLES, Coping) have been suggested to influence each other in specific ways, but the authors used data from only one baseline measure. This approach is flawed because it is problematic to argue that one specific variable could *predict* a second variable when the two variables are measured at the same occasion. Another reason for using repeated-measure designs is that they have the potential to generate a dynamic picture of how the participants change during a period of time. In cross-sectional designs, which could be defined as “snap-shot” investigations, the researcher takes just one picture and

uses it as if it were a constant over time (which psychosocial constructs rarely are). These sorts of one-off designs have substantial limitations that could be rectified by adopting repeated-measure designs.

Another methodological issue that is a limitation in previous studies is that most investigations have used just one of the theoretical models that have been developed as a guideline for both the design of the studies and the interpretation of the results. Even though it is essential to base research on adequate theoretical frameworks, it is unwarranted to exclude other perspectives that potentially could account for some variance in injury rates. One recommendation for addressing these shortcomings in previous research is to perform more qualitative studies. Even if the retrospective designs of many qualitative studies make it impossible to discuss causality, such designs have the potential to generate new knowledge in the field that could later be investigated through quantitative prospective studies. To gain as much information as possible in a qualitative design, the use of loose-structured interview guides is recommended. The reason for this recommendation is that the few qualitative studies that have been performed have used semi-structured interview guides that, at least partly, have been designed based on the model of stress and athletic injury, leading to researchers eventually finding what they were looking for and decreasing the chances of gaining new information from their participants.

In the published intervention studies, some methodological similarities run through most of the investigations. First, a majority of the studies have used quasi-experimental designs with no attentional control groups, meaning that the participants in the control group would not be offered any placebo or attentional treatment. In other words, in the attempt to control for potential confounders in the designs of intervention studies, Randomized Controlled Trials (RCT) investigations with placebo/attentional control treatments should be conducted (Shadish, Cook, & Campbell, 2002).

Second, most of the studies have used traditional Psychological Skills Training (PST) techniques (e.g., imagery, relaxation, goal setting). Because numerous studies have also shown other approaches (e.g., CBT, ACT, Mindfulness) can be effective for reducing stress, such interventions may also be useful for reducing injuries.

Third, some of the studies have screened athletes before the intervention started to choose participants who fit at-risk profiles according to the Williams and Andersen (1998) model of stress and athletic injury (e.g., Johnson et al., 2005). This screening for at-risk athletes has the advantage of delivering interventions to those who may most need them while not spending time and money on those who are not likely to become injured. The disadvantage is that some members of the team may feel left out of the special treatments others are receiving. Testing intervention programs on the full range of athletes, from low to high risk, may also be a direction in which research designs should be

further elaborated. To be able to show effects on all types of athletes may make it easier to promote a program to coaches and administrators who hold the purse strings.

Focusing on other potential methodological limitations in relation to intervention studies, one of the major deficiencies is that none of the interventions have measured potential mechanisms for the link between the intervention program and injury rates. Therefore, we can only speculate about what the relationships between the interventions and the lowered injury rates actually are. Research into mechanisms (most likely neurobiological or behavioral) that explain how interventions lower injury risk needs to become a focus in future research.

Statistical issues.

One important statistical issue to address is that most studies within the field have based their conclusions only on p values. This is surprising because p values say nothing about the magnitude of a specific effect (e.g., the magnitude of the impact that an intervention has on injury rates). Using only the p value to evaluate the significance of the result is associated with some major problems.

One of the most frequently addressed problems is related to the notion that the p value is not a result that says anything about real-world meaning (as many researchers have warned; e.g., Ivarsson, Andersen, Stenling, Johnson, & Lindwall, 2015b; Wilkinson, 2014). Instead the definition of the p value “is the probability of obtaining a value of test statistics, say, D , as large as the one obtained conditionally on H_0 being true: $p(D \geq H_0)$ ” (Nickerson, 2000, p. 247). Given that definition, it is not possible to state that a result that shows a p value of .01 is more relevant or important than a p value of .03 or .10 (e.g., Cohen, 1990; Loftus, 1996). To help researchers discuss whether a result is of practical significance, a few approaches are recommended. For example, calculating an effect size (ES) can be helpful, but effect sizes will not, by itself, indicate whether the result is meaningful or not (e.g., Ivarsson, Andersen, Johnson, & Lindwall, 2013). For researchers to decide the meaningfulness of a result, they have to discuss the potential impact of the findings on people in the context where the study is performed. Statistics (in all forms) are just numeric representations of the real world and should, therefore, almost always be interpreted and discussed in relation to practical or clinical (and not just statistical) significance (Ivarsson et al., 2015b).

Psychological factors influencing the rehabilitation process after sport injuries.

As stated earlier, there are, traditionally, two different perspectives within sport injury research: pre-injury and post-injury. Even though the pre-injury perspective is the main focus of this dissertation, it is also important to present

a brief overview of the post-injury research. Because sport injuries are processes with different stages that influence each other, a post-injury perspective is needed to provide a presentation of the full injury process.

Research within the post-injury perspective has focused primarily on: (a) psychological reactions to sport injuries and the impact of those reactions on both psychological and physiological health and well-being, and (b) factors as well as intervention programs that facilitate the rehabilitation process and increase the odds of a successful comeback to sport.

Research within the area of psychological aspects of sport injury rehabilitation has focused on a few different perspectives: psychological and emotional reactions to sport injuries, psychological factors that facilitate the rehabilitation process, interventions aimed at facilitating the rehabilitation process, and return to sport issues. Research concerning psychological and emotional reactions to sport injuries has shown that the most common reactions are sadness, depression, grief, fatigue, and anxiety (for a review see Wiese-Bjornstal, 2010).

To explain the psychological factors potential impact on the athlete during the rehabilitation process several models have been developed. One example is the *integrated model of psychological response to the sport injury and rehabilitation process* (Wiese-Bjornstal, Smith, Shaffer, & Morrey, 1998). This model was developed to illustrate what psychological reactions could be present during the sport injury rehabilitation process. In the model, personal (e.g., age, personality) and situational (e.g., sport, interpersonal relationships) factors are suggested to influence the athlete's cognitive appraisal of the situation (e.g., coping, attributions). The athlete's appraisal of the situation will then generate emotional responses (e.g., anxiety, depression, mood changes) that in turn will influence behavioral responses (e.g., adherence to treatment, effort, intensity). All responses together with the athlete's cognitive appraisal of the situation will influence the recovery outcomes.

Studies within the post-injury perspective have highlighted psychological variables that have been suggested to facilitate successful rehabilitation processes and outcomes. Examples of psychological variables are cognitive factors, such as goal-setting and positive attitudes toward rehabilitation (Johnson, 1997), recovery imagery (Ievleva & Orlick, 1991), and intrinsic motivation (Podlog & Eklund, 2005) whereas fear of injury (Kvist, Ek, Sporrstedt, & Good, 2005), and other negative emotions (Johnson, 1997) are related to unsuccessful rehabilitation outcomes.

Several intervention studies have been performed to help increase the odds for injured athletes having successful comebacks (Brewer, 2010). Intervention studies have shown that strategies such as stress management and cognitive control (Johnson, 2000), relaxation (Cupal & Brewer, 2001), and building confidence in performance capabilities (Podlog, Dimmock, & Miller, 2011) increased the odds of successful rehabilitation.

Psychological factors associated with returning to sport after injuries is an area of research that has been addressed by a number of studies. In one systematic review, Arden, Taylor, Feller, and Webster (2013) concluded that athletes who reported high levels of autonomy, competence, and relatedness, as suggested in self-determination theory, had an increased likelihood of returning to sport after injury compared to athletes reporting low levels of these basic needs. Also, high levels of self-confidence, as well as low fear levels, were related to higher odds of a player returning to a pre-injury level of participation within sport.

Summary, structure and aims of the dissertation project

To sum up, the injury phenomenon has been studied from a variety of different scientific perspectives, such as physiology, biomechanics, and psychology (e.g., Wiese-Bjornstal, 2010). The focus of this dissertation will be towards the psychological perspective of sport injuries.

In pre-injury research, several researchers (e.g., Hackfort & Kleinert, 2007; Williams & Andersen, 2007) have advocated for research focusing on the ways in which multiple psychosocial factors interact to increase injury vulnerability. This important research increases the knowledge about the complex interactions between variables that influence the injury risk through the athletes' experiences and perceived states. The aim of Study I was, therefore, to investigate female elite soccer players' experiences of the time prior to the occurrence of an ACL injury.

Based on the findings from the first study in this project, as well as previous studies (e.g., Johnson & Ivarsson, 2011; Noh et al., 2007) which have reported anxiety/worry as well as different types of stressors to be variables of interest during the time prior to injury, a prospective study was designed with these variables included. Because coping has been found to buffer the impact of stressors on the stress response (e.g., Rogers & Landers, 2005) this variable was also measured in the study. The aim of Study II was to investigate whether personality, stress, and coping predicted injury occurrence in an elite soccer population.

Because stress was found to be a key variable influencing injury risk both in Study I and II as well as in previous literature (e.g., Johnson & Ivarsson, 2013; Williams & Andersen, 2007), the third study was designed to investigate the impact of accumulated stress on injury risk. Previous research has addressed the importance of stress and has considered it to be a dynamic variable that fluctuates over time. It is important to investigate how this change, along with the accumulated load of experienced stress, will influence injury risk. The aim of Study III was to investigate, by use of a latent growth curve analysis framework, whether athletes' individual levels and changes in

hassle and uplift levels over a 10-week period could predict injury outcomes in an elite junior soccer sample.

The aim of Study IV of the project was to examine the extent to which a mindfulness and acceptance-based intervention program could reduce the number of sports injuries in a sample of soccer players. The rationale for performing a mindfulness and acceptance-based program is that such approaches have, in previous studies (e.g., Harris, 2006; Hölzel, Lazar, Gard, Schuman-Oliver, Vago, & Ott, 2011), been found to be effective in reducing stress. Because stress is found to be a predictor of sport injuries (e.g., study II and III), it is likely that by reducing the athletes' stress levels, the injury risk will also be reduced. Another reason for using a mindfulness and acceptance-based intervention program is that most of the previous studies have used PST interventions (showing promising effects on injury reduction; for a summary see Johnson et al., 2014). One question that has been addressed in relation to PST-based interventions is: Which parts of the PST programs were the "effective ingredients"? A variety of psychological skills (e.g., relaxation, imagery, goal setting) have been taught in past intervention studies, but it has not been possible to determine which parts of the different PST interventions were most helpful at reducing injury risk. In choosing a program that is based on a combination of mindfulness and acceptance and commitment therapy (ACT), there is a much narrower focus to the intervention than there is in PST approaches, and that is: paying attention and constantly bringing attention back to the present moment in combination with cognitive flexibility and values-directed action.

In previous injury studies, most of them have focused mainly on one specific phase within the injury process, which are either injury prediction or injury rehabilitation and related factors. Also, injury has been considered as an isolated event and seldom as a specific transition process within the athlete's career development. One potential problem with treating injuries as isolated events and seeing them as outside the career context in which they happen is overlooking the number and importance of consequences they might have for injured athletes, and, thereby, diminishing the effectiveness of relevant interventions. One of the research aspects of this dissertation is to incorporate a career perspective into the injury topic. The aim of Study V was, therefore, to examine athletic injury experiences as a career transition through the narratives of a former elite handball player.

METHOD

An overview of the methodological designs of the studies is presented in Table 2 (placed in the end of the method section). In the table the specific study populations, instruments, procedures, and data analyses are briefly described.

Study I

Ivarsson, A., Johnson, U., Karlsson, J., Börjesson, M., Hägglund, M., & Waldén, M. (2015). *Female elite footballers' recall of emotions, cognitions and behaviors prior to anterior cruciate ligament injury*. Manuscript submitted for publication.

Participants.

The participants, who were homogeneously sampled in terms of gender and type of injury, consisted of the population of soccer players ($N = 18$), aged between 20 and 35 ($M = 25.89$, $SD = 4.38$) who incurred a total ACL tear in the Swedish women's elite soccer league during the 2012 season. Participants were identified through a prospective injury surveillance study carried out during the season using a methodology similar to that used in previous research (i.e., Fuller et al., 2006). After the last competitive match of the 2012 season, all potential study participants were approached for possible inclusion, and all agreed to take part. All players underwent surgical ACL reconstruction.

Interview.

An interview guide was used to collect data for the study. The participants were asked to describe their backgrounds in soccer, their general life situations, and specific details of any previous ACL injuries. We used an open-ended, low-structured interview guide consisting of questions and requests for information covering a broad area of what was happening in their sport and in their lives, including their physiological and emotional states,

during the two months prior to their injuries. There were also requests for the athletes to reflect on how their perceptions of these experiences influenced their cognitive, physiological, and emotional states, as well as their behaviors during those two months. Additional questions and probes were added to fill out the narratives.

Procedure.

The time and place of the interviews were scheduled post season. On average, the interviews took place six months (range 3-9 months) post-injury. At the time of the interviews 16 of the 18 invited players were located in Sweden, and the other two were located abroad. Due to logistical problems related to finding appropriate times and places for meeting during the off-season, six of the interviews were performed using video communication (Skype; Microsoft Corporation). The first author conducted all the interviews, lasting 25-65 minutes, and transcribed verbatim all the interviews prior to analysis.

Data analysis.

Because the stories were originally in Swedish in most cases (16 of the 18 interviews), they were translated into English by the first author. To validate this translation procedure, a native English-speaking person, who is also fluent in Swedish, conducted a back-translation of the transcripts.

A narrative storytelling approach was selected to analyse the data. This is one perspective that is captured under the framework of narrative analysis (Smith & Sparkes, 2008). First, a narrative analysis was performed to identify key themes. In this step of the analysis, two distinct themes were identified. Second, we selected creative nonfiction for reporting the results of our study (e.g., Richardson, 2000). Creative nonfiction “offers a story using factors developed from systematic research, but uses many of the techniques of fiction . . . to communicate results in compelling and emotionally vibrant ways” (Smith, 2013, p. 135). In line with this definition, some examples of the techniques of fiction are: allusions, composite characters, and contextualized language (Smith, 2013). In this study, the content and form of the story was based on the results from a narrative analysis where the aim of the stories created was to represent the findings of the narrative analysis. Because two distinct themes were identified in the first step of the analysis we decided to create two stories using composite or aggregated characters. Third, in the creation of the stories the participants were invited to provide feedback. The stories were then changed in light of the feedback provided. To enhance the creditability of the stories, the themes that were identified in the narrative analysis were used together with the participants’ real words, phrases, and sentences.

Study II

Ivarsson, A., Johnson, U., & Podlog, L. (2013). Psychological predictors of injury occurrence: A prospective investigation of professional Swedish soccer players. *Journal of Sport Rehabilitation*, 22, 19-26.

Participants.

In the second study, a total of 56 soccer players ($n = 38$ males; $n = 18$ females) from four different teams in the Swedish Premier league participated in the study. Participants ranged in age from 16 to 36 years ($M = 25.05$, $SD = 5.46$). All players were professional and normally practiced 5–7 days per week. The players also played weekly games for the duration of the 8-month season.

Instruments.

Swedish Universities Scales of Personality (SSP).

Trait anxiety was assessed using two subscales, somatic trait anxiety (7 items; e.g., *Sometimes I have irregular heartbeats without any reason*) and cognitive trait anxiety (7 items; e.g., *I have low self-confidence*), from the Swedish Universities Scales of Personality (Gustavsson, Bergman, Edman, Ekselius, von Knorring, & Linder, 2000). Participants responded to items on a 4-point Likert-type scale, ranging from 1 (*not at all*) to 4 (*very much so*). Anxiety subscales from the SSP were selected based on previous research demonstrating good psychometric properties with Swedish samples. Adequate subscale internal reliabilities for somatic trait anxiety ($\alpha = .75$) and cognitive trait anxiety ($\alpha = .82$) were observed in the present investigation. The mean scores for the two subscales were then combined to form an overall average score for trait anxiety ($\alpha = .74$).

Life Events Survey for Collegiate Athletes (LESCA).

The LESCA (Petrie, 1992) was used to measure athletes' history of life-event stressors. The scale is comprised of a list of 69 life events (e.g., *I got married, I have experienced a change in the relationship with my coach*). Athletes were asked to indicate which events they had experienced in the previous 12 months, and then, for each event, to rate the intensity of the stressor on an 8-point Likert-type scale, ranging from -4 (*extremely negative*) to +4 (*extremely positive*). A score for NLES (69 items) was calculated by adding the scores of all the experiences that athletes indicated as negative. Only the negative life event subscale was scored because this variable consistently has demonstrated associations with injury occurrence (Johnson & Ivarsson, 2011; Rogers & Landers, 2005), and few studies have found a relationship between positive life events and injury (Junge, 2000). The LESCA has been used in previous research with similar populations (Johnson

et al., 2005; Johnson & Ivarsson, 2011) and adequate test-retest reliabilities (.76–.84; Petrie, 1992).

The Hassle and Uplift scale.

The Hassles and Uplifts Scale (DeLongis, Folkman, & Lazarus, 1988) was used to measure athletes' levels of daily hassles and uplifts. The inventory consists of 53 items addressing potential daily hassles and uplifts (e.g., family issues, personal responsibilities, work relationships). Athletes were asked to indicate if the situation had been a hassle or an uplifting event over the course of the previous week. Questions were answered on a 4-point Likert-type scale, ranging from 0 (*not at all*) to 3 (*very much*). The Cronbach's alpha for the Hassles and Uplifts Scale was .87 in the present study, a finding consistent with previous research demonstrating an alpha of .82 with athletes from different sports (Fawkner et al., 1999).

Brief COPE.

The Brief COPE (Carver, 1997) was used to measure athletes' coping strategies. The scale comprises 28 items, grouped into 14 subscales: self-blame, self-distraction, active coping, denial, substance use, use of emotional support, use of instrumental support, behavioral disengagement, venting, positive reframing, planning, humor, acceptance, and religion. Items were answered on a 4-point Likert-type scale, ranging from 1 (*I have not used this at all*) to 4 (*I have used it a lot*). Carver (1997) found Cronbach's alphas ranging from .50 to .90. Consistent with previous research (e.g., Mahmoud, 2011), the subscales were divided into two broad categories: adaptive coping (i.e., active coping, use of instrumental support, use of emotional support, positive reframing, planning, religion, humor, and acceptance) and maladaptive coping (i.e., denial, substance use, behavioral disengagement, venting, and self-blaming).

Injury recording.

Based on a nationally used form, the physiotherapists recorded injury data (i.e., injury type, severity, localization, number of days out of practice) for the entire 13-week period of the study. In this study, injury was defined as any physical damage requiring absence from at least one training session or game.

Procedure.

Coaches and physiotherapists from the four participating teams were first contacted by phone and a meeting was arranged at which they received information regarding the study purposes. At this opening meeting, a schedule for the timing and place of questionnaire administration throughout the competitive season was determined. During the first meeting with the team, participants were informed about the study purposes, and informed consent

procedures were conducted. All players included were free from injuries at the beginning of the study. Finally, at the first team meeting, players were asked to complete three out of four questionnaires including the SSP, LESCA, and Brief COPE. Subsequent to the initial meeting, participants completed the Hassles and Uplifts Scale, once per week, for a 13-week period throughout the competitive season. The scale was administered with the assistance of each team's physiotherapists. As daily hassles are a variable that is fluid in nature, repeated measurement enabled a more accurate assessment of changes in athlete perceptions and stressors over time.

Data analysis.

Prior to the statistical analyses were performed the hassle scores for the injured players in this study were calculated by summing the total hassle scores for the 2-week period before the week in which injury occurred. The reason for choosing the two weeks before injury occurrence was that hassle is a state variable that typically fluctuates over time; hence, an athlete experiencing hassle 1 week will not necessarily experience the same level of daily hassle a few weeks later, and injury risk may therefore alter accordingly. For the non-injured athletes, the average scores for all 13 weeks were summed into a single score for hassle.

A path analysis, using Mplus 7.0 (Muthén & Muthén, 1998-2012) with a robust maximum likelihood estimator (MLR), was conducted to investigate the influence of the personality trait (trait anxiety), stressors (i.e., negative life event, daily hassles), and maladaptive coping strategies on injury occurrence. Path analysis is a technique developed to investigate the strength of direct and indirect relationships between manifest variables (Lleras, 2005). A path model can be seen as an extension of a multiple regression because both have their base in the general linear model (GLM) framework (Hox & Bechger, 1998). The difference between the procedures is that a multiple regression can estimate only one response variable at a time, whereas the path analysis could estimate as many variables as the researcher specified in the path model (Lleras, 2005).

To perform a path analysis, the researcher has to develop a specified model. The specified path model for this study is illustrated in figure 2.

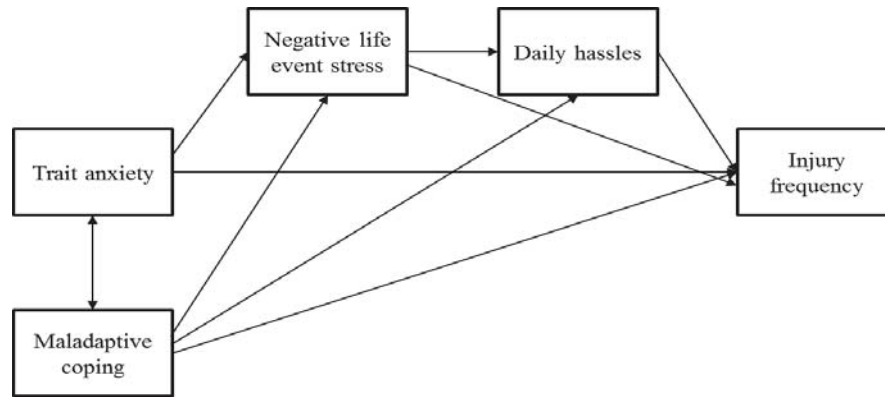


Figure 2. Path diagram of the hypothesized model.

In the model, it is possible to test both correlations and causal relationships (i.e., that one explanatory variable has one effect on an outcome variable). When discussing causal effects, it is important to state that, in a path model, this effect is only statistically tested. Therefore, it is crucial that the path model suggested by the researcher has been grounded in a sound theoretical model (Hox & Bechger, 1998). Also, it is important to state that in order to analyze causes of events (e.g., behaviors, injuries) at least two different observation is needed where the independent variable is measured at T1 and the dependent variable at T2 (McArdle & Nesselroade, 2014).

To evaluate the path model, we used a number of different fit indices. One of the most frequently reported is the χ^2 . The χ^2 is an exact fit index aimed at testing if the path model is different from the null-hypothesis model. The preferred result is that there is a non-significant result from the χ^2 test, meaning that there are no statistically significant differences between the null-hypothesis model and the path model. Other commonly used fit indices are the comparative fit index (CFI), and the root mean square error of approximation (RMSEA). Traditional cut-off criteria (CFI > .90, and RMSEA < .08) were used to indicate acceptable fit (Marsh, 2007). We used methods recommended by Preacher and Hayes (2004) and the Indirect SPSS macro to examine whether negative life events had an indirect effect on injury frequency through the variable of daily hassles.

Mediation analysis is performed to answer the question of how and why an effect between two variables occurs. One way to perform mediation analysis is by using the Sobel test (Sobel, 1982; 1986). The Sobel test is designed to quantify indirect effects, which are defined as the product of: (a) the path between the independent variable and the mediator, and (b) the path between the mediator and the dependent variable (Preacher & Hayes, 2004). The Sobel test does not require the path between the independent and the dependent

variable to be significant, which has been suggested to be a correct assumption for mediational analysis (Zhao, Lynch, & Chen, 2010). Even though the Sobel test has been proven to be a more adequate test procedure for mediation than Baron and Kenny's (1986) procedure, one major shortcoming with the Sobel test is that the data must have a normal sample distribution (Hayes, 2009). The problem is that the distribution is rarely symmetrical (Bollen & Stine, 1990). In order to decrease the symmetry problem, several researchers (e.g., MacKinnon, 2008; Preacher & Hayes, 2004) have suggested using bootstrapping to test for indirect effects. The bootstrapping could be explained by the following sentence: "bootstrapping generates an empirical representation of the sampling distribution of the indirect effect by treating the obtained sample of size n as a representation of the population in miniature" (Hayes, 2009, p. 412). More specifically, bootstrapping is a re-sampling method where the collected data is considered as a distribution from where a large number of random samples are drawn. During this procedure the "probability of selection for any given case remains equal over every random draw (Mallinckrodt, Abraham, Wei, & Russell, 2006, p. 373) The major advantage of bootstrapping in comparison with the Sobel test is that the inference is based on an estimate of the indirect effect without any claims about the sample distribution (Hayes, 2009; Preacher & Hayes, 2004).

Study III

Ivarsson, A., Johnson, U., Lindwall, M., Gustafsson, H., & Altemyr, M. (2014). Psychosocial stress as a predictor of sport injuries in elite junior soccer: A latent growth curve analysis. *Journal of Science and Medicine in Sport*, 17, 366-370.

Participants.

In the third study the participants were 101 junior elite soccer players ($n = 67$ males; $n = 34$ females) ages between 15 and 19 years ($M = 16.7$, $SD = 0.86$). The players were high school students from four schools in total that had soccer programs. All four high schools were certified by the Swedish Soccer Association. The players practiced between 4.5 and 20 hours of soccer/week ($M = 11.22$, $SD = 3.22$) during the study period. At the beginning of 2012, all players included in the study were injury free and in full training.

Instruments.

For this study The Hassles and Uplifts Scale was used. For information about this scale see description for study 2.

Injury recording.

Based on a nationally used form, the athletic trainers for each school recorded injury data (i.e., injury type and severity, number of days out of practice), for the entire 10-week period of the study. In this study, injury was a condition defined by meeting the following two criteria: (a) it occurred as a result of participation of an organized soccer practice or game and (b) it resulted in restriction of the player's participation, in soccer activities, for three days or more beyond the day of injury.

Procedure.

The data collection took place between February and April, 2012 (i.e., pre-season). Coaches from the participating schools were first contacted by telephone, and a meeting was arranged where the coaches received information regarding the purposes of the study. At this opening meeting, a schedule for the timing and place of questionnaire administration throughout the season was determined. Participants were informed at this first meeting about the aims of the study; informed consent procedures were conducted. Finally, at the initial meeting, players were asked to complete the Hassles and Uplifts Scale (DeLongis et al., 1988). Subsequent to the initial meeting, participants completed the Hassles and Uplifts Scale weekly for a 10-week period throughout the pre-season. The scale was administered with the assistance of each school's coach. Because daily hassles is a dynamic variable (i.e., it is fluid in nature), a repeated-measures design enabled a more accurate assessment of athletes' perceptions and stressors than using just one single measuring point would because of changes over time.

Data analysis.

The use of longitudinal designs in psychology research, aimed to investigate change, has increased during the last years (Kwok, Underhill, Berry, Luo, Elliot, & Yoon, 2008). To analyze longitudinal designs, a number of different analyses have been used (Bollen & Curran, 2006; Singer & Willett, 2003). Some examples, which have been used in recent research in sport and exercise psychology, are analysis of variance (ANOVA, both one-way, factorial, repeated measures, and various combinations of those), multivariate analysis of variance (MANOVA), multilevel modeling (MLM) and latent growth curve analysis (LGCM). The procedure that is most commonly used for the analysis of repeated measure designs in sport and exercise psychology is repeated measure ANOVAs (R-ANOVA; Stenling, Ivarsson, & Lindwall, in press). The R-ANOVA procedure focuses on the factor means that are based on group-level information (i.e., inter-individual variance; Liu, Rovine, & Molenaar, 2012). Using LGCM to analyze research questions involving change has a distinct advantage over other models, such as repeated measure ANOVAs, because it is possible to investigate both inter-

and intra-individual change (Duncan & Duncan, 2004). In LGCM the manifest variables (the variables that are measured on multiple occasions) will, together, generate two latent variables, intercept, and slope. These latent variables could predict an outcome such as injury occurrence. Hence, LGCM includes a powerful and flexible methodology to model intra-individual changes, inter-individual differences in intra-individual change, and how levels and true change may predict other outcomes. Because we are interested in investigating both inter- and intra-participant variances in hassles and uplifts over a period of time, the LGCM analysis better suits our aims.

In the present study, LGCM were fit to data using Mplus 7.0 (Muthén & Muthén, 1998-2012) with a robust maximum likelihood estimator (MLR). The reason for using this approach is that we were interested in investigating how both levels and inter- and intra-individual changes influence injury risk. The baseline model contained one latent factor of level (i.e., the athlete's initial value of psychosocial stress at week 1), one latent factor of change (i.e., the athlete's change trajectories in daily hassles across the 10 measurement points, one per week for 10 weeks), and one dependent categorical factor, injured/non-injured. Also, we estimated the variance across the means both for level and change to evaluate if there were inter-person differences concerning levels and changes in daily hassles.

One potential problem in data analysis with repeated measures is the issue of controlling for missing data (e.g., dropout). The missing data could be divided into two broad categories: missing at random and non-ignorable dropout (Muthén, Asparouhov, Hunter, & Leuchter, 2011). Whereas missing at random data could be controlled by functions in different analysis programs—for example, by maximum likelihood estimation or multiple imputations—the non-ignorable dropout has received less attention in psychological studies (Enders, 2011). The non-ignorable dropout could be present, for example, in survival studies where the primary endpoint is the time of an event such as disease or death (Hogan & Laird, 1997). Injury could be conceived as an endpoint event, and because the present study focuses on injury prediction, only the data prior to injury are of interest. Therefore, all data post-injury should be discussed as non-ignorable dropout. A pattern-mixture model was used to estimate a growth model for hassles, intercept, and slope, and influence on injury risk, with binary dummy dropout indicators used as covariates. This specific model is used to specify the dropout indicators' influence on growth factors (Muthén et al., 2011). The following fit indices were used: (a) chi-square statistics; (b) the Bentler comparative fit index (CFI); and (c) RMSEA (with 90% CI). Traditional cut-off criteria (CFI > .90, and RMSEA < .08) were used to indicate acceptable fit (Marsh, 2007).

Study IV

Ivarsson, A., Johnson, U., Andersen, M. B., Fallby, J., & Altemyr, M. (in press). It pays to pay attention: A mindfulness-based program for injury prevention with soccer players. *Journal of Applied Sport Psychology*.

Participants.

The participants were 41 male ($n = 31$) and female ($n = 10$) junior elite soccer players, aged between 16-19 years ($M = 16.97$, $SD = 0.79$). All the participants were recruited from one Swedish soccer high school that is certified by the Swedish Soccer Association. The participants engaged in soccer activities (i.e., practice, games) between 10 and 18 hours a week. Of the participants, 17% played at the senior elite level (first or second team in an elite club), whereas 41% belonged to senior squads in clubs that played in different competitive levels (3rd to 6th division). The rest of the players (42%) competed at the highest junior level in Sweden.

Instrument.

Injury recording.

Based on a nationally used form, the athletic trainers for each school recorded injury data (i.e., injury type and severity, number of days out of practice), for the entire 6-month period of the study. In this study, injury was a condition defined by meeting the following two criteria: (a) it occurred as a result of participation of an organized soccer practice or game and (b) it resulted in a restriction of the player's participation, in soccer activities, for three days or more beyond the day of injury.

Procedure.

To gain access to the players, we contacted the high school soccer coach and arranged a time and a place for a meeting. At the meeting, the coach gave us permission to present the study to the student athletes. All players were then informed about the study design and the ethical standards. All players who agreed to take part in the study signed an informed consent form. *In loco parentis* consent was received from the coach and dean for all players who were under 18 years of age (a common and accepted practice for research with 16- and 17-year-old participants in Sweden). All players were, at the beginning of the season (January), matched in pairs based on gender and on previous injuries. The players in the pairs were then randomly assigned to either the treatment ($n = 21$) or the control group ($n = 20$). The treatment group took part in a 7-session mindfulness program based on the Mindfulness Acceptance Commitment (MAC) approach, and the control group was offered 7 sessions of sport psychology work-shops on team psychology with a particular focus on soccer. Prior to the first session/work-shop, both groups

were divided into three smaller groups containing 6-7 participants. All sessions took place in classrooms at the soccer team's high school. Between January and June, all injuries that occurred were recorded by the high school's athletic trainer and reported to the researchers.

Intervention programs.

Treatment group (mindfulness and acceptance practice).

The program for each session was developed based on the MAC approach (Gardner & Moore, 2007). The MAC approach is, according to Gardner and Moore (2012), based on a combination of mindfulness-based cognitive therapy (e.g., Segal, Williams, & Teasdale, 2002) and acceptance and commitment therapy (ACT; Hayes, Strosahl, & Wilson, 1999).

Mindfulness has been described as "openhearted, moment-to-moment, non-judgmental awareness" (Kabat-Zinn, 2005, p. 24). During the last couple of years, mindfulness studies, conducted in a variety of different disciplines, have shown similar results. Several studies that have shown that mindfulness practice can positively influence both individuals' appraisals of stressful situations (e.g., Weinstein, Brown, & Ryan, 2009) and their stress responses (e.g., Cozolino, 2010). More specifically, studies have shown that mindfulness practice will target similar structures in the brain that stress does, such as the neural networks in the frontal cortex (Cozolino, 2010). Some studies have shown that mindfulness practice has been found to change the activation in the structures of the brain that are related to attention (Fox, Corbetta, Snyder, Vincent, & Raichle, 2006; Hölzel et al., 2007). Along the same lines, Jha, Krompinger, and Baime (2007) found that participation in an 8-week mindfulness-based stress reduction course enhanced performance in directing attention to specific subsets of possible stimuli. Another research finding is that participation in an 8-week mindfulness program can produce a right-left shift in the medial prefrontal cortex, which corresponds with moving from avoidant and anxious responses to curiosity and approach modes and a general lowering of anxiety (for a review see Hölzel et al., 2011). These prefrontal changes, coupled with hippocampal modifications, helped to down-regulate activation in the amygdala (the flight, fight, or freeze center; see Cozolino, 2010; Goldin & Gross, 2010) leading to weaker stress responses.

As previously mentioned, ACT also shares features with the MAC program. The MAC program is related to ACT through the implementation of and discussion about value-driven actions as well as cognitive flexibility (Gardner & Moore, 2007). Also, ACT has been found to decrease levels of stress, along with lowering the risk of burnout symptoms, in a number of studies (e.g., Brinkborg, Mechanek, Hesser, & Berglund, 2011; Flaxman & Bond, 2010).

The participants in the mindfulness treatment condition met in their smaller groups (6-7 per group), once weekly, for 45 minutes. The first author, who has

expertise in sport psychology and mindfulness, delivered the program. All sessions started with a short introduction to a specific topic in line with the topics presented in the MAC manual (Gardner & Moore, 2007). During the rest of the time, short talks about the mechanisms of the MAC approach were combined with discussions between the participants regarding their own reflections on the topics of the session. All sessions also contained experiential mindfulness exercises. More details of each session are provided in Table 3 (see appendix 2). At the end of each session, the participants were given a homework assignment (e.g., listen to an audio file with a mindfulness exercise) that was sent electronically to each player's e-mail address. During the program, all athletes in the group were encouraged to listen to their audio recorded mindfulness exercises at least 3 days a week.

Control group (sport psychology work-shops).

The participants in the control condition met on the same schedule as the participants in the mindfulness condition. Their weekly sessions also lasted for 45 minutes. During these sessions a sport psychology consultant gave presentations about sport psychology topics that were relevant to soccer. The main focus of the topics selected was group psychology (e.g., team communication, team cohesion). The reason for selecting this focus was to ensure that there was minimal overlap between the topics relevant for mindfulness training (e.g., concentration, relaxation, self-regulation). An overview of the topics for the control-group sessions is provided in Table 3 (see appendix 2).

Data analysis.

Because the data were substantially skewed (i.e., a majority of the players reported 0 injuries), the non-parametric Mann-Whitney U test, equivalent to the parametric independent t test was used to investigate if there was a statistically significant difference in injury frequency between the treatment and the control group. A result where $p < .05$ was considered statistically significant but the p value was not the focus of this investigation, as argued by Ivarsson et al. (2013) regarding clinical significance. For an extended discussion about the problems associated with using the p value for evaluating research see page 17 in the introduction of this dissertation.

Cohen's d effect size, with an approximated confidence interval (CI) of 80%, was calculated for illustrating the magnitude of the effect between the two groups. To calculate the Cohen's d effect size for the non-parametric U test, the z value was first transformed into a point-biserial correlation effect size (r_{pb}) using the formula $r_{pb} = z/\sqrt{N}$. Then the effect size estimate r_{pb} was used to calculate the Cohen's d value, by the formula $d = 2r/\sqrt{(1 - r_{pb}^2)}$ (see Ivarsson et al., 2013). The Cohen's d effect size was then adjusted to account

for the potential sampling error variance (for formulas, see Vacha-Haase & Thompson, 2004).

Study V

Ivarsson, A., Stambulova, N., & Johnson, U. (2015). *Injury as a career transition: Experiences of a Swedish elite handball player*. Manuscript submitted for publication.

Participant.

The single participant of this study was a 26-year-old former handball player (we will call him Rob). At the age of 25 he had to terminate his elite handball career due to multiple knee (ACL) injuries. During Rob's handball career he spent five years as a professional player in Germany. For a period of six years he also played for the Swedish national team.

Interview.

A low-structured interview guide consisting of open-ended questions and requests for information concerning Rob's handball career was used. After he had described his career, more focus was directed towards his two ACL injuries. During this part of the interview, Rob was asked to describe the time before, during, and after the injuries occurred. Rob was also asked to describe the rehabilitation process and its outcomes. Rob's thoughts and emotions associated with these specific times were of special interest. Examples of questions were: "Can you recall the time prior to when the injury occurred?" "What were your thoughts, and how did you feel in the beginning of your rehabilitation?", and "What kind of support did you receive during the first weeks of your rehabilitation?" Additional questions and probes were added to fill out the narratives.

Procedure.

The participant was contacted by mail and, after showing interest, the first author made phone contact. During the phone conversation, the participant was informed about the objectives of the study, the ethical issues (i.e., concerning a right to withdraw from the study at any time and that all data were to be treated with confidentiality). The participant decided on the time and place for the first interview. Before the interview started, the participant was again informed about the objectives and ethics of the study. After the first interview was performed, and the first author had listened through the recorded material, a time and place for a follow up interview was scheduled. In the second interview the first author asked questions complementing and expanding on the information from the first interview. During both interviews the first author followed the recommendations of Smith and Sparkes (2008, p.

220) and “acted as an active listener in an attempt to assist the participant to tell his life story in his own way with his own words.” Both interviews were digitally recorded and transcribed. The first interview lasted for 180 minutes, and the second lasted for 35 minutes.

Data analysis.

The narrative oriented inquiry model (NOI; Hiles & Čermak, 2008) was used to guide the research process from the formulation of the research objectives through to the interpretation of narratives. In our study, the *holistic content* (i.e., creating interpreted core narratives) and the *categorical content* (i.e., identifying themes permeating the narratives) *analyses* were selected to complement each other in the interpretation process. In addition, the NOI suggests two major principles of narrative research – transparency and reflexivity – that were followed in this study. Following the *principle of transparency* in the data treatment and interpretation below, we described the analyses in a step-by-step manner.

(1) A working transcript was created by transcribing the two interviews into a raw transcript that was divided into segments (self-contained episodes). During this process, the transcripts were read several times by the first author to gain a deeper understanding for the participant’s stories.

(2) The first author re-read the transcript several times in an attempt to explore how different segments in the text linked different parts of the story together into a core narrative describing Rob’s career (*the holistic content analysis*). Themes permeating Rob’s career development were then identified within the career narrative (*the categorical content analysis*). The career narrative and themes were then translated from Swedish (language of the interview) to English.

(3) Two groups of segments related to Rob’s injury experiences were re-read. We identified four phases in the chronologically organised injury stories; these phases became the structure for two injury experience narratives (*the holistic content analysis*). Themes permeating each phase in the two injury narratives were identified (*the categorical content analysis*) and relevant translations were made.

(4) The first drafts of the three narratives (career, injury one, and injury two) and relevant themes were critically discussed with the second and the third authors, and some reinterpretations were made to better interpret the participant’s meanings.

(5) All three narratives were presented to the participant and, based on his feedback, some additional adjustments of the themes were made.

(6) Finally, the themes relevant to injury experiences were summarised in table 5.

Ethical considerations for all studies

For all studies the participants were informed about the purpose of the study and that they were free to withdraw from the study at any point, regardless of the reason. They were also informed that participation was voluntary, and the confidentiality of their responses was assured. All participants signed an informed consent. For players under 18, the coaches signed a separate informed consent. All of the studies included in the dissertation project were authorised and approved by an institutional ethics committee for human studies.

Table 2

Method overview of the two studies included in the dissertation

	Study I	Study II	Study III	Study IV	Study V
Design	Retrospective	Prospective	Prospective	RCT, longitudinal	Retrospective
Participants	The participants consisted of the total population of female players ($N = 18$), competing in the Swedish women's elite league, who suffered a total ACL tear during the 2012 season.	56 ($n = 38$ male, $n = 18$ female) Swedish Premiere League soccer players. Participants ranged in age from 16 to 36 years.	The participants were 101 (67 males and 34 females) Swedish junior elite soccer players. The participants ranged in from 15 to 19.	Participants were 41 male ($n = 31$) and female ($n = 10$) junior elite soccer players, aged between 16-19 years.	One 26 years old former handball player that at the age of 25 had to terminate from elite handball due to multiple knee injuries
Instruments	Interviews	Swedish Universities Scales of Personality (SSP), Life Events Survey for Collegiate Athletes (LESCA), Brief COPE and Hassle and Uplift Scale	Hassle and Uplift Scale	Experimental group = Mindfulness practice Control group = Sport psychology lectures	Interview

Procedure	All players were interviewed post-season, on average six months after the day of an ACL-injury occurrence, using a semi-structured interview guide.	Participants completed SSP, LESCA and Brief COPE in the beginning of the study. Subsequent to the first meeting, participants also completed the Hassle and Uplift Scale once per week for a 13-wk period throughout the competitive season. Injury data were registered continuously by team physiotherapists during the study period	Participants completed the Hassle and Uplift Scale once a week for a 10-week period. Injury data were registered continuously by athletic trainers during the study period	The players in the pairs were then randomly assigned to either the treatment ($n = 21$) or the control group ($n = 20$). The treatment group took part in a 7-session mindfulness acceptance based program, and the control group was offered 7 sessions of sport psychology workshops.	One former handball player that had to terminate from sports due to several knee injuries was interviewed about his career using a semi-structured interview guide.
Data analysis	Narrative storytelling approach.	A path analysis was conducted to exam the influence of personality traits (i.e., trait anxiety), state-level stressors (i.e., negative-life-event	Latent growth curve models were used to examine whether the level and change in psychological	A Mann-Whitney U test was used to investigate if there was a statistically significant difference in injury frequencies	The narrative oriented inquiry model was used to guide the research process. The holistic content and the

stress and daily hassles), and coping on injury frequency.

stress could predict the frequency of injury over the 10-week period.

between the treatment and the control group. Cohen's *d* effect size, with approximated 80% CI, was calculated to illustrate the magnitude of the effect between the two groups.

categorical content analyses were selected to complement each other in the interpretation process

RESULTS

In the following section, the main results from each study will be presented along with the aim of the study. For the qualitative studies, only summaries of the results will be presented (for the full results, see article I and V, respectively).

Study I

The aim of the first study was to examine female elite soccer players' experiences of the time prior to the occurrence of an ACL injury. The analyses resulted in the construction of two aggregate case examples that described the players' experiences prior to the occurrence of the ACL injury (Malin's and Sara's). In the stories experiences of fatigue, stress as well as worry was from the players' perspective perceived as potential risk factors for injury.

In Malin's tale, she expresses that she was cognitively, emotionally and physiologically exhausted during the time prior to injury occurrence. She also describes her interpretation of the interplay between cognitive, emotional and physiological states prior to injury occurrence. This interplay between the different states might have increased the risk of injury for Malin.

Sara's tale also presents experiences of both internal and external risk factors prior to the ACL injury. Sara's perceived pressure for a quick comeback, which she experienced as coming from people around the team, was something that she described as one of the main reasons for playing matches even when she was not feeling fully recovered from the previous injury. Not feeling fully recovered was, for Sara, a factor that seems to be related to her attention deficits during matches. Another potential injury risk factor in her story was that she broke up with her boyfriend just a few weeks prior to injury occurrence.

Study II

The aim of this study was to investigate whether personality, stress and coping predicted injury occurrence in an elite soccer population. The path model fit the data well, χ^2 ($df = 1$, $N = 56$) = 0.390; $p = .533$; CFI = 1.00; RMSEA < 0.001. The results showed that 24% of the variance in injury occurrence was explained in the hypothesised model. Of the predictor variables, only daily hassles had a strong, positive relationship with injury frequency ($\beta = .55$, $p < .01$). Moreover, negative life event stress (NLES) had a strong positive relationship with daily hassle ($\beta = .51$, $p < .01$). Trait anxiety showed a direct, positive relationship with NLES ($\beta = .45$, $p < .01$) but showed weak, and not statistically significant, relationships with daily hassles, maladaptive coping or injury occurrence. Maladaptive coping had also minimal and no statistically significant relationship with injury occurrence, daily hassles, NLES, trait anxiety or injury frequency.

To test whether daily hassles mediated the relationship between NLES and injury frequency, the recommendations by Preacher and Hayes (2004) were followed. Their recommendation for mediation testing is to use a bootstrapping procedure to compute a confidence interval around indirect effects (bootstrapped sample = 5000). The result showed that NLES had an indirect effect on injury frequency via daily hassles (95% CI [.0039, .044]). The fact that zero fell outside the interval indicated a statistically significant indirect effect, $p < .05$.

Study III

The objective of the study was to investigate, by use of a latent growth curve analysis framework, whether athletes' individual levels and changes in hassles and uplifts over a 10-week period could predict injury outcome in an elite junior soccer sample.

The baseline model (i.e., the first model tested without controlling for non-ignorable dropout) showed acceptable fit, χ^2 ($df = 58$; $N = 101$) = 119.46; $p < .001$; CFI = .91; RMSEA = .01 (90% CI [.070, .128]). Athletes started with a daily hassles value of 9.11 at week 1 with the reported daily hassles decreasing by an average of 0.24 units every week. The variances for both the level and change factors were statistically significant ($ps < .05$), indicating that participants differed in both initial values (levels) of daily hassles at week 1 and in change trajectories across the 10 weeks (change). The intra class correlation (ICC) showed that 72.7% of the total variability in hassles across the 10 observations was due to between-person variance ($ICC = (97.27 / (97.27 + 36.61)) = 0.727 * 100 = 72.7\%$), highlighting substantial inter-individual differences in the sample. Results of both initial levels of hassles ($\beta = 0.02$, $p = .002$) and changes in daily hassles ($\beta = 0.33$, $p = .004$) were statistically

significant in the prediction of injury. This means that more self-reported hassles at week 1 and less decrease (less positive change) in daily hassles across time were associated with injury occurrence. In the second model, the dropout indicators' influence on growth factors was included. This model demonstrated a very good fit with data χ^2 ($df = 141$; $N = 101$) = 146.56; $p = .36$; CFI = .99; RMSEA = .02 (90% CI [$<.001$, .052]). Injury occurrence was also in this model predicted by both initial level of daily hassles ($\beta = 0.02$, $p = .002$) and change in daily hassles ($\beta = 0.33$, $p = .001$), and the effects were statistically significant. The results showed that the dropout indicators did not statistically influenced the growth factors in the model. For results from the first and the second model with level and change of daily hassles predicting injury, see Table 4.

Table 4

Results from the first and the second model with level and change of daily hassle predicting injury

Parameters of the model	Model 1		Model 2	
	Parameter estimate (SE)	Critical value	Parameter estimate (SE)	Critical value
<i>Means</i>				
Level daily hassle	9.11 (1.22)	8.04**	NA	NA
Change daily hassle	-0.25 (0.14)	-2.08*	NA	NA
<i>Variances</i>				
Level daily hassle	110.38 (18.92)	5.83**	73.61 (12.70)	5.80**
Change daily hassle	0.55 (0.18)	3.08**	0.31 (0.12)	2.69**
<i>Correlation</i>				
Level-change daily hassle	-3.71(0.16)	-2.41*	NA	NA
<i>Regression weights^a</i>				
Level daily hassle → injury	0.02 (0.006)	3.83**	0.02 (0.005)	3.11**
Change daily hassles → injury	0.33 (0.11)	2.90**	0.33 (0.10)	3.44**

Model 1=baseline model; Model 2= model including dropout indicators

Note: * p<.05; **p<.01

^aStandardized regression weights, NA = Not available in the output

Study IV

The aim of the study was to examine the extent to which a mindfulness-based program could reduce the number of sports injuries in a sample of soccer players. The results showed that participants experienced 23 injuries in total during the 6-month study period. The time-loss due to injuries ranged between 4 and 33 days for the participants in the treatment group ($M = 5.57$, $SD = 11.50$), whereas the range in the control group was between four and 89 days ($M = 12.70$, $SD = 21.39$). Of the participants in the treatment group, 14 of 21 (67%) remained injury-free, but only 8 of 20 (40%) in the control group were free of injuries at the end of the 6-month data-gathering period.

The result from the Mann-Whitney U test showed no statistically significant difference in injury occurrence during the study period between the intervention and the control group $U(39) = 149.50$, $z = -1.77$, $p = .077$, but there was a medium effect size, adjusted Cohen's $d = -0.59$ (approx. 80% CI [-0.37, -0.74]). Also, the participants in the treatment group experienced fewer injuries (total = 8) than the participants in the control group (total = 15).

Study V

The aims of the study were: (1) to explore the athlete's career development, injuries within the career and their impact, and (2) to explore in detail the athlete's injury experiences.

Rob's Handball Career.

In Rob's early career, he was highly motivated and serious when it came to both handball and school. At the age of 14, Rob was selected to take part in a national youth training camp where 64 of the best players in the country were invited. During this training camp, Rob got his first ACL injury (the relevant narrative is forthcoming). When Rob made his comeback one year later, everything went very well and during the next couple of years Rob became a professional player and he was frequently selected to play for the National team. After a few years of a high amount of training and matches, and sometimes without sufficient time for recovery Rob's knee and back started to hurt, but he did not do anything about it. Then it was time for the World Cup in Sweden, and Rob was highly motivated to perform well. During the tournament, Rob felt that his knee was not 100% recovered, but he played the matches he had to. There were two weeks left between the end of the tournament and the time when Rob incurred his second ACL injury (the relevant narrative is forthcoming). During the rehabilitation that lasted for

over two years, he tried to come back to handball several times, but it did not work and led Rob to the decision to terminate his career at the age of only 25.

Currently Rob has moved on in life and developed other interests. Several times during the interviews, he stated that even though he is still interested in handball, he does not want to be involved at the moment. Instead, Rob has started a company with a few friends, and he invests a lot of time in it. He has also started university studies and, in general, he is looking at the future optimistically.

The injury processes.

In the second step of the analysis, four phases in the chronologically organised injury stories were identified (pre-injury, injury and first reactions, diagnosis and treatment, and rehabilitation and consequences). These phases formed the framework for two injury experience narratives. Distinct demands, resources, barriers, and coping strategies relevant to each phase were then identified. Themes that describe the psychological content related to each phase of the two injuries (narrative 2 and 3) are presented in table 5.

Table 5

Transition phases and relevant themes in regard of the first and the second injuries

Transition phases	The first injury themes	The second injury themes
Pre-injury	<ul style="list-style-type: none"> -Handball is an important part of the player life -Selected to a national youth training camp -Excited -Many matches during a short period of time -Failure landing generated first pain in the knee 	<ul style="list-style-type: none"> -Tight match schedule -Physical and mental fatigue -World cup preparation -Excited to play in World cup in Sweden -Failure landing generated pain in the knee
Injury and first reactions	<ul style="list-style-type: none"> -Knee collapsed during a training session. -First diagnosis of a knee but not a ACL-injury -Optimism, good luck feeling -A lack of knowledge of what to expect 	<ul style="list-style-type: none"> -Knee collapsed during a training session. -Positive mood and expectations -Belief to do a comeback in 6-8 months as a better handball player.
Diagnosis and treatment	<ul style="list-style-type: none"> -Diagnosis of ACL-injury -Shift in emotions to sadness -Suggestion of conservative treatment with 3 month rehabilitation -Optimistic again 	<ul style="list-style-type: none"> -Setbacks after the injury. -Doubts about a successful comeback -Physiotherapists helped to feel confident. -Surgery -The time after surgery associated with optimism

		<ul style="list-style-type: none"> -The knee was swollen -Anxious and scared that there was something wrong with the knee -New surgery and optimism -Major problems with the knee during the rehabilitation -Recommended to handball training -Felt unsecure that he was ready to do a comeback -At the third training the knee collapsed again -Sadness and anger -New surgery -Changed to a new club -Broke up with his girlfriend -Support from the family -ACL surgery -The surgery did not improve his knee function -Termination of his handball career
Rehabilitation and consequences	<ul style="list-style-type: none"> -Comeback to handball -In the first match the knee collapsed again -New rehabilitation process -Negative emotions, pain -Not able to do things the way he was used to in everyday life -Support from family and friends -Successful comeback -Stronger player than before the injury 	

DISCUSSION

The findings from all five studies included in the dissertation will be jointly discussed. Methodological considerations, theoretical and practical implications, and recommendations for future studies will be included in the discussion.

Sport injuries as a systemic phenomenon

Based on the findings, it is suggested that injuries have a transitional nature within an athlete's career development. In study V, four distinct phases were identified during the injury transition process. In all four phases, different psychological phenomena (i.e., demands/challenges, coping processes, resources used, experienced barriers) were experienced by the athlete. Even though several studies have acknowledged that an athlete could go through different phases during the injury process (e.g., Ruddock-Hudson, O'Halloran, & Murphy, 2014), few studies have discussed that different demands/challenges could be present in different transition phases. The section of the discussion will focus more specifically on the demands/challenges associated with each of the four phases identified in the injury process. Because four of the five studies, included in the dissertation, had a pre-injury focus a majority of the discussion will be targeting this specific phase.

In the *first identified phase* (pre-injury), several potential injury prediction variables were investigated. Coping with those risk factors is discussed as one major challenge in this phase. The most distinct finding from all of the prediction studies is that stress is a variable that is associated with an increased risk of becoming injured (see study II and III). This idea is also supported by the results from Study I in which both Malin and Sara experienced strong stress reactions prior to their injuries occurring. The reasons for their reactions are different in the two stories, but they are related to both inter- and intra-personal aspects. That different factors might cause stress reactions for athletes has been suggested in several studies. For example, Hanton, Fletcher,

and Coughlan (2005) found that stressors could be assigned to different categories such as environmental, personal, leadership and team issues as well as performance issues. These stressors might lead to both psychological as well as physiological stress reactions. In the discussion about stress, two of the studies highlighted daily hassles as an important stress variable to focus on (study II and III). These results are in line with Fawkner et al. (1999), who found that an increased level of perceived hassles was related to an increased injury risk. These findings support the suggestion that an accumulation of minor stressors might have a substantial impact on injury risk. Looking at the stress process from a neuropsychological point of view, research has shown that exposure to stress may change the brain's neurological networks (e.g., Fuchs & Flugge, 2003; McEwen, 2000, 2008). The communication between the left and right cerebral hemispheres could be inhibited when a person is exposed to constant stressors. This change in the network structures could lead to decreased communication between the brain areas that process affect and cognition. A diminished communication between these two networks might increase the risk of poor decision-making during competition because it is associated with a decrease in cognitive processing (Cozolino, 2010). Another potential explanation for the link between chronic stressors and injury risk is that accumulated stress can remodel hippocampal neurons as well as the medial prefrontal cortex (McEwen & Gianaros, 2010, 2011), which, in turn has been shown to correlate with impairments in cognitive flexibility and decision making (Cerqueira, Pego, Taipa, Bessa, Almeida, & Sousa, 2005; Liston, Matalon, Hare, Davidson, & Casey, 2006). In both cases, the athlete experiences a decreased ability in making adequate decisions. Decreased ability in making decisions is related to an increased injury risk (Gabbett, Ullah, Jenkins, & Abernethy, 2012).

As mentioned earlier, athletes can experience different type of stressors (i.e., processive or systemic; Anisman, 2014) that might have an effect on different mechanisms that, in turn, can increase the risk of becoming injured. In previous research, as well as in the discussion above, the main focus has been on processive stressors. One reason for the frequent use of study designs that includes cognitive appraisal is that most studies have been based on the model of stress and athletic injury in which the cognitive processes are central.

Even though some of the results from the studies included in the dissertation acknowledge the impact of processive stressors, systemic stressors could also be related to an increased injury risk. For example, both Rob (study V) and Malin (study I) described that, prior to injury, they experienced a massive physical load. This heavy physical load, together with limited recovery time, is suggested to increase the risk for psycho-physiological reactions, such as fatigue (Lehman et al., 1998; Richardson et al., 2008). It is speculated that Rob and Malin experienced an imbalance between (physical) stress and recovery, which led to signs of fatigue. Even though they

experienced this physio-psychological reaction, they chose to ignore stressors and neglect recovery. According to Richardson et al. (2008), such behaviours increase the risk for becoming injured. One explanation for the potential impact of fatigue on injury risk is that high fatigue levels have been found to influence the brain's abilities to suppress irrelevant information (Chaudhuri & Behan, 2000). This decreased ability in selecting relevant information is associated with an increased tendency to make decisions based on irrelevant information (Faber, Maurits, & Lorist, 2012). A diminished selective attention increases the risk of reacting reflexively to stimuli in the environment (Boksem, Meijman, & Lorist, 2005), which will increase the risk of becoming injured (Borotikar, Newcomer, Koppes, & McLean, 2009). Another potential explanation for the relationship between fatigue and injury risk is that fatigue will make muscles and tendons more prone to strain injuries (e.g., Thacker, Gilchrist, Stroup, & Kimsey Jr, 2004).

Focusing on the other psychological factors that previous research has highlighted as potential predictors of injuries, the results from the studies showed weak support for the suggested direct relationships. The suggestion of a direct relationship between personality (i.e., trait anxiety) and injury occurrence was not supported in study II. Instead, it was shown that trait anxiety had an indirect relationship with injury risk through stress. This finding is in line with the findings reported by Ivarsson et al. (2015a), who found personality traits to have an indirect relationship with injury rates through stress responses (i.e., peripheral vision narrowing). Also, Sara's story in study I suggests that anxiety (in this case re-injury anxiety) might increase the likelihood for strong stress responses. One potential explanation for the weak, direct link between trait anxiety and injury occurrence is that a personality trait will not always cause a stress reaction, but it will make an athlete more or less predisposed to experience a specific situation as stressful. For example, if athletes have high levels of trait anxiety, they are likely to experience more situations as stressful. This line of argument is supported by research that has shown that high levels of anxiety are related to increased amygdala activation. High amygdala activation may correlate to increased selective attention to threat (Bishop, 2007), which may increase the likelihood of the person experiencing more situations as stressful. It is, therefore, suggested that trait anxiety can predispose an athlete to stronger stress responses and, through that indirect influence, injury risk.

Based on previous research, coping is suggested to be related to sport injuries. This finding was not replicated in our studies (see study II). One potential explanation for the failure to find the link between coping and injury occurrence could be the complexity of coping behaviours and reactions. Given that coping strategies are closely related to psychological responses to specific situations, the use of just one baseline measure, might lead to an incomplete picture of the player's actual coping strategy in a specific situation. Because

coping is suggested to be a process that fluctuates over time (Nicholls & Polman 2007), we probably did not grasp this in the second study where coping was measured at only one occasion.

Because stress was found to be associated with an increase in injury risk, we designed a study to test if a mindfulness- and acceptance-based intervention could decrease injury risk (study IV). In the light of Cohen's and other researchers' (e.g., Cohen, 1994; Gigerenzer, 2004; Loftus, 1996) arguments about the differences between statistically significant and practically/clinically significant results, we argue that the study produced some promising findings (adjusted Cohen's $d = .59$). This result suggests that the intervention could reduce the amount of injury to an extent that would be meaningful for soccer athletes, coaches, and sport administrators. Considering the substantial impact that injuries could have on athletes (e.g., Hagger et al., 2005; Stambulova et al., 2007), clubs (e.g., Ekstrand, 2013) and community (e.g., de Loes, Dahlstedt, & Thomée, 2000), all preventive interventions that could contribute to decreased injury rates should be of interest to the sport community. The results from this study are also in line with previous research findings where most of the intervention studies have shown meaningful levels of injury reductions in the intervention group (Mean Hedges $g = 0.70$; Ivarsson et al., 2015a).

There could be several explanations why the mindfulness- and acceptance-based intervention was successful in reducing injuries. One of the potential explanations is that mindfulness practice has been found to down-regulate amygdala activation (Cozolino, 2010). Such down-regulation of amygdala activation is related to decreased magnitude of stress response. Given that stress and the magnitude of the stress response will influence injury risk, mindfulness training might decrease this risk. Another potential explanation for the effectiveness of the intervention could be that mindfulness practice has been related to functional changes in the brain's attention systems (Fox et al., 2007; Hölzel et al., 2007). These changes can lead to increased capacity to pay attention to relevant cues in the environment (Cozolino, 2010). Because previous research has found peripheral vision narrowing to be a predictor of sport injuries (Rogers & Landers, 2005), increased attentional abilities might decrease injury risk. The explanation for this explanation may be that attention and executive functions are closely related with humans' abilities to select goal directed behaviors through, for example, paying attention towards important information (Clacy, Sharman, & Lovell, 2013). To be more correct in the selection of behaviors that meet the demands for a specific situation might be associated with a decreased injury risk.

One interesting aspect concerning the intervention studies performed in this area is that they have used different intervention programs (e.g., cognitive-behavioural therapy, psychological skills training, mindfulness and acceptance training) leading to similar results. Several potential explanations

for this finding are to be found. First, research has shown that the specific techniques used in therapy do not account for much of the potential effects of the treatment. Several meta-syntheses, comparing results of meta-analyses from different psychotherapy perspectives (e.g., general psychotherapy, CBT, psychodynamic psychotherapy), has shown similar therapeutic effects between the various treatments (Lipsey, & Wilson, 1993; Shedler, 2010). Research has suggested that it is, instead, the common factors (e.g., the quality of the therapeutic relationship) that are present in all psychotherapy models that will probably have a substantial impact on outcomes (e.g., Andersen & Speed, 2010; Rogers, 1992; Tryon & Tryon, 2010). One of the factor's that has gained the most attention in the literature is the quality of the relationship between the therapist and the client. If it is a high quality, non-judgmental relationship where the client feels comfortable to talk about anything, it is more likely that the intervention will have an effect compared to a lower quality interpersonal relationship (e.g., Andersen & Ivarsson, 2015; Mannion & Andersen, 2015; Schore, 2014). This relationship is found in both face-to-face as well as e-based intervention studies (e.g., Knave & Maercker, 2007; Sucala, Schnur, Constantino, Miller, Brackman, & Montgomery, 2012). To increase the likelihood of establishing such relationships, the participants in the intervention study (study IV), in both conditions, were divided into smaller groups. In designing the intervention, attention was directed towards creating exercises that stimulated the participants to share their experiences with the other participants in the room. During all of those mindfulness-based exercises, researcher/leader tried to establish dialogues with the participants to facilitate the quality of the relationship.

Another potential explanation is that almost all interventions have, to some extent, used some type of psychological skills training (e.g., relaxation, stress management) that targets stress responsivity. Such training programs could potentially have similar effects on brain function as mindfulness and acceptance training do. It is, therefore, speculated that changes in brain function could be the mediating factor in all of the successful psychologically-based interventions that have been performed within the field of sport injury prevention.

In the *second identified phase* (injury and first reactions), one of the major challenges seems to be the ability to cope with both the new situation (e.g., being injured and not being able to practice) and the pain that often is associated with severe injuries. Such challenges can have negative emotional consequences for some athletes, whereas others almost immediately adjust and get on with their rehabilitation (e.g., Mainwaring, Krasnow, & Kerr, 2001). In Rob's story, it is clear that he had a positive attitude towards both injuries. Having a positive attitude is a reaction that previous studies discuss as an effective coping strategy (e.g., Johnson, 1997).

In the *third identified phase* (diagnosis and treatment), one of the major demands is to get the right diagnosis. Even though Rob was a professional player, he got different diagnoses from different medical professionals. One interesting aspect when it comes to Rob's emotions during this phase was that they were related to the perceived status of his knee. Because an athlete's mood could influence the quality of the rehabilitation process (e.g., Santi & Pietrantonio, 2013), it is important to monitor mood changes during this period.

One of the major challenges in the *fourth identified phase* (rehabilitation and consequences) is motivation in following the rehabilitation program. Staying motivated, even when there are setbacks in the rehabilitation process (described in both Rob's injury narratives), is essential in this phase. To stay motivated, it is important to use effective coping strategies, such as searching for effective problem solutions and being goal-oriented (e.g., Carson & Polman, 2008). Another challenge that also interferes with an athlete's abilities to stay focused on the rehabilitation plan is coping with stressors other than the injury. In Rob's case, he ended his relationship with his girlfriend and changed clubs during this phase of his second ACL injury. Experiencing major life events or several transitions at the same time is closely related to an increased stress level and coping may require substantial external support and internal resources (e.g., Stambulova & Wylleman, 2014). The last challenge in this phase is about making a comeback at the right time. In elite sports there are many internal and external pressures to make a comeback as soon as possible after an injury. Sara (in study I) described the stress she felt because her coaches and teammates pushing her to comeback fast. Also, in Rob's story similar experiences are present. Being both mentally as well as physically ready is important for increasing the odds of a successful comeback to sport (Johnson, Ivarsson, Karlsson, Häggglund, Waldén, & Börjesson, 2015; Podlog & Eklund, 2007). To sum up, the ability to stay motivated while following the rehabilitation program, and coping with the specific challenges and demands that the athlete experiences during the different phases, are important for increasing the likelihood of a successful rehabilitation.

Methodological reflections

One strength of the dissertation project was gained by being based on a mixed-method approach. By applying a mixed-method approach in research it is possible to "draw from the strengths and minimize the weaknesses" (Johnson & Onwuegbuzie, 2004, pp. 14-15) of traditional approaches (e.g., qualitative and quantitative). In this dissertation project, the mixed-method approach has given us opportunities to explore the injury phenomenon from different viewpoints. Also, using a mixed method approach made it, in this project, possible to use multiple approaches to answer the research questions

of interest. Using this mixed-method approach made it possible to gain increased knowledge in the area of psychology and sport injuries.

In the following paragraphs the most important methodological reflections (i.e., strengths and limitations) for each study will be presented. For an extended summary of methodological reflections, see the articles.

Studies I & V.

The first potential limitation is that the interviews were carried out after the season ended, and memory recall may have been less accurate in relation to injuries occurring earlier, rather than later, in the season. Nevertheless, because the brain constantly modifies our perceptions and memories and, therefore, also, the stories we tell about specific experiences (Cozolino, 2010), it is the *current truth* that we were able to grasp in our interviews. Second, because the authors were responsible for constructing the aggregated cases, their interpretations and biographies are reflected within the results. Readers should be aware of these issues when reading and interpreting the results. Third, because the approach is essentially idiographic and retrospective, no causal relationships could be established between the variables of interest.

Study II.

First, that the sample size was relatively small is considered as one limitation with the study. This limitation might have influenced different aspects of the SEM procedure. As one example, research has suggested that small sample may influence the accuracy of the fit indices (e.g., Fan, Thompson, & Wang, 1999).

Second, although the physiotherapists used a standardised assessment form for determining injury occurrence and severity, inter-clinician variance in injury evaluation may have influenced determinations regarding injury occurrence.

Third, that the researchers did not instruct the physiotherapists to withhold preventive treatment in instances where physical findings of concern were evident may have influenced the number of injuries reported.

Fourth, that a path analysis is just a statistical procedure to investigate suggested variable interactions. It is, therefore, important to state that the model and hypothesis are based on previous research.

Concerning the methodological strengths of the study is one advantage that the mediation analysis was that it was performed in a longitudinal mediation process (Selig & Preacher, 2009). It is more accurate to talk about time dependent relationships between variables when using a longitudinal mediation process because the different variables are not measured at the same time.

Study III.

One potential limitation is that our participants consisted of only junior elite soccer players, which may limit the possibility of generalising the results to other levels and groups of soccer players. Another potential problem could be that the players who incurred injuries were non-ignorable dropouts because it could be expected that the injured players would differ in the measured variables from the other players. This issue was statistically controlled for in the model by using the procedure recommended by Muthén et al. (2011). We note, however, that even if a statistical procedure was used to control for non-ignorable dropout, it could still be a potential bias for the results. Finally, the study involves a rather small number of participants, which could be a limitation. A power analysis, based on the effect size of the RMSEA (MacCallum, Browne, & Sugawara, 1996), was performed to help counter this problem. The power analysis showed sufficient power for the number of participants in the study.

Study IV.

A few limitations should be addressed in relation to the fourth study. First, all participants were students at the same soccer high school, and there might be a problem with cross-contamination between the participants in the two groups that, in turn, could have decreased the magnitude of the differences in injury occurrence between the groups.

Second, the result was not statistically significant (according to our pre-specified cut-off for statistical significance). Nevertheless, numerous researchers besides Cohen (1990) have stressed that *p* values are problematic (e.g., highly dependent on sample size; Kruschke, 2013), largely uninformative, and have little, if anything, to say about the real-world meaning of the results (e.g., Cohen, 1994; Gigerenzer, 2004; Loftus, 1996; Wilkinson, 2014). To interpret the real-world meaning of the result, we followed the recommendations of Andersen, McCullagh, and Wilson (2007), who emphasised that test statistics (e.g., mean values, effect sizes, difference scores) should be discussed in light of the study's context, and the context here is the psychological, medical, emotional, and financial costs of sport injuries.

Third, because the quality of the relationships between practitioners and clients has been shown to influence a variety of intervention outcomes (e.g., Andersen & Speed, 2010), and that two different consultants delivered sessions for the two conditions (experimental and control), the different deliveries between each condition may have influenced the quality and types of interactions in each group.

Fourth, even though determining what is clinically significant has been suggested to be important when discussing the meaningfulness of intervention results (see Wilkinson, 2014), this procedure is not without concerns. Because

establishing clinical significance is a subjective procedure, where the researcher interprets the statistics in relation to the context, (e.g., Welsh & Knight, 2015) this process could be highly influenced by the researcher's biases.

Fifth, that there were no formal checks of how many times the participants in the intervention group practiced the recorded mindfulness exercises they were given is a limitation because the amount of practice might have influenced the results.

Despite these limitations, a few strengths should also be addressed in relation to the design of the study. First, the intervention was based on an RCT design. By applying an RCT design, it might be possible to decrease the potential impact of confounders that could influence the results (e.g., Shadish et al., 2002). Second, before the players were enrolled into one of the conditions (experimental or control group), they were matched on previous injury histories for the 6 months prior to the study starting. Because previous injuries have been found to increase the risk for new injuries (Hägglund, Waldén, & Ekstrand, 2006), this matching procedure may decrease the impact of this variable on the results. Third, to increase the chance of evaluating the "true" effectiveness of the intervention program, an active control condition was included in the study. Including an active control condition is suggested to account for the potential influence of the expectancy effect on the results (e.g., Green, Strobach, & Schurbert, 2014).

Practical implications

In this dissertation, the injury transition process is shown as heterogeneous in the sense that, during the four phases, injured athletes might experience specific psychological content (e.g., demands/challenges, coping strategies, resources, barriers). Athletes, sport psychology consultants, coaches, and members of the sport medicine teams might benefit from being made aware about specific demands and barriers relevant to the different phases of the injury transition process. If the sport community gained knowledge of the different challenges/demands and barriers that athletes are facing, both inside and outside sports, which could influence cognitions and behaviours, the likelihood of developing adequate resources to face the challenges would increase. One way to achieve increased knowledge is through education. Perhaps the most important group to target in such education is coaches. In Swedish coach education today, both in soccer and in handball, almost no time is spent on topics related to sport injuries and how to help athletes not only make comebacks from injuries but also to help prevent injuries from happening in the first place. Below, the most important recommendations working in each of the phases of the injury process are presented.

To potentially address issues in the *pre-injury phase* (i.e., to prevent an injury), it is important to help athletes cope with the stressors in sport and everyday life. We know, for example, that relatively threat-free environments and relationships that are secure and caring with non-contingent positive regard may down-regulate cortical and subcortical stress circuits (Cozolino, 2010), which may affect subsequent injury risk. It is important for the coach and medical team to develop a climate in which the players feel secure to talk freely. In the work of developing these environments, coaches and medical teams can model caring, curious, compassionate, and non-judgemental approaches to sport. Also, several psychological intervention strategies, such as mindfulness and acceptance based training (see study IV), psychological skills training (e.g., Johnson et al., 2005) and cognitive-behavioural therapy (e.g., Perna et al., 2003) were shown to be successful in different athletic samples in decreasing injury rates through improved stress management skills and decreased magnitudes of stress responses.

Another important aspect for athletes to focus on to prevent sport injuries is to schedule (and adhere to) decent time for recovery from past injuries. As described before, imbalance between stress and recovery is a risk factor for injuries. By adjusting the recovery to match the stress load may lead to a decreased injury risk (Richardson et al., 2008).

In the *injury and first reaction phase*, the most important tasks might include providing emotional support to deal with pains/negative emotions, and clarifying the situation so that athletes are better informed when coping with uncertainty.

During the *diagnosis and treatment phase*, athletes might need help with accepting their injuries, taking control over the situation, and planning for rehabilitation after diagnosis is established and major treatment (e.g., surgery) is done. One useful strategy, based on the literature, is goal setting, with short-term as well as long-term goals for the rehabilitation period, that is formulated in collaboration with the help of medical experts (Johnson et al., 2015).

In the *rehabilitation and consequences phase*, it is important to work on preventing and dealing with the setbacks that might occur. Staying motivated is essential in this phase (Wierike, van der Sluis, van den Akker-Scheek, Leferink-Gemser, & Visscher, 2013), and some positive imagery exercises (e.g., visualizing a successful comeback or how the body is getting stronger) might be useful (Cupal & Brewer, 2001). Other intervention strategies that have been found to be facilitative for the rehabilitation process are stress management and cognitive control (Johnson, 2000), relaxation (Cupal & Brewer, 2001), and confidence building in performance capabilities (Podlog, Dimmock, & Miller, 2011).

Theoretical implications for future research

The combined results from the studies in this dissertation highlight the importance of considering the complexities of injury phenomena. Some of the findings are in line with the ones suggested in the theoretical frameworks for both pre- and post-injury, but some of them are not. To capture this complexity, including within- and between-person changes in psychological variables as well as different transition processes, a few recommendations for future studies is suggested.

First, in the theoretical models (e.g., the model of stress and athletic injury) the athlete's cognitive appraisals of the situation are suggested to be associated with the level of perceived stress. This approach is one way to investigate the stress concept. Nevertheless, it is also warranted to acknowledge the balance between physical load and recovery that, also, can produce stress reactions and may, in turn, increase the injury risk for an athlete through, for example, increased poor decision making and generalised muscle tension. This psychophysiological perspective should also be included in pre-injury studies.

Second, more studies should focus on investigating mechanisms that mediate or moderate the relationship between stress levels and injury risk. Up to now, a number of studies have found stress to be related to increased injury risk, but few studies have investigated the mechanisms that stress could affect. For example, high levels of perceived stress are associated with changes in the activation of the brain's various subsystems (e.g., amygdala; Cozolino, 2010). This increased activation will, in turn, be correlated with the magnitude of the stress responses. Strong stress responses are, in turn, suggested to increase the risk for injury (e.g., Borotikar et al., 2009; Rogers & Landers, 2005). This recommendation is also directed towards prevention studies where researchers should investigate potential mediating variables between interventions and injury outcomes.

Third, to gain extended knowledge in the research area, it is recommended that researchers use a systems theory approach. Most of the theoretical frameworks that have been used until now are rather narrow. By using a systems theory approach, it will be possible to include a career development perspective into future studies. Such an approach combines individualism and holism into one comprehensive system (Bunge, 2003). In the area of modern systems theory, a number of core principles have been suggested, for example: "multiple levels of analyses at multiple time-scales", "concepts and models on non-linear dynamic systems", and that "small differences in beginning states can have a large impact on subsequent outcomes" (Pickel, 2011, p. 245). The parts of a system interact in complex ways to create wholeness, and investigating wholeness rather than pieces of the whole is a fundamental concept. Having the suggestions from Schack and Hackfort (2007) in mind (e.g., that an athlete is embedded within several dynamic systems that are

interacting and changing together), most studies in sport injury research do not address this complexity issue.

Conclusions and future studies

The aforementioned limitations notwithstanding, findings from the studies indicate the importance of stress as a key predictor of sport injuries. Stress is, in the studies, viewed as having several causes (not just processive stressors), and this is one important concept to include in future studies. Even if stress seems to be the main variable, it is suggested that it is, rather, a cluster of variables (both personal and social) that interact with one another to predispose the athlete to injuries. In light of these arguments, it is recommended that future research include a systems theory perspective when investigating sport injuries. In line with this suggestion, it is also important to emphasise discussing sport injuries as, not only, a process that is embedded in the athlete's career, but also, to consider the injury itself as a process. Moreover, because stress seems to be a key variable on which to focus, intervention programs should be designed to target the stress process (e.g., mindfulness-acceptance-based programs). It is also important to emphasise that sufficient time for recovery might be a preventive strategy.

It is also important to acknowledge that, in the rehabilitation process after an injury, there can be several phases with different challenges/demands that injured athletes will face. It is, consequently, important for both the coach and the sport medicine team to be able to change the strategies during the process to help the athlete meet the specific challenges/demands.

To create an environment that has the knowledge of how to help the athlete during the full injury transition process, education is essential. It is, therefore, suggested to incorporate this information in a module in coach, as well as sports medicine, education.

Concerning methodological issues, previous sport injury research from a psychological perspective has focused, in general, on analyses where mean values are the base for the analysis procedures. Mean values and trends may mask highly relevant between-person heterogeneity in terms of change and associations across time (both from a theoretical, as well as, an applied perspective). Using analytical approaches that treat individuals who *stick out* and deviate from the mean as errors and noise in the data might lead to a risk of missing valuable information needed to understand the mechanisms behind sport injuries. It is suggested that investigating individual differences and within-person changes, as well as relationships between within-person changes in different variables linked to sport injuries, is needed.

The ability to pay attention to relevant stimuli is suggested to be one important task for athletes to increase the chances of adequate decision-making as well as decrease the risk of becoming injured. By learning how to

deal with stress, athletes could increase the probability of focussing on things that happening right here, right now. We should, therefore, help athletes develop skills that help them make adequate decisions based on relevant information, both inside and outside sport. This approach may, we hope, help them stay relatively injury free and happy during their careers.

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Table 1

Overview of the studies found in the literature search

Article	Type of publication	Sport type	Age group	Sample size	Participants receiving treatment	Variables included in analyses
Andersen & Williams (1999)	J	Mixed	Adolescent	196	N	HoS, SR
Blackwell & McCullagh (1990)	J	Football	Adolescent	105	N	HoS, Pers, C
Bond et al. (1988)	J	Swimming	Adults	33	N	NPers
Brink et al. (2010)	J	Soccer	Adolescent	53	N	HoS
Bum (1998)	T	Mixed	Adults	320	N	HoS
Byrd (1993)	T	Mixed	Adolescent	113	N	HoS, Pers, C
Coddington & Troxell (1980)	J	Football	Adolescent	114	N	HoS
Cryan & Alles (1983)	J	Football	Adolescent	151	N	HoS
Devantier (2012)	J	Soccer	Adults	87	N	HoS, Pers, C
Edvardsson et al. (2012)	J	Soccer	Adolescent	27	Y	I
Fawkner et al. (1999)	J	Mixed	Adults	98	N	HoS
Fields et al. (1990)	J	Running	Adults	40	N	Pers

Galambos et al. (2005)	J	Mixed	Adolescent/ Adults	845	N	HoS
Gunnoe et al. (2001)	J	Football	Adolescent	331	N	HoS
Hanson et al. (1992)	J	Track and field	Adolescent	181	N	HoS
Hardy & Riehl (1988)	J	Mixed	Adolescent	86	N	HoS
Hicks (1993)	T	Football	Adolescent	78	N	HoS
Ivarsson & Johnson (2010)	J	Soccer	Adults	48	N	HoS, Pers, C
Johnson (2011)	J	Mixed	Adults		N	HoS, Pers, F, C
Johnson et al. (2005)	J	Soccer	Adults	32	Y	I
Johnson & Ivarsson (2011)	J	Soccer	Adolescent	108	N	HoS, Pers, C
Keller et al. (2013)	J	Tennis	Adolescent	60	N	NPers
Kerr & Goss (1996)	J	Gymnastics	Adolescent	24	Y	I
Kerr & Minden (1988)	J	Gymnastics	Adolescent	41	N	HoS; Pers
Kleinert (2007)	J	Mixed (study 1) Football (study 2)	Adults Adolescent	293 1021	N N	Pers Pers
Kolt et al. (2004)	J	Gymnasts	Adolescent	20	J	I
Kolt & Kirkby (1996)	J	Gymnasts	Adolescent	162	N	Pers

Kolt & Roberts (1998)	J	Field Hockey	Adult	50	N	Pers
Kontos (2004)	J	Football	Adolescent	260	N	HoS
Krasnow et al. (1999)	J	Dance	Adolescent	65	N	HoS
Lavallée & Flint (1996)	J	Mixed	Adults	55	N	Pers
Lysens et al. (1986)	J	Mixed	Adolescent	99	N	HoS
Maddison & Prapavessis (2005)	J	Rugby	Adults	470 (study 1), 64 (study 2)	N (study 1), Y (study 2)	HoS, Pers, C I
Nigorikawa et al. (2003)	J	Mixed	Adolescent/ Adults	2164	N	Pers
Noh et al. (2005)	J	Dance	Adolescent	105	N	HoS; Pers, C
Noh et al. (2007)	J	Dance	Adolescent	35	Y	I
Osborn et al. (2009)	J	Ice hockey	Adults	18	N	Pers
Passer & Seese (1983)	J	Football	Adolescent	104	N	HoS
Patterson et al. (1998)	J	Dance	Adults	46	N	HoS, C
Perna et al. (2003)	J	Rowing	Adolescent	34	Y	I
Quarrie et al. (2001)	J	Football	Adults	258	N	HoS
Rogers & Landers	J	Football	Adolescent	171	N	HoS, C, SR

Table 3

Description of the Topics for the Intervention and Control Groups' Sessions

Session	Intervention	Control
1	<p>Topic: Education/information about the theoretical and practical aspects of the intervention.</p> <p>Content:</p> <ul style="list-style-type: none"> - The participants were informed about the ethical guidelines for the study as well as the structure for the full MAC program. - Presentation of the definition of mindfulness and the content of the MAC approach, based on the first chapter in Gardner and Moore (2007). - Discussion about thoughts and emotions related to the participants' best and worst performance. - Mindfulness exercises (e.g. mindful breath). 	<p>Topic: Short introduction to sport psychology. During the session a broad introduction to sport psychology was delivered including examples of different psychological concepts (such as goal setting and self-efficacy).</p>
2	<p>Topic: Introduction to mindfulness and cognitive defusion.</p> <p>Content:</p>	<p>Topic: The psychology of soccer. In this presentation information about the psychological variables (e.g., perception) that are central in soccer was presented. This</p>

	<ul style="list-style-type: none"> - Discussion about the participants' reflections of the last session. - Short presentation about thoughts and cognitive schemes. - Discussion- about the participants' experiences of schemas both within and outside sports. - Mindfulness exercises. 	session was based on the book <i>Look at the Game</i> (Alm & Fallby, 2010).
3	<p>Topic: Introduction to values and values-driven behaviors.</p> <p>Content:</p> <ul style="list-style-type: none"> - Discussion about the participants' reflections of the last session. - Short presentation of the relation between goals, values, and behaviors. - Discussion about the differences between values-driven vs. emotion-driven choices. - Mindfulness exercises. 	Topic: Group dynamics. The 5-step model of group development was presented. In the presentation concepts as roles, communication, norms, and rules were included and discussed in relation to team performance. Also psychological aspects of team cohesion were presented.
4	<p>Topic: Introduction to the concept of acceptance</p> <p>Content:</p> <ul style="list-style-type: none"> - Discussion about the participants' reflections of the last session. - Short presentation of the acceptance concept. - Discussion about the differences between 	Topic: Group dynamics. The participants did some brief exercises with focus on teamwork. These brief exercises were based on MTA. After the exercises discussions about their performance in the exercises were held.

	acceptance and avoidance. The participants were encouraged to describe situations where they had experienced avoidance.	
5	<ul style="list-style-type: none"> - Mindfulness exercises. <p>Topic: Introduction to how to work to enhance commitment.</p> <p>Content:</p> <ul style="list-style-type: none"> - Discussion about the participants' reflections of the last session. - Presentation of the concepts <i>motivation</i> and <i>commitment</i> and their relationships to <i>behaviors</i>. - Discussion about the difference between motivation and commitment. - Reflection of what behaviors that are related to commitment. - Mindfulness exercises. 	<p>Topic: The concepts of talent development. The focus of this lecture was to provide information about important aspects to consider when working with talent development. More specifically, different studies within the area of talent development research were presented.</p>
6	<p>Topic: Introduction to how to combine mindfulness, acceptance, and commitment in practice</p> <p>Content:</p> <ul style="list-style-type: none"> - Discussion about the participants' reflections of the last session. - Practical exercise (see p. 161-162 in Gardner & Moore, 2007). 	<p>Topic: Motivation. The focus of this lecture was to describe central aspects of motivation and how this will influence us both in sports and in everyday life.</p>

	<ul style="list-style-type: none"> - Discussion about if and how the players had started to integrate the topics we had discussed in previous sessions within their lives (both inside and outside sport). - Mindfulness exercise. 	
7	<p>Topic: Discuss how to maintain and enhance mindfulness, acceptance and commitment.</p> <p>Content:</p> <ul style="list-style-type: none"> - Discussion about the participants' reflections of the last session. - Discussion about the possibility to integrate mindfulness into the participants' soccer practice. - Written and oral evaluation of the program was held. - Mindfulness exercise. 	<p>Topic: Summary of the topics that had been presented during the previous weeks. Written evaluation of the sessions.</p>