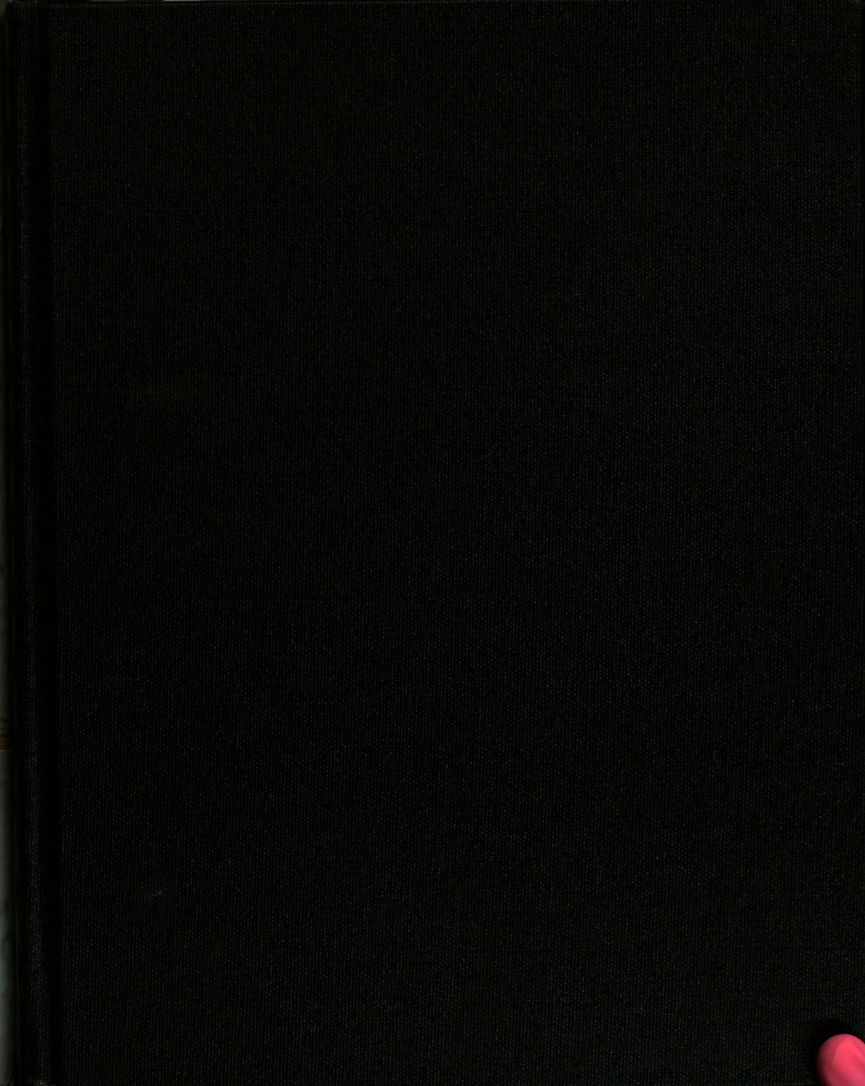




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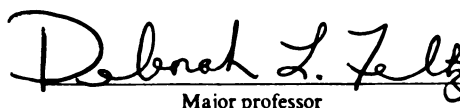
THE EFFECTS OF PERCEIVED RISK OF INJURY,
RISK-TAKING BEHAVIORS, AND
BODY SIZE ON INJURY IN YOUTH SPORT

presented by

Anthony Paul Kontos

has been accepted towards fulfillment
of the requirements for

Ph.D. degree in Kinesiology


Major professor

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**THE EFFECTS OF PERCEIVED RISK, RISK-TAKING BEHAVIORS,
AND BODY SIZE ON INJURY IN YOUTH SPORT**

By

Anthony Paul Kontos

A DISSERTATION

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ABSTRACT

THE EFFECTS OF PERCEIVED RISK OF INJURY, RISK-TAKING BEHAVIORS, AND BODY SIZE ON INJURY IN YOUTH SPORT

BY

Anthony Paul Kontos

This study examined perceived risk of injury, risk-taking behaviors, perceived ability, body size and injury among 253 (142 male, 111 female) competitive and recreational soccer players aged 11 to 15 years. All psychological variables were assessed at the beginning of the season using self-report measures. Body weight and height were obtained using a field anthropometer and digital weight scale. Prospective injury data were recorded for matches and practices during an 8-week soccer season. A confirmatory factor analysis (CFA) for the Risk of Injury in Sports Scale (RISSc) supported the six-factor, hierarchical structure previously reported by Kontos, Feltz, and Malina (2000). Results of an exploratory factor analysis (EFA) for the Risk-Taking Behaviors Scale (RTB) supported a two-factor solution involving 9 of the original 12 items. Participants high in body mass index (BMI: kg/m^2) reported higher levels of perceived risk on the General and Overuse factors of the RISSc. Perceived ability was positively related to scores on the RTB, suggesting that more confident athletes engage in more risk-taking behaviors. An inverse relationship between the RISSc and RTB was found only among athletes who overestimated their abilities (compared to coaches' ratings). In support of previous research (King et al., 1989), girls reported significantly higher levels of

perceived risk of injury across all factors of the RISSc than did boys. Boys reported engaging in significantly more risk-taking behaviors than did girls, supporting the findings of Morrongiello and Rennie (1998). As expected, the number of previous injuries was positively related to scores on the RISSc. A total of 2,686 exposures, 21 injuries, and 35 nuisance (i.e., player returned to play the following day) injuries were recorded, resulting in an injury incidence (non-nuisance) rate of 7.8 injuries/1000 exposures. The 21 injuries resulted in a total of 197 days of time loss for the injured athletes. As predicted, most injuries were to the ankle and knee, and were the result of contact with another player during a match. One-half of all recorded injuries were attended to either by a coach or parent. Case-control analyses revealed that BMI and an under-estimation of ability were significant risk factors for injury. The discussion examines implications of the findings, directions for future research, and provides support for a new developmental model of injury for youth sports.

To my wife and parents:

Danna, Mom, and Dad

"You are only as strong as those around you."

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"Do or do not. There is no try."

-Yoda

I could not have 'done' were it not for the following individuals:

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"When trying to reach our goals, sometimes it can feel like we are in a boat far from shore. We look up and see the shore off in the distance and feel as though we are making no progress, and before we know it, we have lost our focus on paddling, thus making little progress. On the other hand, if we keep our head down and focus on each stroke, soon we look up and find ourselves on the shore."

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CHAPTER I

INTRODUCTION

Statement of the Problem

Imagine two 13-year old soccer players, Rob and Jim. Both athletes are on the same team, and are considered by their coach to be of equivalent skill level. However, Rob perceives little risk of becoming injured while playing soccer, and consistently engages in risk-taking behaviors on the field such as slide-tackles, diving headers, and collisions with opponents. Jim, on the other hand, is overly concerned with being injured while playing soccer. In fact, he tries to avoid altogether contact situations on the field, such as tackles and contact with physically larger opponents. Which young athlete is more likely to be injured: (a) Rob, who perceives little risk of getting injured in sport and engages in risk-taking behaviors; or (b) Jim, who perceives a high probability of injury in sport and avoids risk-taking behaviors? What are the factors that might influence Rob's decision to engage in risk-taking behaviors, and Jim's decision to avoid such behaviors? Most importantly, do these thoughts about being injured and subsequent decisions to engage in risk-taking behaviors directly influence the injury process?

The answers to these questions are complicated by the athletes' perceptions of their capabilities, or self-efficacy. Using a social-cognitive framework, Bandura (1997) has argued that an individual's self-efficacy, the estimation of one's ability at a given activity, sets the foundation for subsequent perceptions and behaviors. As such, young athletes' estimations of their ability in a particular sport may influence their perceived risk of injury and decision to engage in risk-taking behaviors. Therefore, one could postulate that Jim has a lower level of self-efficacy that underlies his higher perceived

risk of injury and decision not to engage in risk-taking behaviors. In contrast, Rob may perceive himself to be high in ability in soccer, and be unconcerned with risk of injury, and therefore, confident to engage in risk-taking behaviors. In either case, it is the athletes' perceptions, not the coach's, that are most salient within a social-cognitive framework.

The perceived risk of injury and risk-taking behavior relationship is further confounded by the influence of biological factors. For instance, in a previous study that I conducted (Kontos, Feltz, & Malina, 2000), a seventh grade football player was 4 feet 9 inches (1.45 m) in stature and weighed 90 lbs. (40.9 kg). In contrast, another player in the study was 6 feet 3 inches (1.90 m) in stature and weighed over 240 lbs. (109 kg)! Both players played on the same middle school team, and could potentially collide during play. This disparity in body size and body mass index (BMI: kg/m^2) could influence adolescent athletes' thoughts and behaviors in sports. Therefore, going back to the example of Rob and Jim, it is possible that their body size and BMI may affect their perceived risk of becoming injured and approach to risk-taking in sports. An athlete's gender may also play a role in perceived risk of injury and risk-taking behaviors. Hence, BMI and gender may function as moderators in relation to perceived risk of injury and risk-taking behaviors.

Understanding the effects of the preceding factors on injury in adolescent athletes is important for sport psychologists, coaches, parents, and athletes to address. However, researchers have yet to examine the construct of perceived risk of injury in sports, or assess directly the link between perception of risk of injury and risk-taking behaviors. Further, the potential effects of estimation of ability, physical size, and BMI on perceived

risk of injury, risk-taking behaviors, and injury outcomes are unknown. Thus, this study examined the inter-relationships among perceived risk of injury, risk-taking behaviors, estimation of ability, body size, gender, and injury in adolescent athletes. Perceived risk of injury, as it is being used in the present study, represents one's perception of the probability of incurring an injury. This concept does not include components of fear or worry nor does it pertain to the objective assessment of risk (Sheehy & Chapman, 1986). These components may also have relationships to risk-taking behaviors and injury outcomes, but are beyond the scope of this study.

Nature of the Problem

Unintentional injuries constitute a major health concern among children aged 1 to 19 years (Rodriguez, 1990). The risk of unintentional injury, in general, peaks in adolescence (Scheidt et al., 1994), when children are susceptible to engaging in risk-taking behaviors (Morrongiello & Rennie, 1998). Risk-taking behaviors typically include such everyday activities as running into a street and playing with sharp objects (e.g., Morrongiello & Rennie, 1998), or jumping a ramp with a bicycle and swimming in deep water (Potts, Martinew, & Dedmon, 1995). It is logical to postulate that a similar trend in risk-taking behaviors exists among adolescents participating in sports. This suggestion is reinforced by the fact that the proportion of serious injuries resulting in long term or permanent disability or disfigurement that occur as a result of sports participation among athletes aged 10 to 13 years is significantly higher than for any other age group of youth athletes (Bijur et al., 1995).

Current estimates place the number of young athletes participating in sports in the U.S. at over 45 million (Bijur, et al., 1995). Many sports are year-around endeavors,

increasing the amount of exposure to injury young athletes like Rob and Jim receive from training, practices, and competition. As a result of these increases in participation and exposure, disparities in physical size, and greater likelihood for engaging in risky behaviors, adolescent athletes are seemingly at greater risk for injury than younger or older youth athletes. Concomitantly, approximately 2.9 million youth sport injuries occur annually in the U.S. (Bijur et al., 1995). The need to address further the underlying factors influencing the injury process among adolescents is evident. The framework for examining these factors should be constructed from a psychobiological perspective, as both psychological and biological (e.g., body size) factors play a role in injury.

Psychological factors. The paucity of research on perceived risk in sport necessitates a review of the research from personality and social psychology on the related concept of fear. Fear refers to a learned emotional reaction to a specific perceived danger. Typically, fear has been examined using self-report measures that have covered a wide array of general fears such as failure and criticism, the unknown, minor injury, danger, and medical fears. In psychological literature, fear also has been studied among children and adolescents (e.g., King et al., 1989; Ollendick & King, 1994). A positive relationship between fear and age, up to 12 years, was found in one sample of adolescents (Ollendick & King, 1994). A similar trend was reported, though with less magnitude, among a similar group of adolescents (King et al., 1989). Both studies reported a negative trend in self-reported fears beginning in adolescence. Together, these findings suggest that fear increases with age up to 12 years, after which it decreases throughout adolescence and into adulthood. However, these findings were for children across a relatively large age span (6-18 years). In contrast, these findings were not supported in a

study of 11 to 15 year old youth athletes (Kontos et al., 2000), which indicated no significant differences in perceived risk of injury in sports by age. The restricted age range of the latter study may have influenced these contrary findings. Therefore, in the current study, which was limited in age (11-14 years), age differences in perceptions of risk were not anticipated.

Unfortunately, researchers (e.g., King & Ollendick) examining fear have provided few explanations regarding the developmental nature of fears in childhood and adolescence. One could speculate that as young children become more aware of their environment, they realize that certain events present a potential danger. The increasing prevalence of these events throughout childhood results in greater numbers and generalization of fear. This is compounded by the fact that young children are limited in their capabilities to rationalize and affect their fears. As children enter adolescence (11-15 years) and gain more social and familial experience, they may realize that they possess the capabilities to deal with many previously uncontrollable fears (e.g., meeting others, being criticized by parents). Further, adolescents are also cognitively able to debunk many fears that were previously thought in childhood to be legitimate (e.g., the dark, ghosts). Subsequently, both the number and magnitude of fears decreases from adolescence into adulthood.

The results of King et al. (1989) and Ollendick and King (1994) also suggest that females are more “fearful” than males. Similarly, results of our study indicated that females had significantly higher perceived risk of injury scores than males (Kontos et al., 2000). However, males are injured more often in sport than females (Taimela et al., 1990). Together, these trends suggest that, although males report fewer fears or

perceived risk, they may incur more injuries than females. These findings may, however, reflect differences in socialization such that males may tend to report higher risk-taking behaviors and females may more honestly report perceived risk of injury.

Researchers have yet to examine the relationship between perceived risk of injury in sport and injury incidence among athletes. Morrongiello and Rennie (1998), however, examined self-reported injury-risk behaviors, and injury attributions and vulnerability among 6, 8, and 10 year old youth. A picture depicting either a smiling or upset (i.e., frowning) young child on top of a playground slide was shown to participants. Participants were then asked to describe the child in depicted in the picture. They were also asked to determine how likely they were to be injured performing a variety of activities. The authors' assessment of perception of risk represented children's fears about the situation rather than their actual perceived risk of injury. Unlike the current study, these authors did not use an athletic sample for study and did not prospectively measure injury outcomes. Nevertheless, their results suggest that boys report engaging in significantly more risk-taking behaviors than girls. Additionally, children with higher risk-taking scores attributed injuries more to luck than to their actions or the actions of others, and believed themselves to be less likely than peers to become injured. In contrast, children who reported fewer risk-taking behaviors rated themselves as more likely to be injured than their peers (Morrongiello & Rennie, 1998). This offers support for the notion that young athletes who have a low perceived risk of injury may actually engage in more risk-taking behaviors, thus exposing themselves to greater risk of injury. However, the authors of this study did not assess other potentially moderating factors such as perceived ability or confidence.

The contention of a negative relationship between the perceived risk of injury and injury put forth by Morrongiello and Rennie (1998) is in contrast to Bandura's (1997) suggestion that athletes who perceive a situation as risky are low in self-efficacy and have a higher anticipation of failure, and greater potential for injury. Therefore, one could assume that perceived risk of injury is positively related to injury. However, Bandura (1997) extends this theory to suggest that some individuals may, in fact, be over-efficacious. This over-efficacious estimation of ability is, in turn, related to a lower perceived risk of injury and a more "reckless," attitude toward sports. These individuals may develop a sense of invincibility based on their overestimation of their abilities and may engage in more risky and potentially injurious behaviors (Bandura, 1997). This overestimation of ability has been demonstrated in children 9-12 years of age (Chase, Ewing, Lirgg, & George, 1994). Therefore, an overestimation of one's abilities in a particular sport and a concomitant inaccurate perceived risk of injury may lead to more risk-taking behaviors and a greater probability for injury. For example, a young football player, who overestimates his abilities and inaccurately perceives playing football to be a low risk activity may engage in behaviors on the field that place him at a high risk for injury. To assess this relationship, an examination of the accuracy of athletes' perceptions of their abilities compared to an objective measure of their abilities must be made.

Self-efficacy theory states that individuals high in self-efficacy or estimation of ability, accurate or otherwise, are inherently more confident in the outcomes of their behaviors (Bandura, 1997). As a result, athletes who estimate their abilities to be high in a particular sport would be likely to believe that their behaviors in that sport will lead to positive outcomes. As injury is a negative outcome, these athletes may believe that due to

their high ability they are unlikely to be injured from engaging in risk-taking behaviors. Hence, athletes with high estimations of their abilities in a sport would be more likely to engage in risk-taking behaviors than would athletes with low estimations of their abilities. In summary, an inaccurately high estimation of ability may be related to low perceived risk of injury, and subsequent high levels of risk-taking behaviors and likelihood for injury. Consequently, it is likely that an accurate perception of risk of injury is associated with an appropriate level of risk-taking and injury. Further, a high estimation of ability, regardless of accuracy, may be positively related to risk-taking behaviors and injury. The key in determining these relationships is linking perceived risk of injury, to estimation and overestimation of ability, and subsequent risk-taking behaviors.

Finally, it is vital to understand the directional nature of the relationship between perception of risk of injury and risk-taking behaviors proposed in this study. Earlier, theoretical support was provided for three relationships: (a) an inverse relationship between perceived risk of injury and risk-taking behaviors for those athletes who overestimate their ability, (b) a positive relationship between estimation of ability and risk-taking behaviors, and (c) a positive relationship between risk-taking behaviors and injury. I propose that an athlete's perceived risk of injury will interact with his previous risk-taking experiences to influence his decision to engage in future risk-taking behaviors. In contrast, Horvath and Zuckerman (1993) suggest that perceptions of risk result from experiences in risk-taking. It would seem to make sense that both assertions are partially correct. In other words, athletes' perceptions of risk and decisions to engage in risk-taking behaviors interactively influence each other. From the predominately

correlational evidence provided by researchers (Smith et al., 1992; Morrongiello & Rennie, 1998), it is difficult to ascertain whether perceived risk influences risk-taking behaviors or vice versa. In the current study, the examination of perceived risk of injury and risk-taking behaviors in a sport context will provide an initial assessment of this previously unexamined relationship. However, it will not allow for a determination of direction of influence from perceived risk to risk-taking behaviors. This study's participants, adolescent-aged athletes who are just beginning to explore risk-taking behaviors, will likely not be affected by the influence of previous risk-taking behaviors, as suggested by Horvath and Zuckerman (1993).

Williams and Andersen (1988, 1998) have proposed that previous injuries influence future likelihood for injury. While both the number and severity of previous injuries are probable antecedent factors influencing risk of injury, I propose that athletes' previous experiences with injuries will influence their perceived risk of injury and subsequent risk-taking behaviors. More specifically, I postulate that the number of previous injuries will be positively related to perceived risk of injury.

Body size. The above mentioned psychological factors may be very useful in predicting an athlete's likelihood for injury. However, psychological factors alone account for only one piece of the injury puzzle. Clearly, other factors play a role in determining an athlete's potential for injury. Researchers have long suggested that environmental and biological factors are equally important in assessing risk for injury (Bergandi, 1985; Taerk, 1977). Of particular relevance in studying a physically diverse population, such as adolescent athletes, are factors related to body size. For example, Rob and Jim may differ in their perceptions of risk of injury and risk-taking behaviors

because Rob is physically larger, and potentially has a different BMI than Jim. In support of this contention, researchers have found evidence that BMI and body size are useful predictors of injuries among adolescent athletes (Gomez et al., 1998; Steele & White, 1988). However, neither of these studies has provided conclusive evidence for such a relationship.

Currently, most sports are organized based exclusively on chronological age (CA: Malina & Beunen, 1995). However, there is tremendous variation in weight and stature within the same CA (Malina, 1996). This is particularly relevant in the period of adolescent growth (females- ages 11 to 13 years; males- ages 12 to 15 years), when individuals display the greatest disparities in weight, stature, and strength due to variations in growth rates and maturity timing (Malina & Beunen, 1995). As a result, in many contact sports like hockey, soccer, and rugby, where collisions are not an uncommon occurrence, there is the potential for a 13-year old 200 lb. (90.8 kg) athlete to collide with a 13-year old 100 lb. (45.4 kg) athlete. An exception to this approach, is the approach adopted by many youth football organizations, which takes into account weight or maturity as well as CA (Caine & Broekhoff, 1987). While the benefits of ‘maturity matching’ remain to be demonstrated empirically, the implementation of such programs is sensible, however, uncommon. Therefore, in the current world of CA-based age groupings for sports, further investigation of the effects of differences in body size in relation to perceived risk of injury, risk-taking behaviors, and injury is warranted (Malina, 1996).

In the current study, I speculated that disparities in height, weight, and BMI among adolescent athletes might influence their perceptions of risk of injury and

decisions to engage in risk-taking behaviors in sport. Adolescent athletes who are heavy and relatively shorter (i.e., high BMI) are likely to be less agile and, thus, perceive themselves to be awkward and susceptible to injury in a sport such as soccer. In contrast, adolescent athletes with low or moderate BMIs are likely to possess more agility and skill level in soccer. Therefore, I hypothesized that athletes with high BMIs would have higher levels of perceived risk of injury and engage in fewer risk-taking behaviors than those athletes with low or moderate BMIs. Gomez et al. (1998) suggest that athletes low in BMI lack muscular development and may be at greater risk for injury than athletes of moderate to high in BMI. They also suggest that athletes high in BMI are more likely to incur lower extremity injuries. However, the generalizability of these suggestions, which were based on a study of offensive linemen in football, is questionable. Further, Gomez et al. (1998) did not examine perceptions or behaviors in their study. As such the assessment of the relationship between BMI and injury in this present study was exploratory. I did not propose any specific relationships between height and weight and perceived risk of injury, risk-taking behaviors, and injury.

Purpose of the Study

Researchers have yet to examine how young athletes' perceived risk of injury in sports might affect their risk-taking behaviors and subsequent injury outcomes. Moreover, while a link between perceived risk of injury and risk-taking behaviors has been proposed by researchers (Sheehy & Chapman, 1986; Smith et al., 1992), it has not been directly examined. Thus, the purpose of this study was to examine the relationships among perceived risk of injury, risk-taking behaviors, and injury among adolescent athletes.

As other psychological and biological factors are suggested to affect injury outcomes, particularly among adolescent athletes, the second purpose of this study was to examine the interrelationships among perceived risk of injury, risk-taking behaviors, estimation of ability, body size, gender, and injury. Finally, this study will provide injury epidemiology data in the sport of soccer for adolescent boys and girls.

Hypotheses

The following hypotheses were proposed for this study:

1. An inverse relationship between perceived risk of injury and risk-taking behaviors for those athletes who over-estimate their ability.
2. A positive relationship between estimation of ability and risk-taking behaviors.
3. A positive relationship between risk-taking behaviors and injury.
4. A positive relationship between the number of previous injuries and perceived risk of injury.
5. Girls perceive higher levels of risk of injury than boys.
6. Boys report engaging in more risk-taking behaviors than girls.
7. Athletes high in BMI report higher levels of perceived risk of injury than athletes low or moderate in BMI.
8. BMI demonstrates a cubic trend in relation to injury that approximates a U shape.

Operational Definitions

For this study, the following definitions were used:

1. Body Mass Index- The ratio of weight for height as determined by the formula kg/m^2 .

2. **Estimation of Ability-** Athletes' self-reported levels of ability in soccer compared to other players in the same league, and of the same age and gender.

Overestimation of ability refers to athletes' inflation of their estimation of ability in comparison to a coach's rating. Underestimation of ability refers to athletes' deflation of their estimation of ability in comparison to a coach's rating.
3. **Injury-** Any injury incurred while playing a soccer match or practice and either:

(a) kept the athlete out of the current match and any subsequent sport activities the day following the injury, or (b) required medical attention, or dental care beyond icing or wrapping.
4. **Nuisance Injury-** Any injury incurred while playing a soccer match or practice and both (a) caused an athlete to miss part or all of the match or practice in which the injury occurred, and (b) did not keep an athlete from participating in sport activities the following day.
5. **Perceived Risk of Injury in Sports-** Athletes' self-reported level of perception of risk or probability incurring an injury while playing a sport as determined by their responses to the 24 items of the Risk of Injury in Sport Scale (RISSc) and subsequent calculations of one second-order and six first-order factor scores.
6. **Risk-Taking Behaviors-** Athletes' self-reported frequency of engaging in soccer-specific behaviors as determined by their responses to the 9 items of the Risk-Taking Behaviors Scale (RTB) and subsequent calculations of one overall and two factor scores.

Limitations

This study was limited by the following uncontrolled factors:

1. This study did not measure or determine the maturational status of the athletes. Because this is a factor that could affect athletes' perceptions and behaviors, and likelihood for injury, it may underlie some of the findings in this study.
2. Participant selection was voluntary and non-random, potentially causing a subject self-selection effect.
3. Injury data were obtained from coaches and parents, as opposed to physicians or other trained medical persons. This may have resulted in inaccurate reporting of data and injury descriptions.
4. All data were collected only at the beginning of the season and, therefore, were not reflective of changes during the 8-week data collection period.
5. Estimation of ability and overestimation will be determined using a single-item question to participants and coaches.

Assumptions

The following assumptions were made for this study:

1. The written measure of self-reported risk-taking behaviors in this study was a valid measure of actual risk-taking behaviors among soccer players.
2. Both boys and girls responded to all questions in an equally honest manner.
3. Coaches and parents accurately and completely reported all injury data.

Delimitations

The scope of this study was delimited by the following factors:

1. The participants were male and female youth soccer players, aged 11 to 14 years from Mid-Michigan.
2. There were 18 coaches and teams involved in this study.
3. Measurements of all predictor and descriptive variables were limited to a single, cross-sectional assessment.
4. Injury data were collected during an 8-week soccer season.

CHAPTER II

LITERATURE REVIEW

Introduction

This chapter reviews the literature on perceived risk and risk-taking behaviors. A related research topic from psychology literature, fear, is also discussed. Most of the research in these areas has focused on non-sport populations. Therefore, the relevant literature in the area of sensation seeking in sports is also presented. This literature review is somewhat redundant with some of the key issues discussed in Chapter I, as there is a relative dearth of literature in this area. Next, social-cognitive and self-efficacy theories are reviewed in relation to estimation of ability and its effects on perceived risk and risk-taking behaviors. This is followed by a review of the literature related to body size and, more specifically, BMI. As this study examined injuries in the sport of soccer, a brief review of studies examining injury trends in youth soccer is provided.

Psychological Factors

It is common knowledge that psychological factors influence athletic injury to varying degrees. The interaction-based model of stress and athletic injury (Andersen & Williams, 1988) has driven much of the research in this area. Many psychological variables (e.g., life-stress: Blackwell & McCullagh, 1990; competitive anxiety: Petrie, 1993; and locus of control: Pargman & Lunt, 1989) have been studied using this framework. The stress model of injury is, however, an adult-based model that does not consider the many dynamic factors affecting youth and adolescent athletes such as maturation/growth, biological factors (e.g., body size, strength, agility), and the socialization process. Moreover, the influence of significant others such as coaches,

parents, and peers, is eschewed by the stress model. In spite of these facts, researchers continue to apply the model to studies of injury among youth sport athletes. In summary, while the stress model provides a conceptual framework in which to study sports injury among adults, its applicability to youth sports is limited. Nonetheless, certain contentions of the model are applicable to the examination of perceived risk of injury and risk-taking behaviors.

Within the stress model, Williams and Andersen (1998) speculate that an increase in the number of previous injuries, among other factors, results in a negative cognitive appraisal of a sport situation, which, in turn, may be related to an increased likelihood for injury. Similarly, the construct of perceived risk of injury pertains to an athlete's cognitions regarding being injured in a particular sport context. However, in spite of this link, researchers have yet to examine this area in sports. Smith et al. (1992) extended the argument of Williams and Andersen (1998) in suggesting that an athlete's cognitions must also be directly linked to subsequent behaviors to affect the likelihood for injury. Thus, it is pertinent to examine both the cognitions and behaviors of athletes to understand the effects of psychological variables on the potential for injury. However, researchers have yet to examine both perceived risk of injury and risk-taking behaviors in relation to injury in youth sports.

Perceived Risk and Risk-Taking Behaviors. Conceptually, risk can be viewed from a structural or functional perspective (Sheehy & Chapman, 1986). The structural concept focuses on objective elements of the environment that can be detected or described, whereas, the functional concept reflects the characteristics of the decisions and actions made in response to the perceived risk (Sheehy & Chapman, 1986). As children

are better able to grasp structural than functional concepts (Prawat & Wildfong 1980), of particular relevance to youth athletes is the structural concept of risk. However, both functional and structural aspects of risk are important in determining actual decisions to engage in risk-taking behaviors. The current study utilized a measure that represented athletes' perceptions of their probabilities of incurring an injury. The related concepts of fear and worry regarding outcomes of a behavior were not assessed in this study.

Several recent studies (e.g., Brenner & Collins, 1998; Morrongiello & Rennie, 1998) have examined the relationship between perceived risk and risk-taking behaviors among children and adolescents. Although these studies have defined perceived risk as vulnerability, they focused on risk-taking behaviors in a specific domain such as health-related risk (Brenner & Collins, 1998) and play-related risk behaviors (Morrongiello & Rennie, 1998).

Brenner and Collins (1998), using a public health (i.e., Centers for Disease Control) based theoretical perspective, examined health-risk behaviors (e.g., drug use, sexual behaviors, safety behaviors) among adolescents aged 12-17 years. They reported that while the prevalence of multiple risk behaviors was relatively low among this sample, the prevalence of risk behaviors increased with age up to 17 years. Further, male participants were more likely to engage in risk behaviors than were females. These findings are reflective of two hypothesized trends regarding risk behaviors: (a) risk-taking behaviors increase with age from 12-17 years, and (b) males engage in more risk-taking than females.

Morrongiello and Rennie (1998), using an empirically-driven approach, examined self-reported injury-risk behaviors and injury attributions and vulnerability among 6, 8,

and 10 year old youth. A picture depicting either a smiling or upset young child on top of a playground slide was shown to participants. Participants were then asked to describe the child in depicted in the picture. The authors' assessment of perception of risk represented children's fears about the situation, and did not include any objective assessment of risk, or perception of personal probability. Unlike the current study, these authors did not use an athletic sample for study and did not directly measure injury outcomes. Nevertheless, their results suggest that boys report engaging in significantly more risky behaviors than girls. Additionally, children with higher risk-taking scores attributed injuries more to luck than to their actions or the actions of others, and believed themselves to be less likely than peers to become injured. Boys tended to make these attributions more than girls did. In contrast, children who reported fewer risk-taking behaviors described the playground depiction as more 'fearful' than those children who reported engaging in more risk-taking behaviors (Morrongiello & Rennie, 1998). This offers support for the notion that young athletes who have a low perception of risk of injury may actually engage in more risk-taking behaviors, thus exposing themselves to greater risk of injury. Conversely, those athletes that have higher perception of risk may engage in fewer risk-taking behaviors. Additionally, some research suggests that males are injured more often in sport than females (Taimela et al. 1990). Together, these trends suggest that, although males report fewer fears, they may incur more injuries than females.

The measurement of risk-taking behaviors is an integral issue in this line of research. Inherently, it would be ideal to observe risk-taking behaviors first-hand, rather than relying on self-report measures to assess their prevalence (Speltz et al., 1990). This would eliminate the potential problems caused by recall bias and social desirability.

Observed data on risk-taking behaviors are limited though, as a result of the high number of observers and length of time of observation required to obtain such data. Also, individuals tend to socially conform in the presence of an external observer. Therefore, most studies on risk-taking behaviors have relied on self-report measures. The validity of self-reported measures for risk-taking behaviors has been substantiated (Potts et al., 1995). Children's responses to the Injury Behavior Checklist (IBC) were validated with teachers' and parent's reports of risk-taking behaviors (Potts et al., 1995). Hence, self-report measures of risk-taking behaviors appear to be representative of actual observed (by teachers) and informant (i.e., reported by parent) reported behaviors.

Researchers must be cautious in assuming that parent and observed measures are the 'gold standard' for assessing risk-taking behaviors. For, as Weiss has (2000) suggested, young athletes' perceptions of behaviors are more salient to potential negative consequences from sport participation than are parents' or coaches' perceptions. This contention was supported in a study by Speltz et al. (1990) which found that children's responses to the IBC were more predictive of subsequent injury than were parents' ratings of children's risk behaviors. As such, it appears that children's self-reported risk-taking behaviors may be of greater predictive value than observed or informant measures.

Fear. In psychological literature, the related construct of fear has been studied among children and adolescents (e.g., King et al., 1989; Ollendick & King, 1994). Using the Fear Survey Schedule for Children-Revised (FSSC-R), which measures general fear across broad categories including the unknown, medical fears, injury, and death, Ollendick and colleagues have examined fear among children for over a decade. Most salient among their findings on fear in children are age and gender differences. A positive

relationship between fear and age, up to 12 years, was found in one sample of adolescents (Ollendick & King, 1994). A similar trend was reported, though with less magnitude, among a similar group of adolescents (King et al., 1989). Both studies reported a negative trend in self-reported fears beginning in adolescence. Together, these findings suggest that fear increases with age up to 12 years, after which it decreases throughout adolescence and into adulthood. However, these findings were for children across a relatively large age span (6-18 years). In contrast, these findings were not supported in a study of 11 to 15 year old youth athletes (Kontos et al., 2000), which indicated no significant differences in perceived risk of injury in sports by age. The restricted age range of the latter study may have influenced these contrary findings.

In cross-cultural studies, however, different trends between age and fear have been reported. As such, culture may influence this relationship. For instance, in a study comparing self-reported fears among American, Australian, Chinese, and Nigerian children (Ollendick et al., 1996), cultural differences were apparent. American and Australian children demonstrated a negative linear trend between fear and age. The Nigerian children's fear pattern across age resembled a U shape, whereas the Chinese children's fears peaked in adolescence (inverted-U shape). Additionally, the Nigerian children reported significantly higher levels of fear across all categories. Therefore, age differences in fear may be culturally specific. Although the present study examined perceived risk in a culturally homogeneous sample, it is important to acknowledge these differences as they may be relevant to future cross-cultural studies of risk.

With regard to gender differences, the results of King et al. (1989) and Ollendick and King (1994) suggest that females are more "fearful" than males. In fact, with one

exception, every study on fear using the FSSC-R that I reviewed reported similar gender differences. The one exception was the cross-cultural study by Ollendick et al. (1996), which reported that among Nigerian and Chinese children, no gender differences were evident. Again, cultural influences may play a role not only in age differences, but also in gender differences, in the levels of self-reported fears among children.

Sensation Seeking. Researchers (Backx, Beijer, Bol, & Erich, 1991; Straub, 1982) have suggested that certain athletes are ‘high-risk’ individuals who seek high-risk activities. These athletes are subsequently more likely to engage in risk-taking behaviors than athletes who are not ‘high-risk’. The concept of the ‘high-risk’ or sensation-seeking individual is based on the work of Zuckerman (1969), who coined the term and developed the Sensation Seeking Scale- Form V (SSS) to measure the trait. The SSS is a general trait measure of sensation seeking and consists of four factors: (a) thrill and adventure seeking (e.g., speed or danger), (b) experience seeking (e.g., sensory indulgence), (c) disinhibition (e.g., sexual behaviors), and (d) boredom susceptibility (e.g., aversion to routines).

With respect to gender, males have demonstrated consistently higher levels of sensation seeking than females (e.g., Zuckerman, Buchsbaum, & Murphy, 1980; Zuckerman, Eysenck, & Eysenck, 1978). Though biological mechanisms (e.g., circulating testosterone) have been proposed (Zuckerman et al., 1980) to influence these differences, researchers have not, to this point, substantiated these mechanisms.

It has long been accepted that sensation seeking decreases in a linear fashion once adults enter their 20’s (Zuckerman et al., 1978). However, among children and adolescents, it is thought that sensation seeking increases steadily in childhood, and

increases markedly through adolescence. These age trends in sensation seeking in childhood and adolescence, while theorized to exist, have been elusive to researchers. This has been a consequence of the adult-based focus of the SSS in measuring sensation seeking (Zuckerman et al., 1978). As such, the hypothesized trends in sensation seeking among adolescents or children have yet to be evaluated.

Researchers have also yet to examine the relationship between the perception of risk of injury in sport and injury incidence among athletes. Smith et al. (1992), however, have examined sensation seeking in high school varsity athletes. They observed that athletes low in sensation seeking reported more negative life-stress and had higher incidences of injury than those high in sensation seeking. However, Smith et al. (1992) used a general measure of sensation seeking (SSS) which did not reflect sports specific events. Nonetheless, their findings suggest that sensation seekers (i.e., 'high risk' individuals), who actively seek out 'high risk' situations, have an inherently greater ability to deal with the stress associated with these situations. In turn, this may predispose sensation seekers to better cope with potentially injurious or otherwise dangerous situations, thus limiting their likelihood for injury.

In a study of sensation seeking among high (e.g., hangliding) and low (e.g., bowling) risk sport participants, Straub (1982) examined athletes' scores on the SSS in relation to sport participation. Straub (1982) hypothesized that athletes participating in high risk sports would score higher on the SSS than athletes in low risk sports. He also conjectured that low sensation seekers who unwillingly participate in high risk sports may have a greater potential for injury than high sensation seekers. The findings indicated that only the experience seeking and boredom susceptibility factors of the SSS

were predictive of sport participation. The thrill and adventure seeking factor, which has been proposed by Zuckerman (1979) to be the most relevant SSS factor among athletes, was not related to sport participation in this study. Although the study did not directly assess the hypothesis concerning being injured, it did provide evidence that the SSS is too general to measure differences in risk-taking between low and high risk sport athletes.

One concern I have in regard to the research on sensation seeking is that it fails to consider perceptions of risk or fear as they relate to sensation seeking. The SSS measures self-reported levels of behaviors, and as such, does not examine the cognitions associated with decisions to engage in these behaviors. Further, Zuckerman and colleagues (Horvath & Zuckerman, 1993) postulate, without any empirical evidence, that sensation seeking or risk-taking determines subsequent perceptions of risk. They disagree with the notion that perceived risk influences decisions to engage in sensation seeking behaviors, as proposed in the current study. It is more likely that the influence of sensation seeking or risk-taking on perceived risk is interactional. It is also likely that age plays a role in the importance of perceived risk over experience in risk-taking, as younger athletes are unlikely to have much experience with risk-taking behaviors. In any case, as Smith et al. (1992) suggested, researchers must simultaneously measure cognitions and behaviors in order to understand the interrelationships between the two factors.

Self-Efficacy Theory and Estimation of Ability. The concept of self-efficacy theory has developed from Bandura's (1977, 1986) work in social cognitive theory. Self-efficacy refers to one's belief in one's capabilities to perform successfully a behavior which results in a certain outcome (Bandura, 1986). The key tenet in the theory is that one's perceptions of one's capabilities are based on specific sources of information,

namely: past performance, vicarious experiences, verbal persuasion, and physiological/emotional states. Self-efficacy theory has been successfully applied to a variety of contexts related to injury and sport including pain perception and tolerance (Baker & Kirsch, 1991) and sports performance (Feltz, 1988). However, researchers have not examined self-efficacy in direct relation to injury outcomes. Despite the dearth of research on self-efficacy in relation to sport injuries, several key postulates can be gleaned from related research and suggestions from Bandura's (1997) review of self-efficacy research. An example of this is the concept of an athlete being over-efficacious in sport presented in the following paragraph.

The contention proposed earlier in this chapter for a negative relation between perception of risk of injury and injury incidence is in contrast to Bandura's (1997) suggestion that athletes who perceive a situation as risky are low in self-efficacy and have a higher anticipation of failure, and greater potential for injury. However, Bandura (1997) extends this theory to suggest that some individuals may be over-efficacious, resulting in lower perceptions of risk and a more "reckless," attitude toward sports. These individuals develop a sense of invincibility based on their overestimation of their abilities and may engage in more risky and potentially injurious behaviors (Bandura, 1997). This overestimation of ability has been demonstrated in children 9-12 years of age (Chase et al., 1994). An overestimation of one's abilities and a concomitant lower perception of risk of injury, may lead to more risk taking behaviors and a greater probability for injury. In summary, a higher perception of risk may, in fact, be related to a reduction in risky behaviors and decreased likelihood for injury.

Body Size, BMI, and Injury

It is important to consider the relationships between body size characteristics and psychological constructs such as perceived risk, risk-taking behaviors, and self-efficacy (i.e., estimation of ability). Among adolescent figure skaters, body weight (controlling for age and height) and self-esteem were negatively correlated (Vadocz, 1999). As self-esteem and self-efficacy are correlated, the results of this study can be inferred to this relationship as well. Smaller and leaner athletes who described their physical attributes positively had a more positive self-concept (Vadocz, 1999). Similar trends are evident among elite female gymnasts. Researchers (Claessens et al., 1999) have reported a modest relationship between anthropometric variables, primarily weight-related factors and performance scores in gymnastics competition. These relationships are especially important in regard to injury, as both self-concept and performance are related to an athlete's potential for injury (Williams & Andersen, 1998).

Among adolescent athletes, there is tremendous variation in anthropometric measures (Malina, 1996). Moreover, during the period of adolescent growth (females- ages 11 to 13 years; males- 12 to 15 years) there are substantial differences in the development and attainment of strength, agility, and motor skills, concomitant with variations in body size (Malina & Beunen, 1995). Kontos & Malina (2000) have suggested that these differences may influence perceptions, how young athletes are socialized into or away from sports, and subsequent behaviors. Researchers, however, have yet to examine how differences in body size may affect perceptions and behaviors related to injury in sport during adolescence.

Although BMI is hypothesized to influence injury indirectly through its affect on perceived risk, it may also directly influence the likelihood for injury. Few studies have examined the relationship between body size or BMI and injury. Gomez et al. (1998) examined BMI and body fatness among high school football linemen. They compared injury rates of high and low BMI athletes. The researchers postulated that athletes with higher BMIs would have higher injury rates than those with lower BMIs. The findings indicated that BMI was indeed positively related to injury rates, suggesting that BMI is a useful predictor of injury. This finding was, however, only applicable to lower extremity injury rates. Though the results of this study were promising, and provided some empirical evidence for the hypothesized relationships between BMI and injury in the present study, the relevance of the data to athletes in other sports is questionable.

Steele and White (1986) explored the effects of body size and BMI, along with several other biological predictors, on injury in female gymnasts. They reported that both weight and height were significant predictors of injury. Weight was positively related to injury, while height was negatively related to injury. BMI was unrelated to injury status. Unfortunately, the researchers provided little in the way of interpretation of these findings. Still, weight was the most significant factor related to injury among the factors examined in the study. However, the atheoretical and seemingly ‘shot-gun’ approach to this study minimized its potential application and worth in understanding the body size-injury relationship.

BMI has been inferred by researchers to assess both maturation status (Thompson & Morris, 1994) and body fatness (Gomez et al., 1998). Several criticisms of the use of BMI as a proxy for fatness and maturation status have been proposed (Garn, Leonard, &

Hawthorne, 1986). Specifically, the BMI does not act independently of height, especially in children during adolescence. Moreover, sitting height and leg length are particularly influential in BMI scores. For example, adolescents or children with short legs for their height will have higher BMI scores, regardless of body fatness. This fact has resulted in the interpretation (or misinterpretation) by some researchers (e.g., Thompson & Morris, 1994) of BMI as an indicator of maturation. BMI scores are also influenced by both lean and fat body mass, negating their efficacy as a measure of body fatness.

The previously discussed studies involving height, weight, and BMI have not assessed strength. Backous et al. (1986), however, reported that among soccer players, tall and weak (i.e., low grip strength score) athletes had the highest incidence of injuries. The authors suggest that these athletes were skeletally mature, but muscularly weak, predisposing them to greater likelihood of injury. The differences in injury rates in this study while significant, were small, representing only 2-3 more injuries among the tall and weak group. Also, in lieu of actual maturational data, the authors assumed that grip strength and height were a sufficient proxy for maturation. Further, grip strength is not an ideal measure of sport-relevant strength in lower-body dominant sport such as soccer.

Soccer Injuries

Many of the studies conducted on injury in youth soccer have utilized data collected at weekend tournaments, where exposure rates are high, and the competition is intense (e.g., Maehlum, Dahl, & Daljord, 1986; Nilsson & Roaas, 1978). These cross-sectional studies do not, however, provide a logical comparison to the present study's prospective, season-long methodology. Thus, this review will focus on studies examining injury over a season or other comparable time period.

Overall injury incidence rates in youth soccer are low with reported rates ranging from 0.51 injuries/1000 hours of exposure (Sullivan, Gross, Grana, & Garcia-Moral, 1980) to 45.2 injuries/1000 hours of exposure (Hoff & Martin, 1986). Match injury rates tend to be higher than practice rates (Keller, Noyes, & Buncher, 1987). In a review of soccer injury studies, Larson, Pearl, Jaffet, and Rudawsky (1996) reported that the most common types of injuries in youth soccer were contusions (32.9-47.0%), sprains (19.4-35.3%), and strains (8.8-27.8%). This summary, however, reflects the relatively sensitive (e.g., any injury reported, time loss less than 1 day) definition of injury used in most studies of youth soccer injuries. Therefore, one would expect the percentage of contusions to decrease as a result of a more stringent (i.e., minimum time loss of 1 day) injury definition. In regard to injury location, the lower extremity (61.0-89.0%) and more specifically the ankle (16.0-41.2%) are the most commonly injured areas among youth soccer players. This finding is intuitive, as most contact and physical motion involved in soccer, with the exception of heading and goal keeping, occurs below the waist.

Most studies of injury in youth soccer have not examined potential mechanisms of injury (Larson et al., 1996). The few studies that have examined injury mechanism in youth soccer have dichotomized their findings into either acute or overuse categories (Ekstrand et al., 1983; Engstrom, Johansson, & Tornkvist, 1991). The vast majority (69-96%) of the injuries in these studies have been the result of acute injury mechanisms. Unfortunately, acute injuries may have multiple causes including collision with another player, contact with the ball, contact with the surface, or injury from a foul. Therefore, while acute and overuse categories provide a good starting from which to assess injury mechanisms, they need to be further delineated into more specific mechanisms.

CHAPTER III

METHOD

Design

The data collection methodology employed in this study was a prospective cohort design. All participants were followed for between four to eight matches (i.e., 8-week season), during which time injury data were collected. An assistant and I collected all questionnaire and observed height and weight data at the beginning of the competitive season. Subsequently, injury and exposure data were collected during the eight-week competitive season. Predictor variables including perceived risk of injury, risk-taking behaviors, estimation of ability, and demographic data (age, gender) were assessed using written self-report measures. Height and weight, and subsequent calculations of BMI were based on observed measures obtained at the beginning of the data collection period. At the completion of the season, relationships among participants' scores on the predictor variables and injury were determined using correlational, MANOVA, curvilinear, and case-control analyses. Before delving further into the method of this dissertation, it is necessary to review the results of the pilot study that served as its foundation.

Pilot Study (Kontos et al., 2000)

Overview. A scale was developed to assess adolescent athletes' perceptions of risk of injury across different sports using a three phase approach. In Phase 1, focus groups were conducted with 21 adolescent athletes to generate potential items for the scale. A total of 36 items representing 5 factors were generated to form the initial pilot version of the Risk of Injury in Sports Scale (RISSc). For Phase 2, a sample pool of 502 respondents completed the RISSc. Results of an exploratory factor analysis (EFA) on a

random sample of 251 respondents supported a 6-factor solution involving 30 of the original 36 items. In Phase 3, a confirmatory factor analysis (CFA) on the remaining 251 participants supported the 6-factor structure of the RISSc with 24 of the 30 items from the EFA.

Phase 1: Focus groups. A volunteer sample of 21 youth athletes was recruited from a middle school in the Midwest. The sample consisted of 11 females and 10 males, aged 12 to 14 years. All of the participants were competitive athletes at the scholastic, club or recreational level. The participants were divided into four groups based on their age and gender. The two all female groups were led by a female assistant, while the two all male groups were led by the first author. The groups were structured, facilitated, and analyzed using the methods outlined by Vaughn, Schumm, and Sinagub (1996). At the beginning of each session, the group facilitator provided information to the participants about the ground rules for the focus group, and explained that the purpose of the focus group was to, “learn more about young athletes’ thoughts about playing sports and being injured in sport.” Each group began with informal introductions followed by a solicited short statement from each participant concerning his/her sport background and interests. Participants were then asked to discuss some of the issues in sport about which they were concerned. In both groups the conversation turned to injuries, and the participants were asked to discuss in more detail the thoughts they had about being injured in sport. The focus group discussions were allowed to develop on their own, however, the facilitators redirected the group discussion on occasion to maintain focus on thoughts concerning playing sports and being injured in sport.

From these focus groups, phrases representing specific situations related to the athletes' perceived risk of injury in sports were generated. All of the dialogue from the focus groups was transcribed, and examined for trends. We then unitized the phrases from the participants into categories based on their content and value to the research focus. This process revealed five theme areas representing: (a) collision/contact injuries, (b) injuries in practice or games, (c) overuse injuries, (d) specific injury types, and (e) surface and equipment injuries. Individual items based on the original statements from the focus group participants were then debated and refined by the researchers and matched with each theme. Refer to Vaughn et al. (1996) for a complete description of these procedures. A total of 36 items were generated to form the initial pilot version of the RISSc. On the scale, the participants were asked the following about their sport: "What do you think are the chances that you will..." followed by the individual items. Responses for each item were on a Likert-type scale of 1 (very unlikely) to 6 (very likely).

Phase 2: EFA. In Phase 2, the pilot scale of the RISSc was completed by 502 volunteer participants 11-15 years of age from two middle schools in the Midwest. The sample represented youth sport athletes from over 20 scholastic (29%), club (41%) and recreational (30%) level team and individual sports. Using a computer generated random selection, the sample was then divided into two samples of 251 participants each. The two samples were similar and represented approximately equal numbers of male and female participants (see Table 1). Due to incomplete data, the EFA sample had 237 participants, and the CFA sample had 243 participants.

Table 1. Descriptive Statistics and Frequencies for Phase 2 and Phase 3 Samples.

	Age in Years	Gender	Race	Grade
Phase 2				
N	251	249	249	251
Mean	12.96	na	na	na
SD	0.92	na	na	na
Min	11	na	na	6
Max	15	na	na	8
Frequencies	11- 19	Male- 127	African American- 5	6 th - 30
	12- 51	Female- 122	Asian- 5	7 th - 88
	13- 105		American Indian- 8	8 th - 133
	14- 73		Hispanic- 14	
	15- 3		White- 212	
			Other- 5	
Phase 3				
N	250	250	250	251
Mean	13.00	na	na	na
SD	0.94	na	na	na
Min	11	na	na	6
Max	15	na	na	8
Frequencies	11- 11	Males- 123	African American- 4	6 th - 26
	12- 60	Females- 127	Asian- 3	7 th - 87
	13- 98		American Indian- 8	8 th - 138
	14- 80		Hispanic- 7	
	15- 1		White- 217	
			Other- 11	

Using Cronbach's Alpha, the internal reliability of the scale for the EFA sample was .90. All of the items except one ('injure your knee') contributed positively to the overall alpha. Intercorrelations between individual items ranged from .03 to .71, indicating low to moderate correlations but no multicollinearity ($R > .80$, Pedhazur, 1982). Results of an EFA using a principal component analysis with a varimax rotation revealed seven factors with Eigen values greater than 1, however, one of the factors was eliminated from further analysis. The factor that was eliminated consisted of only two items ('injure your knee', and 'injure yourself from a bad landing') that were not

correlated highly enough to represent a separate factor based on the suggestions of Tabachnick and Fidell (1996).

Of the original 36 items, 4 ('injure your face', 'be injured by being struck by a ball or other object', 'be injured because you were unlucky', and 'injure yourself from repeatedly using a part of your body') did not meet the loading criteria of .40 on a single factor with no other loading greater than .35, and 2 ('injure your knee' and 'injure yourself from a bad landing') loaded on the factor that was eliminated. The 6 factors that were retained represented 54.7% of the total variance, and consisted of the following perception of risk factors: (a) 'uncontrollable', (b) 'controllable', (c) 'overuse', (d) 'upper body', (e) surface-related, and (f) re-injury. Although these factors were similar to the original five themes from the focus groups, they were not exactly the same. However, because the original themes were not theoretically based, we felt that the use of the EFA factors was more appropriate to enter into a CFA. The loadings on the 6 factors for the remaining 30 items ranged from .43 to .86, and met the loading criteria. The factors, items, and item loadings are presented in Table 2.

The six items that did not meet the loading criteria were not included in the Phase 3 CFA. Additionally, the following items: 'tear a muscle', 'be injured from overusing a part of your body', 'be injured in a game, match, or meet', 'have a concussion or other head injury', 'injure yourself in a collision with a teammate', and 'be injured because your protective equipment does not work well' had relatively high (i.e., >.30) cross-loadings on more than one factor. However, as this was an exploratory analysis, we initially entered all 30 items for the CFA.

Table 2. RISSc EFA Factor Loadings (λ).

Factors and items	λ
Uncontrollable	
Injure yourself in a collision with an opponent	.70
Be injured from a foul or 'cheap shot'	.78
Be injured by more aggressive opponents	.84
Be injured in game, match or meet*	.53
Have a concussion or other head injury*	.43
Be injured by bigger or stronger opponents	.79
Injure yourself in a collision with a teammate*	.54
Controllable	
Be injured running into an object on the field or court	.45
Be injured trying to perform a skill that you have just learned	.55
Be injured performing a skill that is hard for you to do	.63
Be injured because your protective equipment does not work well*	.54
Be injured not paying attention to what you are doing	.70
Be injured by losing your focus while playing your sport	.65
Injure yourself on a dangerous piece of equipment	.55
Overuse	
Be injured from overusing a part of your body*	.56
Be injured from not 'taking a break' from your sport	.76
Be injured from playing too many sports at the same time	.56
Be injured practicing too hard	.66
Be injured competing too hard	.46
Upper body	
Injure your neck or spine	.53
Tear a muscle*	.50
Injure your arm or wrist	.74
Injure your shoulder	.86
Surface-related	
Fall down and injure yourself	.63
Injure yourself on a poor playing surface	.44
Injure your ankle	.60
Trip and injure yourself	.73
Re-injury	
Have the same injury as someone else on your team recently had	.51
Re-injure an area that you have recently injured	.65
Be injured in a practice	.45

* Indicates items that were eliminated from the final version of the RISSc.

Phase 3: CFA. The 30 items of the RISSc were loaded onto the 6 factors from the EFA. Based on the correlations among the factors, we speculated that the RISSc would consist of a hierarchical second-order factor comprising the six first-order factors. The CFA was conducted on the remaining random sample of 243 participants with a maximum likelihood procedure on a Pearson correlation matrix using LISREL 8 (Joreskog & Sorbom, 1996). Using Cronbach's Alpha, the internal reliability of the 30-item scale for the CFA sample, was .94. All individual item alphas exceeded .93. All of the items contributed positively to the overall alpha. Intercorrelations between individual items ranged from .07 to .72, again indicating low to moderate correlations but no multicollinearity ($R > .80$, Pedhazur, 1982). A number of solution indices and indices of fit were utilized to assess the CFA solution. Solution indices included parameter estimates, t values, and R^2 . Indices of fit included the χ^2 , non-normed fit index (NNFI), comparative fit index (CFI), and the root-mean-square residual error of approximation (RMSEA).

First-order CFA. The solution for the initial CFA using all 30 items loading onto 6 factors revealed that several of the parameter estimates were not significant (see Table 3). The t values ranged from 7.51 to 10.49. The R^2 values were between .26 and .68. The initial global indices of fit were encouraging, though not as high as had been expected. The $\chi^2 (390, 242) = 983.12, p < .001$ was very large. The NNFI (.81) and CFI (.83) were below the generally accepted values of .90. The RMSEA was .08, which is at the highest suggested acceptable level (Browne & Cudek, 1993). Therefore, the solution was in need of modification.

The modification indices indicated that we should free-up several parameters. Specifically, ‘be injured because your protective equipment does not work well’, ‘be injured from overusing a part of your body’, and ‘be injured in a collision with a teammate’, were freed-up to load on more than one factor. In addition, based on the high loadings on another factor, ‘have a concussion or other head injury’ and ‘be injured in a game, match, or meet’ were loaded onto two factors: ‘controllable’ and ‘uncontrollable’. ‘Tear a muscle’ was loaded onto ‘upper body’ and ‘surface-related’. The reanalysis provided improvements in the NNFI (.89) and CFI (.90). However, these values were still relatively low, and the $\chi^2 (354, 243) = 718.43$ was still quite high. Additionally, the dual loadings did not seem to be intuitively or theoretically sound.

We decided to remove the items from the CFA that had initially cross-loaded on more than one factor. This decision was supported by the EFA cross-loadings for the same items. Thus, we eliminated ‘be injured because your protective equipment does not work well’, ‘be injured from overusing a part of your body’, ‘be injured in a game, match, or meet’, ‘be injured in a collision with a teammate’, ‘have a concussion or other head injury’, and ‘tear a muscle’ from the second reanalysis. The second reanalysis revealed a better fit with the $\chi^2 (237, 243) = 423.11$, $p < .001$, NNFI = .91, CFI = .93, and RMSEA = .05, all substantially improved. Because the items that were eliminated represented four of the six factors, no single factor’s integrity was compromised (see items with an asterisk, ‘*’, in Table 2). The factor loadings (λ), R^2 , and t values for the second reanalysis are presented in Table 3.

Table 3. RISSc CFA Factor Loadings (λ), Squared Multiple Correlations, and t Values from the Second Reanalysis.

Factors and items (item #)	λ	R^2	t
Uncontrollable			
Injure yourself in a collision with an opponent (1)	.66	.44	9.76
Be injured from a foul or 'cheap shot' (6)	.71	.51	9.33
Be injured by more aggressive opponents (7)	.88	.78	5.42
Be injured by bigger or stronger opponents (9)	.79	.63	8.11
Controllable			
Be injured running into an object on the field or court (8)	.51	.26	10.47
Be injured trying to perform a skill that you have just learned (11)	.72	.52	9.38
Be injured performing a skill that is hard for you to do (14)	.76	.58	8.88
Be injured not paying attention to what you are doing (17)	.70	.49	9.54
Be injured by losing your focus while playing your sport (20)	.74	.54	9.21
Injure yourself on a dangerous piece of equipment (22)	.56	.31	10.33
Overuse			
Be injured from not 'taking a break' from your sport (10)	.63	.39	9.83
Be injured from playing too many sports at the same time (13)	.61	.37	9.94
Be injured practicing too hard (16)	.82	.68	7.05
Be injured competing too hard (19)	.74	.55	8.70
Upper body			
Injure your neck or spine (18)	.68	.46	9.28
Injure your arm or wrist (23)	.78	.60	7.80
Injure your shoulder (24)	.83	.69	6.37
Surface-related			
Fall down and injure yourself (5)	.64	.41	9.58
Injure yourself on a poor playing surface (12)	.68	.46	9.27
Injure your ankle (15)	.66	.44	9.39
Trip and injure yourself (21)	.71	.50	8.94
Re-injury			
Have the same injury someone else on your team recently had (2)	.67	.45	9.12
Re-injure an area that you have recently injured (3)	.65	.43	9.28
Be injured in a practice (4)	.75	.56	7.88

Note. These data reflect only the 24 items from the revised RISSc. RISSc= Risk of Injury in Sport Scale.

Second-order CFA. The hierarchical structure (i.e., general perception of risk factor) of the 24 item scale was assessed using a second-order CFA. The second-order CFA was warranted because the six factors were correlated with one another (see Table 4). The R^2 values, except for ‘uncontrollable’ were above .50, and the t values, except for upper body, were above 8.00. The NNFI (.91) and CFI (.95) were substantial. The goodness of fit indices provided partial support for a second-order factor. However, ‘uncontrollable’ seemed to be a problem factor, with a loading (λ) of only .50 on the higher order factor. As such, the hierarchical general factor of the RISSc while partially supported, may actually comprise two higher order factors: (a) ‘uncontrollable risk’, and (b) ‘general risk’. The overall factor structure and path coefficients are presented in Figure 1.

Table 4. Intercorrelations Between the Six First-Order Factors of the RISSc from the CFA (corrected for attenuation).

Factors	Uncontrollable	Controllable	Overuse	Upper body	Surface-related	Re-injury
Uncontrollable	1.00					
Controllable	.42	1.00				
Overuse	.43	.78	1.00			
Upper body	.33	.68	.60	1.00		
Surface-related	.43	.79	.71	.69	1.00	
Re-injury	.49	.70	.74	.70	.83	1.00

Internal consistency of the RISSc. Cronbach Alphas were computed for the revised 24-item RISSc, and each of the 6 first-order and the ‘general risk’ second-order factors. The individual factor reliabilities were .84 (‘uncontrollable’), .81

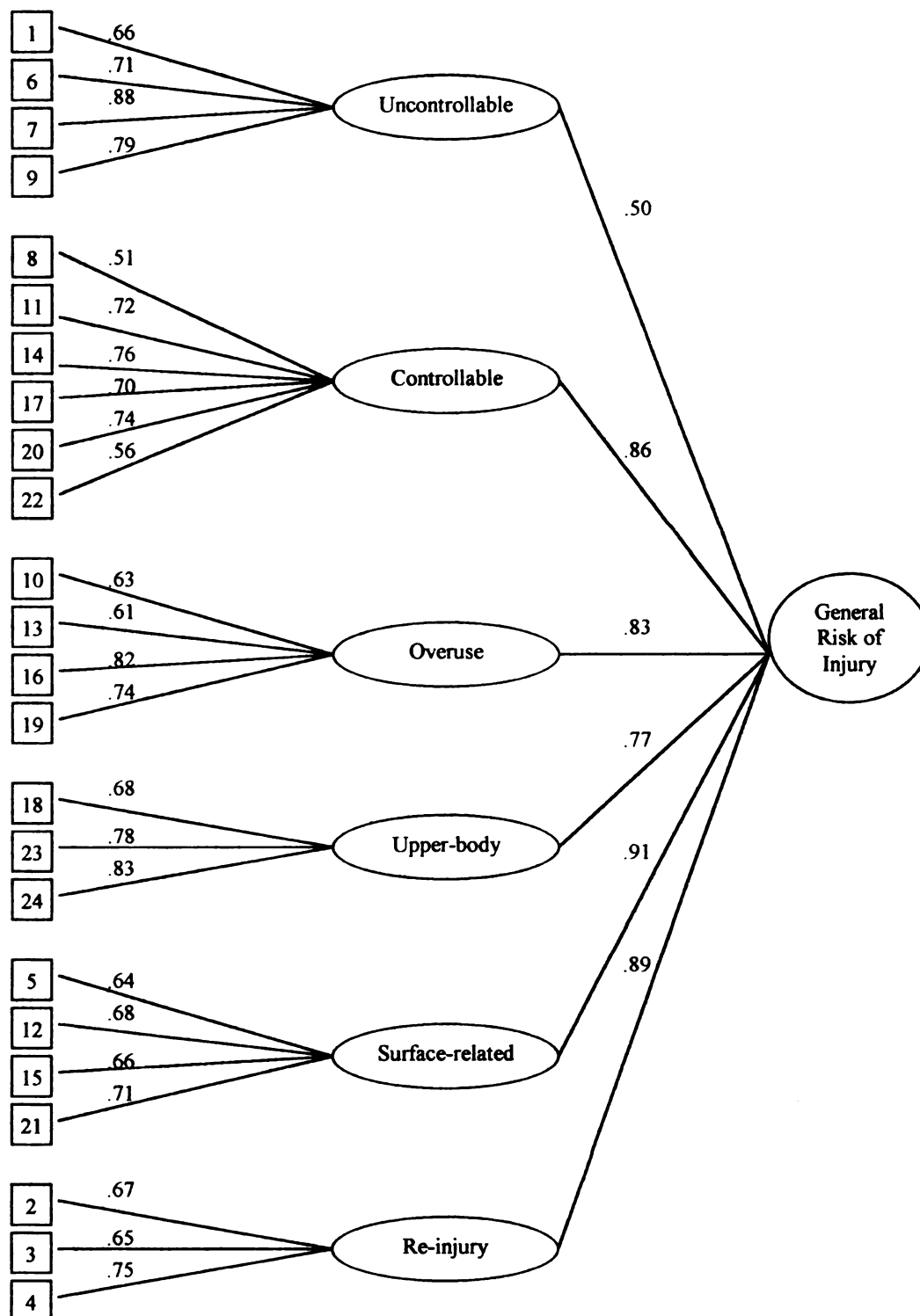


Figure 1. RISSc pilot study CFA overall factor structure and path coefficients.

(‘controllable’), .75 (‘overuse’), .77 (‘upper-body’), and .72 (‘re-injury’). These values were all above the generally accepted values. Only one individual item, ‘injure your neck or spine’, did not contribute positively to a factor’s (‘upper-body’) overall reliability. However, this item did contribute positively to the overall scale reliability, and the reliability of the ‘upper-body’ factor ($\alpha = .77$) was still at an acceptable level. The overall reliability of the 24-item scale was .91, which is well above the generally accepted values. All of the individual items contributed positively to the overall scale reliability.

Participants

Two hundred and fifty-three youth soccer players (142 male, 111 female) participated in the dissertation study. The participants ranged in age from 11 to 14 years, and had a mean age of 12.68 years ($SD = .92$). The participants were recruited, on a voluntary basis, from 18 soccer teams representing 2 soccer organizations in Michigan. The majority of the participants ($n = 174$) were from competitive United States Soccer Federation (USSF) soccer teams, with the remainder of the sample ($n = 78$) from recreational local teams. Teams played between 4 and 8 matches, with an average of approximately 6 matches per team during the season. On average, teams had between 1 and 2 practices per week, lasting approximately 1 to 1 ½ hours each. However, many practices were canceled due to weather conditions, resulting in most teams ($n = 13$) having more matches than practices during the course of the 8-week season. Written consent was obtained prior to the study from parents, athletes, and coaches. Oral consent was obtained from organizational administrators at a preseason soccer meeting. All participants were given a code number that was used to identify them throughout the

study. The master code list, which was necessary to collect and code injury data, was kept in a secure place, to which only I had access.

Measures

Risk of Injury in Sport Scale (RISSc). The revised version of the RISSc (see pilot study description above) was completed by each participant prior to the season (see Appendix A). The RISSc required approximately 10 min. to complete. The total and six-factor scores of the RISSc were calculated for each athlete.

Risk-taking behaviors. Each participant prior to the season completed the Risk-Taking Behaviors Scale (RTB), which was validated and developed for this study. Although I developed the RTB based on the Injury Behavior Checklist (Speltz, Gonzalez, Sulzbacher, & Quan, 1990), and my experience as a soccer coach and player, the validity of the questionnaire was formally tested before it was used. The face validity of the RTB was assessed using a panel of three experts representing diverse areas of knowledge (sport psychology, soccer, and injury epidemiology). They were asked to rate, on a scale of 1 (not relevant) to 5 (very relevant), the relevance of each item on the scale (see Appendix B). Each item required an average rating of 4 or above to be retained. Raters were also asked to provide a rationale for each individual rating below 4. Any items averaging below 4 were revised and re-evaluated by the panel, or eliminated. As a result of this validation process, two items were eliminated from the final scale used in the study. The revised RTB consisted of 12 items assessing participants' willingness to engage in risk-taking behaviors specific to the sport of soccer (see Appendix C). Participants indicated, on a scale of 1 (never) to 4 (frequently), how often they engage in each risk-taking behavior. The RTB required approximately 5 minutes to complete. The

results of an EFA supported a two factor structure involving nine items of the RTB (see Results section). The two factors were: (a) ‘physical risk-taking behaviors’ (PRTB), which included physical contact-related behaviors; and (b) ‘skill risk-taking behaviors’ (SRTB), which included behaviors related to performing difficult soccer skills. As this was an exploratory analysis, the two factor and total RTB scores were calculated for each participant.

Estimation/overestimation of ability. Participants’ estimation of ability in soccer was assessed using a single question that asked participants to rate, on a 5-point Likert-type scale, their “overall skill level in soccer compared to other players in their league of the same age and gender (see Appendix D).” Coaches were also asked to rate, using the same scale and question, each participant’s skill level (see Appendix E). The coach’s rating served as the objective rating of participants’ abilities in soccer. An overestimation of ability score was then derived for each participant by subtracting the coach’s rating of the player’s skill from the player’s rating. The overestimation scores fell into one of three categories: a) over-estimator (positive score), b) accurate estimator (score of zero), or c) under-estimator (negative score). These categories were then used to assess the impact of inaccurate estimation of ability on the relationship between perceived risk and risk-taking behaviors.

Height and weight. Just prior to the first match of the season, weight was measured using a battery-powered, portable, digital scale. The scale was calibrated using known weights, and was accurate, as per the manufacturer’s and from observational data, to within .1 kg. Height was measured using a field anthropometer. Subsequent calculations of BMI were made using these data. Whenever possible, measurements were

made on a level surface (e.g., concrete sidewalk). However, when a known level surface was not available, the measurements were made on a 2 x 3 foot, leveled, particleboard to ensure accuracy. Comparing field and laboratory measurements of the same individuals validated these methods.

Inter-and intra-rater reliabilities for height and weight. The inter-rater reliability for height was assessed using five randomly selected participants from one measurement session. Both the researcher and the assistant measured height on the same participant using the same scale and protocol. The researcher and the assistant were blind to each other's measurements. A comparison of these measurements indicated a high coefficient of inter-rater reliability (.99). The technical error for the inter-rater measurements ranged from 0.0cm to 0.7cm, which is within the generally accepted error of 1.0cm (Roche, 1992). Intra-rater reliability was assessed using repeated measurements conducted for every 10th participant. A total of 24 pairs of measurements were taken. The researcher conducted 13 pairs of measures, and the assistant conducted 11 pairs of measures. Both the researcher's and assistant's intra-rater reliability was .99. The researcher's technical error ranged from 0.0cm to 0.7 cm, and the assistant's technical error ranged from 0.1cm to 0.4cm. Again, these measurement errors were within generally accepted values. Intra-rater reliability for weight was assessed using repeated measurements conducted for every 15th participant. A total of 14 pairs of measurements were conducted. Results indicated that intra-rater reliability was .99 and technical error ranged from 0.0kg to 0.1kg, again within accepted values (Roche, 1992). Inter-rater error was not assessed, as the efficacy of the scale was assumed to be consistent across measurements.

General demographic data. Self-reported measures of each participant's age (using birth date to calculate age at time of study and injury), and gender were obtained at the beginning of the season (see Appendix D). This form required approximately 2 minutes to complete. Coaches provided at this time data pertaining to the playing status (i.e., starter vs. nonstarter) and playing time of each player. During the course of the study, coaches provided information regarding attendance at practices and matches for each participant. This information was used primarily to determine exposure for each participant.

Injury. Prior to the start of the season, each athlete completed a previous history form to assess injuries during the past 12 months (see Appendix F). The previous injury form assessed injuries that occurred both in sport and non-sport activities. Participants were asked to provide information only for injuries that required medical attention or a withdrawal from sport or other physical activity for more than one day.

The injury data collection period lasted approximately eight weeks, and covered four to eight matches. During this time, an injury was recorded if it was incurred while playing a soccer match or practice and either: (a) kept the athlete out of the current match and any subsequent sport activities the day following the injury, or (b) required medical attention, or dental care beyond icing or wrapping. This definition precluded nuisance injuries such as minor contusions, cuts, and blisters. However, nuisance injury data were also obtained to assess their relevance in the context of this study. I recorded on a standardized form (see Appendix G) all injury data. The injury data, which included location, type, treatment, management, field location, nature, practice/match, and position information, were obtained by phone from coaches. Additional contextual notes

regarding the circumstances of the injury were also recorded on the injury form. Follow-up and confirmatory information regarding the status of the injured player was obtained via phone interviews with parent and athlete using the same form. Re-injuries were not recorded as new injuries, however, any additional treatment or participation restriction due to a re-injury counted toward the original injury's severity assessment.

Player exposure estimates were calculated for each athlete, for matches, practices, and total exposures. These estimates were based on attendance information provided during the season by coaches. The risk of injury per player per exposure was calculated from this information. However, this may not be a useful measure for the purposes of this study, due to the relative rarity with which injury is expected to occur in a study of this size. Therefore, case-control analyses were used to assess injury in relation to the predictor variables (see Statistical Analyses section: Schootman, Powell, & Albright, 1994).

Procedures

I met with several soccer organization administrators to obtain permission to collect data from teams in the necessary age groups from their organizations. From this meeting, I developed a list of potential teams to be included in the study. Coaches were then contacted by phone to inform them of the study and its purpose, and to request their team's participation in the study. A total of 18 teams (10 male, 8 female) and coaches agreed to participate in the study. An attempt was made to recruit approximately equal numbers of girls' and boys' teams. Upon approval from organizational administrators and coaches, separate meetings were held with each team to inform players and parents of the purpose of the study, and to request their consent to participate. At this meeting, written

consent was requested from parents (see Appendix H) and athletes (see Appendix I). These forms along with parent evening telephone numbers (for later collection of injury data) were collected at the initial data collection session.

A convenient meeting time for the initial data collection session was arranged with each coach and team. Whenever possible, the initial data collection session occurred approximately one week prior to the team's first match. At this time, my assistant or I obtained measures of previous injury history, perceived risk of injury, risk-taking behaviors, estimation of ability, height and weight, and demographic information. Starting status, estimated playing time, and objective ratings of participants' soccer skill for each participant were concurrently obtained from coaches.

I assessed each team for a total of four to eight matches. During this time, match and practice injury data for each participant were collected. The injury data were obtained by phone from coaches, who were contacted two times per week. When an injury was reported, I followed-up by phone with the injured athlete and his/her parents to obtain further information regarding the severity, medical treatment, and nature of the injury. Any injury incurred at the end of the season was assessed using the same protocol.

Statistical Analyses

Descriptive statistics (e.g., mean, SD, range) were calculated to describe the sample. Reliabilities, using Cronbach's Alpha, were calculated for the RISSc and RTB. A CFA of the RISSc was conducted to confirm the hierarchical overall and six-factor structure of the scale with this sample. An EFA was conducted to assess the initial structure of the RTB with this sample. Height, weight, and BMI curves were also calculated and compared to known data for adolescents of similar ages. Injury rates were

calculated per player per exposure. Hypotheses 1, 2, 3, and 4 were tested using Pearson correlations. Hypotheses 5, 6, and 7 were tested using separate one-way MANOVAs with perceived risk of injury and risk-taking behaviors as the dependent variables. Hypothesis 8 was assessed using a curvilinear regression analysis and MANOVA. In addition to the statistics that tested the hypotheses, partial correlations for age and gender were also conducted.

Because, as expected, there were few injuries in this study, case-control analyses were conducted to better assess the relationship between the predictor variables and injury. In a case-control analysis, a measure of association between a risk factor and the occurrence of sports injuries is made using an odds ratio (OR: Schootman, Powell, & Torner, 1994). The OR is the ratio of odds of injury in those athletes with risk factors compared to those without. For example, an OR of 2.1 for the effect of risk-taking behaviors on the occurrence of injury indicates that those athletes that engage in risk-taking behaviors are 2.1 times more likely to be injured than those who do not. In this study, each risk factor (i.e., predictor variable) was assessed using high and low categories representing the upper and lower quartiles of each factor's distribution in this study. In order to assess ORs, cases and controls were delineated on some factor. For this study, cases were comprised of injured athletes, and controls were comprised of uninjured athletes. Separate ORs for injury, nuisance injury, any injury (injury or nuisance injury), and previous injury were conducted. The ORs for cases and controls were then compared, using multiple Mantel-Haenszel χ^2 tests, to assess the hypothesized associations among the predictor variables and injury. Confidence intervals (CI) for the

95th percentile were also calculated for the ORs. The CIs were calculated using the formula provided by Schoutman et al. (1994).

CHAPTER IV

RESULTS

Introduction

This chapter begins with a presentation of the factor structures and reliability of the RISSc and RTB. Following this presentation, the remaining predictor variables are described. Next, the epidemiological injury data pertaining to both previous and prospective injuries are discussed. The relationships between the predictor variables and injury are then examined using case-control analyses. The results section concludes with a critical examination of the hypotheses proposed in Chapter 1.

RISSc: CFA, Internal Consistency, and Descriptive Data

A CFA was conducted on the 24 items of the RISSc using LISREL 8 (Joreskog & Sorbom, 1996). A total of 248 participants in this study completed all 24 items of the RISSc and were, therefore, included in the analyses. The 24 items were loaded onto the 6 first-order factors reported by Kontos et al. (2000). The six factors consisted of the following perceived risk of injury in sport areas: (a) 'uncontrollable', (b) 'controllable', (c) 'overuse', (d) upper-body, (e) 'surface-related', and (f) 're-injury'. The hierarchical structure (i.e., general perception of risk factor) of the 24 item scale was assessed using a second-order CFA.

Results of the CFA generally supported the six first-order and second-order factors of the RISSc. Solution indices used to assess the CFA included parameter estimates, t values, and R^2 . Indices of fit included the χ^2 , non-normed fit index (NNFI), comparative fit index (CFI), and the root-mean-square residual error of approximation (RMSEA). The t values ranged from 6.10 to 10.39. The R^2 values were between .22 and

.66. The initial global indices of fit were decent, though not as high as had been expected. The χ^2 (248, 237) = 457.16, $p < .001$ was relatively large, however, the NNFI (.88) and CFI (.89) were just below the generally accepted values of .90. In contrast, the RMSEA was .06, which is considerably below the highest suggested acceptable level (.08: Browne & Cudek, 1993). As this CFA was conducted on a homogeneous (i.e., single sport) sample, and because the indices of the solution and fit were near or above accepted values, the first-order structure of the model was considered to be sufficient.

The second-order CFA in this study provided less support for the hierarchical structure of the RISSc than reported in previous research (Kontos et al., 2000). The parameter estimates (λ) were all relatively high, ranging from .69 ('overuse' to .97 ('surface-related')). The R^2 values, except for 'overuse' ($R^2 = .48$) were above .50, and the t values, except for 'surface-related', which was very low (4.00), were above 9.00. The NNFI (.75) and CFI (.85) were, however, relatively low. While the solution indices provided initial support for the second-order factor, the goodness of fit indices provided only minimal support. Based on these results, the efficacy of the second-order structure of the RISSc is still questionable. Consequently, analyses involving the second-order 'general risk' factor should be interpreted with caution. The overall first- and second-order structure and path coefficients are presented in Figure 2. A new path from 'uncontrollable' to the 'general risk' second-order factor is depicted by the dashed line. This new path conflicts with the data from the pilot study CFA for the RISSc, which indicated that 'uncontrollable' likely was a separate construct within the overall risk of

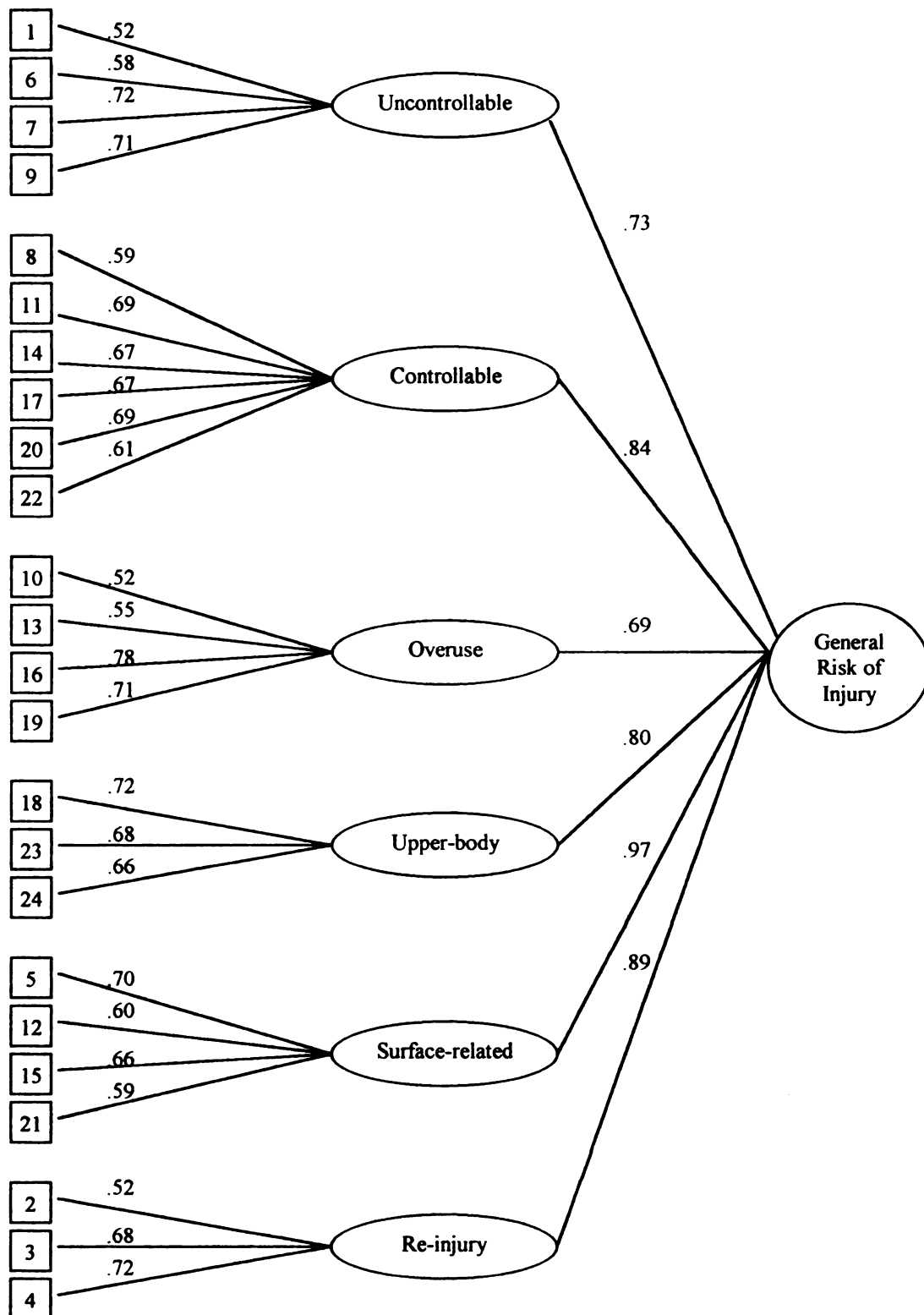


Figure 2. RISSc CFA overall factor structure and path coefficients.

injury framework. As a result, the contribution of this new path to the original model structure is uncertain.

Using Cronbach's Alpha, the internal consistency for the overall RISSc was .91, with all individual items contributing positively to the overall alpha. The alpha for the second-order 'general risk' factor (20 items) was .90, again with all items contributing positively to the total alpha. The alphas for the six first-order factors were .73- 'uncontrollable', .82- 'controllable', .72- 'overuse', .72- 'upper-body', .73- 'surface-related', and .64- 're-injury'. Item #1 ('injure yourself in collision with another player') from the 'uncontrollable' factor was the only item that did not contribute positively to the alphas of the six first-order factors. With the exception of the 're-injury' first-order factor (.64), all alphas exceeded the generally accepted minimum value for internal consistency (>.70).

Means, standard deviations, and ranges for all RISSc items were examined (see Table 5). All item means ranged from 1.79 to 3.49, and all standard deviations were between .69 and 1.39. Overall, the data suggested that participants used all choices within the Likert scale range (1 to 6) of the 24 RISSc items. The means for the overall scale and 'general risk' factor were 2.98 (SD = .78) and 2.46 (SD = .69), respectively. The first-order factor means ranged from 2.17 (SD = .82) for the 'controllable' factor to 3.10 (SD = .88) for the 'uncontrollable' factor. There were no age differences in RISSc scores.

RTB: EFA, Internal Consistency, and Descriptive Data

As the RTB was a newly developed measure, initial analyses of the factor validity and internal consistency of the scale were conducted. A total of 248 participants completed all items of the RTB. Results of an EFA using a varimax rotation produced

Table 5. RISSc Total, Factor, and Item Means, Standard Deviations, and Ranges.

Factors and items (item #)	M	SD	Range
Total RISSc (T)	2.98	.78	4.67
General Risk (G)	2.46	.69	4.35
Uncontrollable (U)	3.10	.88	4.83
Injure yourself in a collision with an opponent (1)	3.08	1.12	5.00
Be injured from a foul or 'cheap shot' (6)	3.05	1.23	5.00
Be injured by more aggressive opponents (7)	3.26	1.18	5.00
Be injured by bigger or stronger opponents (9)	3.00	1.20	5.00
Controllable (C)	2.17	.82	4.75
Be injured running into an object on the field or court (8)	1.84	1.13	5.00
Be injured trying to perform a skill that you have just learned (11)	2.07	1.02	5.00
Be injured performing a skill that is hard for you to do (14)	2.30	1.09	5.00
Be injured not paying attention to what you are doing (17)	2.43	1.28	5.00
Be injured by losing your focus while playing your sport (20)	2.13	1.09	5.00
Injure yourself on a dangerous piece of equipment (22)	2.25	1.16	5.00
Overuse (O)	2.28	.81	5.00
Be injured from not 'taking a break' from your sport (10)	2.13	1.13	5.00
Be injured from playing too many sports at the same time (13)	2.38	1.24	5.00
Be injured practicing too hard (16)	2.28	.98	5.00
Be injured competing too hard (19)	2.32	1.05	5.00
Upper-body (UB)	2.35	.89	5.00
Injure your neck or spine (18)	1.79	1.00	5.00
Injure your arm or wrist (23)	2.84	1.19	5.00
Injure your shoulder (24)	2.43	1.13	5.00
Surface-related (SR)	2.84	.90	5.00
Fall down and injure yourself (5)	2.42	1.25	5.00
Injure yourself on a poor playing surface (12)	1.99	1.15	5.00
Injure your ankle (15)	3.49	1.23	5.00
Trip and injure yourself (21)	2.45	.69	5.00
Re-injury (RI)	2.85	.94	4.67
Have the same injury someone else on your team recently had (2)	2.51	1.12	5.00
Re-injure an area that you have recently injured (3)	3.32	1.39	5.00
Be injured in a practice (4)	2.73	1.17	5.00

three factors with Eigen values greater than 1. The three factors accounted for 53.6% of the total variance for the factor solution. To be included in a factor, an item had to have a loading greater than .40 on a single factor with no other loading greater than .35. If an item did not meet these criteria, it was eliminated from the factor structure. One item (#1- 'volunteer to be in wall') did not meet the loading criteria, and was eliminated from further analyses. The remaining items had factor loadings ranging from .52 to .77. Individual factors had to contain at least two items to be considered a factor. If a factor consisted of only two items, the items had to be highly correlated, otherwise, the factor and its items would be eliminated from the factor structure (Tabachnick & Fidell, 1996). The third factor of the original solution contained only two items ('challenge aggressively for the ball', and 'attempt to block another player's shot') that were not highly correlated with each other and the factor was, therefore, eliminated from the final solution. The remaining two factors accounted for 41.1% of the variance and represented two types of risk-taking behaviors: (a) 'physical risk-taking behaviors (PRTB)', which included items related to physical contact; and (b) 'skill risk-taking behaviors (SRTB)', which included items related to performing difficult and potentially injurious soccer skills. A summary of the two factors and their concomitant item loadings (λ) is provided in Table 6.

Using Cronbach's Alpha, the internal consistency of the overall scale (including only the 9 items that loaded onto one of the 2 factors) was .78. All individual item alphas, except #3- 'dribble aggressively in a crowd of players' contributed positively to the overall alpha. The PRTB factor alpha was .77. The SRTB factor alpha was .71. All items

Table 6. RTB EFA Factor Loadings (λ).

Factors and items	λ
Physical Risk-Taking Behaviors (PRTB)	
Purposely collide with another player	.76
Foul another player	.73
Slide tackle another player	.64
Tackle the ball away from another player with contact	.69
Provoke another player by taunting or teasing them	.68
Skill Risk-Taking Behaviors (SRTB)	
Go up for a header in a crowd of players	.75
Dribble aggressively in a crowd of players	.52
Attempt a diving header	.77
Attempt to perform a difficult skill	.68

in both the PRTB and SRTB contributed positively to their respective overall factor alphas. The alphas from the RTB, PRTB, and SRTB exceeded the generally accepted standards for internal consistency ($<.70$). As this was an exploratory factor analysis, the two factor and total (9-item) RTB scores were calculated for each participant and utilized in subsequent data analyses.

Means, standard deviations, and ranges for all RTB items were examined (see Table 7). All item means ranged from 1.60 to 2.51, and all standard deviations were between .91 and 1.02. Overall, the data suggested that participants used all choices within the Likert scale range (1 to 4) of the RTB items. The means for the PRTB and SRTB factors were 2.09 ($SD = .71$) and 2.11 ($SD = .71$), respectively. The overall mean for the RTB was 2.10 ($SD = .60$). There were no age differences in RTB scores.

Table 7. RTB Total, Factor, and Item Means, Standard Deviations, and Ranges.

Factors and items (item #)	M	SD	Range
Overall RTB (Items 1-9)	2.10	.60	2.89
Physical Risk-Taking Behaviors	2.08	.71	3.00
Purposely collide with another player (1)	2.11	.99	3.00
Foul another player (6)	2.30	.97	3.00
Slide tackle another player (7)	2.00	1.01	3.00
Tackle the ball away from another player with contact (8)	2.42	1.00	3.00
Provoke another player by taunting or teasing them (9)	1.60	.94	3.00
Skill Risk-Taking Behaviors	2.11	.71	3.00
Go up for a header in a crowd of players (2)	2.42	1.02	3.00
Dribble aggressively in a crowd of players (3)	2.51	.98	3.00
Attempt a diving header (4)	1.74	.91	3.00
Attempt to perform a difficult skill (5)	1.79	.95	3.00

Estimation of Ability

Overall, the participants in this study estimated their abilities in soccer to be relatively high ($n = 245$, $M = 3.60$, $SD = .78$). Coaches' estimations of their players' abilities in soccer were similarly high ($n = 245$, $M = 3.45$, $SD = .96$). Among all participants, 38.5% ($n = 71$) were categorized as OE, 33.3% ($n = 84$) as AE, and 28.2% ($n = 97$) UE. This finding suggests that the majority of participants (66.7%) were inaccurate in their estimations of their abilities in relation to coaches' estimations. Girls ($n = 110$, $M = 3.60$, $SD = .70$) and boys ($n = 140$, $M = 3.56$, $SD = .83$) reported similar estimations of their abilities, suggesting that there were no gender differences in estimation of ability. Further, the numbers of girls and boys who were categorized as OE, AE, and UE were comparable. A MANOVA (as opposed to separate ANOVAs, because estimation of ability and over-estimation of ability were positively correlated [$r = .41$, $p < .05$]) was conducted to examine the effect of age on estimation of ability and over-estimation of ability. Results of the MANOVA using Wilk's $\lambda = .96$, $F(6, 478) = 1.76$,

$\eta^2 = .02$, $p = .11$, were not significant. However, Roy's $gcr = .04$, $F(3, 240) = 3.15$, $\eta^2 = .04$, $p < .05$, the use of which with 3 or more groups is advocated by Harris (1975), was significant. Between subjects effects were evident only for estimation of ability ($F[3, 240] = 2.67$, $p < .05$). The Scheffe post-hoc tests indicated that between age differences in estimation of ability were not significant ($p = .19$). The mean estimation of ability scores did, however, demonstrate a weak positive trend with age.

Height, Weight, BMI

Both the median and mean overall heights for participants in this study were 1.58 m ($n = 247$, $SD = .09$). Boys ($n = 137$, $M = 1.58$ m, $SD = .10$) and girls ($n = 110$, $M = 1.59$ m, $SD = .07$) had similar mean and median (boys- 1.58m, girls- 1.59m) heights. Girls ($M = 52.6$ kg, $SD = 9.80$, Median = 52.1 kg), however, were on average slightly heavier than boys ($M = 49.7$ kg, $SD = 9.80$, Median = 48.9 kg). Heights and weights for the participants in this sample demonstrated a linear relationship with age (see Figures 3 and 4). Girls aged 11-12 years tended to be taller and heavier than boys. From age 12.5-14

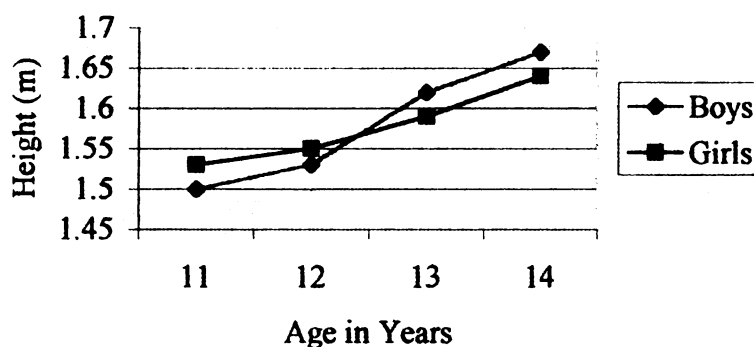


Figure 3. A comparison of heights for boys and girls across age.

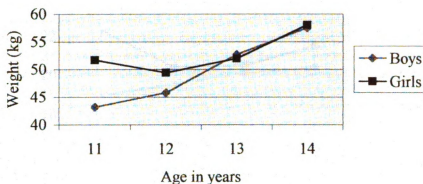


Figure 4. A comparison of weights for boys and girls across age.

years, boys were taller than girls. Boys and girls were similar in weight from age 13-14 years. Approximately 9% ($n = 10$) of the females and 8% ($n = 12$) of the males in this study had BMI scores above the recommended age cut-off points for BMI as an indicator of obesity (Cole et al., 2000). The mean BMI for males ($M = 19.80 \text{ kg/cm}^2$, $SD = 2.53$, Median= 19.41 kg/cm^2) was slightly lower than that reported for females ($M = 20.84 \text{ kg/cm}^2$, $SD = 3.35$, Median= 20.74 kg/cm^2). Girls had higher BMI scores than boys across all ages (see Figure 5). Among girls, a curvilinear relationship between BMI scores and age that approximated a U shape was found. In contrast, among boys, a linear relationship between BMI scores and age was evident. However, the U shape curve for girls appeared to be an artifact of the heavy weights of the 11-year old girls in this study.

The height, weight, and BMI data from the present study were also compared to data for similar aged adolescents from the Centers for Disease Control (CDC) National Center for Health Statistics (Kuczmarski et al., 2000). The comparisons, by gender, are

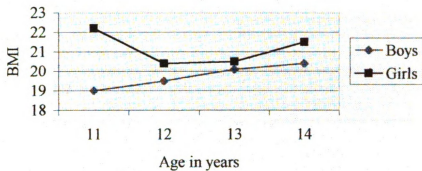


Figure 5. A comparison of BMI scores for boys and girls across age.

depicted in Figures 6-11. The results suggest that the current sample of adolescent male and female soccer players are heavier, taller, and have higher BMIs for age than the CDC reference sample.

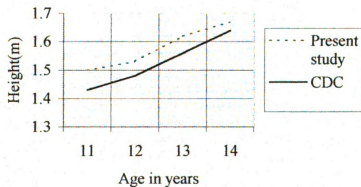


Figure 6. A comparison of stature for age among boys from the present and Centers for Disease Control (CDC) studies.

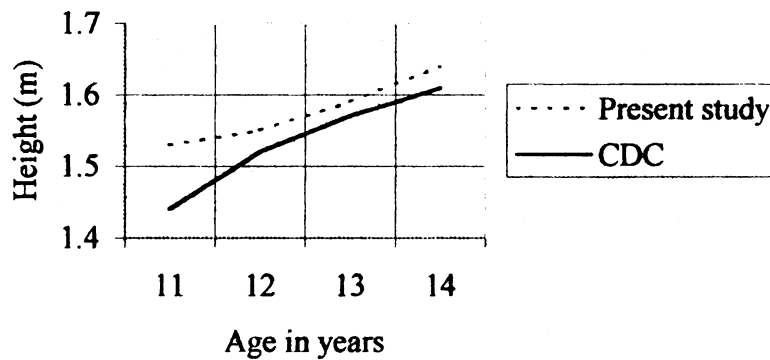


Figure 7. A comparison of stature for age among girls from the present and Centers for Disease Control (CDC) studies.

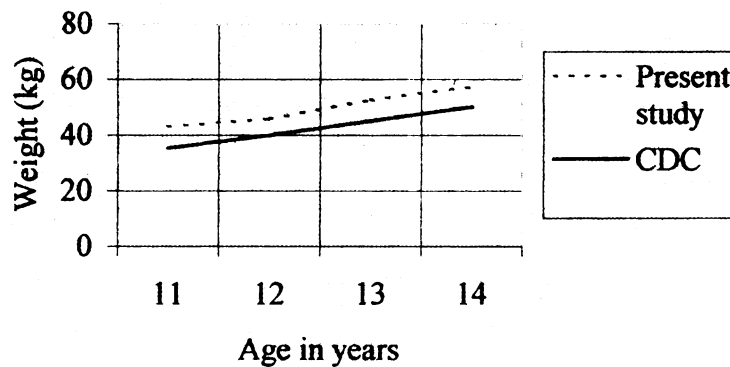


Figure 8. A comparison of weight for age among boys from the present and Centers for Disease Control (CDC) studies.

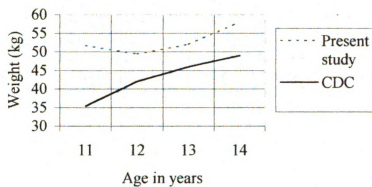


Figure 9. A comparison of weight for age among girls from the present and Centers for Disease Control (CDC) studies.

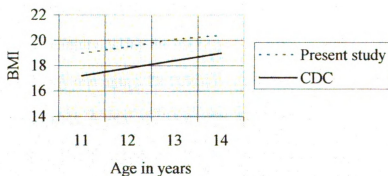


Figure 10. A comparison of BMI for age among boys from the present and Centers for Disease Control (CDC) studies.

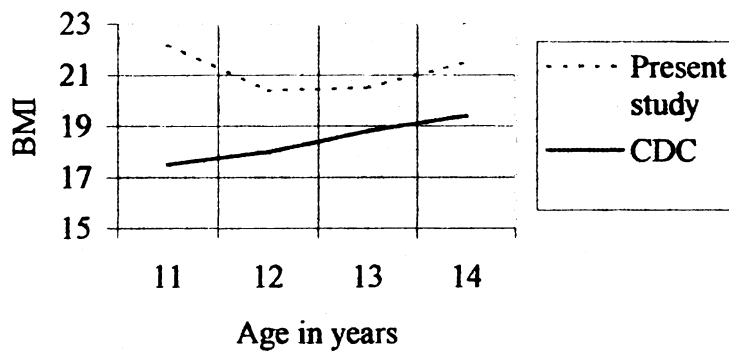


Figure 11. A comparison of BMI for age among girls from the present and Centers for Disease Control (CDC) studies.

Injury Data

Previous injury data. A total of 116 (46.2%) of the participants in this study reported at least one injury during the previous 12 months. The majority of participants (59.3%) reported only one injury. However, as many as five previous injuries were reported by participants. A total of 194 injuries were reported. Most injuries involved the ankle (26.8%), knee (16.0%), and foot (10.3%). In regard to the upper-body, substantial numbers of injuries were reported for only the wrist (10.0%) and head/face (10.0%). Sprains (40.7%) and strains (16.5) accounted for over half of the injury types. However, among those participants reporting an injury during the past 12 months, 18.6% sustained a fracture. Most injuries were attended to by either a physician (56.2%) or parent/coach (26.8%). The most common treatments provided for injured athletes included

immobilization (32.5%) and soft wraps (19.5%). Among the 194 reported previous injuries in this study, 21.1% received no treatment.

Prospective injury data. A total of 21 participants sustained injuries during the study. None of the injured participants sustained multiple injuries. The 21 injuries resulted in 197 days of time loss. A fractured ankle, that sidelined a participant for 56 days, was the most severe injury in the study. In addition to the 21 injuries, 35 nuisance injuries, resulting in no time loss, were recorded.

Exposures were determined by summing the number of practices and matches in which each participant took part. A total of 2,686 overall, 1,552 match, and 1,134 practice exposures were recorded. The average number of exposures per participant was 10.4 ($SD=3.2$). The overall injury incidence rate was 7.8/1000 exposures. As 20 of the 21 injuries in the study occurred in matches, the injury incidence rate for matches (12.9/1000) was considerably higher than the rate for practices (0.88/1000). The injury rates for girls (7.6/1000) and boys (8.0/1000) were comparable.

The lower extremity represented 76.2% of all injury locations, with the majority of the injuries involving the ankle (52.4%) or knee (14.3%). The most common injury types were sprains (57.1%), general trauma (lacerations and contusions: 23.8%) and strains (14.3%). Typically, either a coach/parent (47.6%) or a physician (47.6%) was responsible for the management of the injuries in this study. Emergency Medical Services (EMS) were utilized for one injury. Most injuries (57.1%) received minimal (rest, ice, compression, elevation) or no treatment. Soft wraps (28.6%) and immobilization (14.3%) comprised the remaining treatments provided to injured players.

Injuries occurred primarily in the middle third (50%) or defending third (33.3%) of the field. Consequently, midfielders (36.8%) and defenders (26.3%) were the most commonly injured players. Most injuries (70%) were the result of contact with another player from a collision or tackle or from contact with an object. None of the injuries in the study occurred subsequent to a foul.

Case-Control Analyses

There were only 21 injuries in this study. The numbers of nuisance (35) and total (injuries and nuisance injuries: 54) injuries were also low. Consequently, a comparison of injury incidence rates and the use of correlational or multiple regression analyses would reveal very little about the relationships between the predictor variables and injury. Therefore, a series of case-control analyses assessing the utility of each predictor variable in predicting injury status were conducted.

The case-control analyses in this study were conducted using the methodology outlined by Schootman et al. (1994). Data concerning the presence or absence of each risk factor (i.e., predictor variable) in relation to injury status were summarized as depicted symbolically in Table 8. Odds ratios for each risk factor were then calculated using the following ratio: $a \times d / (b \times c)$, which represented the odds of injury among participants who possessed the risk factor compared to the odds of injury among those without the risk factor. In order to calculate an OR, each risk factor was assessed using high and low categories reflecting the upper- and lower-tertile distributions of each predictor variable. High groups had the risk factor, whereas low groups did not. Using the

Table 8. The number of cases (injured) and controls (uninjured) in a population with and without the presence of a risk factor (i.e., predictor variable).

Risk Factor Present	No. of cases (injured)	No. of controls (uninjured)	Total
Yes	a	b	m ₁
No	c	d	m ₂
Total	n ₁	n ₂	n

Note. From “Study Designs and Potential Biases in Sports Injury Research,” by M.

Schootman, J.W. Powell, and J.C. Torner, 1994, Sports Medicine, 18(1), p.25. Copyright 1994 by Adis International Limited. Adapted with permission of the author.

Mantel-Haenszel χ^2 test (see Equation 1), the null hypothesis (that there was no relation between the risk factor and injury) was then tested.

$$\chi^2 = \frac{(n - 1) \times (ad - bc)^2}{n_1 \times n_2 \times m_1 \times m_2} \quad (1)$$

A χ^2 value greater than 3.84 indicated a significant ($p < .05$, 2-tailed) relationship between the risk factor and injury.

Case-control analyses were conducted on the RISSc and RTB factors, estimation of ability, accuracy of estimation of ability, BMI, previous injuries, age, and gender in relation to status in three injury outcomes: (a) injury, (b) nuisance injury, and (c) any (injury or nuisance injury present) injury. As these factors represented both categorical and continuous data, the comparison criteria used for the case-control analyses (i.e., risk factor vs. no risk factors) are described in Table 9. Results of the case-control analyses are summarized in Table 10. An OR of 1.00 indicates no association between the risk factor and injury. An OR greater than 1.00 indicates an increased likelihood of injury,

Table 9. Comparison criteria for the risk factors included in the case-control analyses.

Risk Factor	Risk Factor	No Risk Factor
RISSc Factors Scores	Upper-tertile	Lower-tertile
RTB Factor Scores	Upper-tertile	Lower-tertile
Estimation of Ability	Upper-tertile	Lower-tertile
Accuracy of Estimation		
OE vs. AE	OE	AE
UE vs. AE	UE	AE
OE vs. UE	OE	UE
Body Mass Index	Upper-tertile	Lower-tertile
Previous Injury	Yes	No
Age (in years) 11-12 vs. 13-14	Age (in years) 11-12	Age (in years) 13-14
Gender	Boys	Girls

while an OR of less than 1.00 indicate a decreased likelihood of injury. BMI (OR= 3.41) was the most significant risk factor for injury. This finding suggests that participants with a high BMI had a significantly greater risk of injury. Under-estimators of ability were significantly more likely to sustain a nuisance injury than both over-estimators and accurate estimators. Generally, higher scores on the RISSc factors were related, though not significantly, to an increased likelihood of injury. Higher scores on the 're-injury' factor, in particular, were significantly related to an increased likelihood of having been previously injured. Similarly, higher scores on the RTB factors were related to a non-significant increase in the likelihood of injury. This finding did not apply to the

Table 10. A summary of odds ratios and 95% confidence intervals (C.I.) among risk factors for three outcomes: injury (I), nuisance injury (N), any injury (A).

Risk Factor	Odds Ratios			95% C.I.		
	I	N	A	I	N	A
RISSc						
General Risk	2.23	1.41	1.85	0.56-8.95	0.48-4.15	0.74-4.60
Uncontrollable	2.78	1.14	1.59	0.69-11.2	0.38-3.39	0.63-4.00
Controllable	1.24	0.98	1.23	0.38-4.08	0.36-2.66	0.53-2.85
Overuse	1.57	2.16	2.12	0.53-4.67	0.87-5.37	0.98-1.78
Upper-body	0.25	0.33	0.51	0.12-2.12	0.18-1.54	0.19-1.36
Surface-related	1.62	1.19	1.37	0.44-5.94	0.46-1.18	0.60-3.11
Re-injury	2.51	2.08	1.99	0.52-12.2	0.73-5.94	0.79-4.99
RTB						
PRTB	0.69	0.74	0.68	0.21-2.25	0.31-1.77	0.32-1.47
SRTB	0.64	1.71	1.17	0.18-2.26	0.72-4.08	0.89-2.50
RTB total	0.61	1.18	0.94	0.14-2.63	0.43-3.21	0.39-2.24
Estimation of Ability	0.88	1.13	1.24	0.30-2.59	0.56-2.30	0.55-2.82
Accuracy of Estimation						
OE vs. AE	0.57	0.98	1.06	0.14-2.36	0.29-3.35	0.39-1.06
UE vs. AE	0.71	2.76*	2.30	0.21-2.40	1.04-7.35	0.99-5.33
OE vs. UE	0.81	0.36*	0.46	0.19-3.52	0.13-1.03	0.19-1.11
Body Mass Index	3.41*	1.35	2.20	1.08-10.8	0.52-3.49	0.97-4.99
Previous Injury	1.60	0.73	1.07	0.54-4.76	0.33-1.62	0.54-2.13
Age (in years)						
11-12 vs. 13-14	1.03	1.45	1.23	0.35-3.06	0.64-3.29	0.61-2.48
Gender						
Boys vs. Girls	1.01	0.85	0.75	0.41-2.48	0.40-1.82	0.40-1.42

Note. RISSc= Risk of Injury in Sports Scale; RTB= Risk-Taking Behaviors Scale; PRTB= physical risk-taking behaviors; SRTB= Skill Risk-Taking Behaviors; RTB total= total risk-taking behaviors; OE= over-estimator; AE= accurate estimator; UE= under-estimator.

*Mantel-Haenszel $\chi^2 = 3.84$, $p < .05$, 2-tailed

injury status category of injury. The results suggest that previous injuries, age, and gender were not useful predictors of injury status among participants in this sample.

Correlations among Predictor and Outcome Variables

A series of Pearson correlations (2-tailed, $p < .05$) were conducted to assess the interrelationships among the predictor and outcomes variables in this study. A summary of the correlations is presented in Table J1 in Appendix J. Both height (m) and weight (kg) were positively correlated with several of the RISSc factors. Height was moderately correlated with the 'general risk' ($r = .17$), 'control' ($r = .13$), 'upper-body' ($r = .13$), and 're-injury' ($r = .20$) factors. Weight was moderately correlated with the 'general risk' ($r = .20$), 'control' ($r = .14$), 'overuse' ($r = .17$), 'upper-body' ($r = .15$), 'surface-related' ($r = .14$), and 're-injury' ($r = .17$) factors. Height was also moderately correlated with PRTB ($r = .17$) and RTB ($r = .18$). BMI demonstrated moderate correlations with 'general risk' ($r = .14$) and 'overuse' ($r = .17$). As expected, the RISSc factors were all significantly correlated with each other, as were the RTB factors. The remaining significant correlations are discussed in relation to the evaluation of the hypotheses that follows.

A series of partial correlations controlling for age were also conducted to assess the potential influence of age on the relationships among the predictor variables. A summary of the correlations is presented in Table K1 in Appendix K. The results indicate that when age was partialled out, inverse relationships between BMI and risk-taking, and weight and risk-taking, became apparent. This finding suggests that age may confound the relationships among these variables. The negative correlations between the PRTB and RTB overall factors and injury were strengthened significantly as a result of partialing out age. Several of the positive relationships between the RISSc factors and injury

became significant as a result of controlling for age. The remaining findings mirrored the results of the bivariate correlations discussed above.

Evaluation of Hypotheses

Hypothesis 1- An inverse relationship between perceived risk of injury and risk-taking behaviors for those athletes who over-estimate their ability. To assess this hypothesis, participants were first categorized into one of three estimation of ability categories: (a) over-estimators, (b) accurate estimators, and (c) under-estimators. A series of separate Pearson correlations (1-tailed) between the RISSc and RTB factors were then conducted for each of the three categories. The results of these analyses indicated that an inverse relationship between the RISSc and RTB and SRTB factors was evident only among over-estimators. Specifically, among over-estimators ($n = 70$), 'overuse' was inversely related to both SRTB ($r = -.30$) and RTB ($r = -.21$), and both 'general risk' ($r = -.25$) and 'uncontrollable' ($r = -.30$) were inversely related to SRTB. Conversely, among accurate estimators ($n = 82$), a positive relationship between the 'overuse' ($r = .20$) and 're-injury' ($r = .31$) RISSc factors and SRTB was found. The 're-injury' ($r = .24$) factor was also positively related to overall RTB. No relationships were found between the RISSc factors and RTB factors for under-estimators ($n = 92$). These findings support the first hypothesis. A summary of the correlations (1-tailed) for all three groups is presented in Table 11.

Hypothesis 2- A positive relationship between estimation of ability and risk-taking behaviors. This hypothesis was examined using Pearson correlations (1-tailed) to assess the relationship between participants' estimation of their soccer ability and scores

Table 11. Correlations between the RISSc and RTB factors for over-estimators (OE: n=70), accurate estimators (AE: n= 82), and under-estimators (UE: n=92).

	PRTB	SRTB	RTB
General Risk			
OE	-.08	-.25*	-.18
AE	.01	.17	.09
UE	-.05	-.03	-.05
Uncontrollable			
OE	-.01	-.30**	-.16
AE	.07	.15	.13
UE	-.03	-.10	-.07
Controllable			
OE	-.04	-.18	-.12
AE	-.06	.13	.03
UE	-.13	-.08	-.13
Overuse			
OE	-.08	-.30**	-.21*
AE	.01	.21*	.11
UE	-.09	-.04	-.08
Upper-body			
OE	.02	-.16	-.07
AE	-.01	.08	.04
UE	.16	.06	.15
Surface-related			
OE	-.14	-.20*	-.19
AE	-.01	-.02	.01
UE	.04	-.01	.03
Re-injury			
OE	-.02	-.18	-.10
AE	.12	.31**	.24*
UE	-.08	-.02	-.07

Note. RTB= total risk-taking behaviors; PRTB= physical risk-taking behaviors; SRTB= Skill Risk-Taking Behaviors.

* $p < .05$

** $p < .01$

on the RTB factors. Estimation of ability ($n = 245$) was positively related to the overall RTB ($r = .30, p < .01$), and PRTB ($r = .16, p < .05$) and SRTB ($r = .36, p < .01$) factor

scores, thus supporting Hypothesis 2. The magnitude of the relationship between estimation of ability and SRTB was the highest among the correlations.

Hypothesis 3- A positive relationship between risk-taking behaviors and injury.

The results of a series of Pearson correlations between the factors of the RTB and the number of injuries, nuisance injuries, and combined (nuisance injuries and injuries) injuries provided little support for this hypothesis. In fact, only the relationship between SRTB and the number of nuisance injuries ($r = .14$) was significant ($p < .05$). However, the remaining relationships were equivocal, and in some instances, non-significant negative trends were evident. A summary of the correlations is presented in Table 12. As a result of the low number of injuries in the study (i.e., cases), a series of case-control

Table 12. Correlations between the RTB factors and Injuries, Nuisance Injuries, and Combined Injuries.

	Injuries	Nuisance Injuries	Combined Injuries
PRTB	-.04	-.07	-.08
SRTB	-.04	.14*	.10
RTB	-.05	.03	.00

Note. RTB= total risk-taking behaviors; PRTB= physical risk-taking behaviors; SRTB= Skill Risk-Taking Behaviors.

* $p < .05$

** $p < .01$

analyses were conducted to further assess this hypothesis. ORs for high and low risk-taking groups (using the upper- and lower-tertiles) on three injured outcomes (injured, nuisance injured, any injured) were then compared using Mantel-Haenszel χ^2 tests. None of the ORs were significantly different at the $p < .05$ level ($\chi^2 > 3.84$). The highest OR (1.71) calculated was for injured status, indicating that the high risk-taking group was 1.71 times more likely to sustain a nuisance injury than the low risk-taking group. The remaining ORs approximated 1.00, suggesting no effect for risk-taking behaviors on the risk of being injured (see Table 10).

Hypothesis 4- A positive relationship between the number of previous injuries and perceived risk of injury. A series of Pearson correlations (1-tailed) were conducted between the number of self-reported previous injuries in the past 12 months and the factors of the RISSc. The ‘uncontrollable’ ($r = .17, p < .05$), ‘upper-body’ ($r = .16, p < .05$), ‘surface-related’ ($r = .15, p < .05$), and ‘re-injury’ ($r = .16, p < .05$) factors were all positively, but weakly related to previous injuries. The remaining RISSc factors were not significantly related to previous injuries, though they all indicated positive trends. Overall, these results indicate positive, but weak support for the fourth hypothesis.

Hypothesis 5- Girls report higher levels of perceived risk of injury than boys. A MANOVA comparing RISSc factor scores between boys ($n = 138$) and girls ($n = 110$) was conducted to test this hypothesis. The MANOVA was significant, Wilk’s $\lambda = .82, F(6, 241) = 8.57, \eta^2 = .18, p < .01$. Stepdown F s revealed that girls had significantly higher mean scores than boys for all factors of the RISSc thus supporting this hypothesis (see Figure 12). A summary of the RISSc factor score means, standard deviations, and effect sizes for boys and girls is presented in Table L1 in Appendix L.

Hypothesis 6- Boys report engaging in more risk-taking behaviors than girls. A

MANOVA comparing RTB factor scores between boys and girls was conducted to test this hypothesis. The MANOVA was significant, Wilk's $\lambda = .93$, $F(2, 245) = 9.29$, $\eta^2 = .07$, $p < .01$. Stepdown F s revealed that boys had significantly higher mean scores than girls for all factors of the RTB (see Figure 13). A summary of the RTB factor score means, standard deviations, and effect sizes for boys and girls is presented in Table M1 in Appendix M.

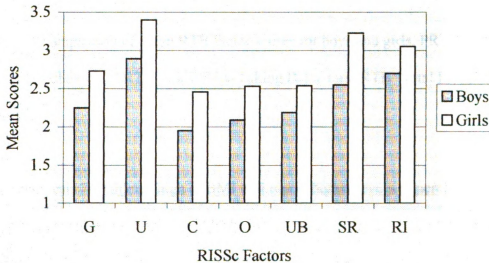


Figure 12. A comparison of mean RISSc factor scores for boys and girls. T= total RISSc scale; G= general risk, U= uncontrollable, C= controllable; O= overuse; UB= upper-body; SR= surface-related; RI= re-injury.

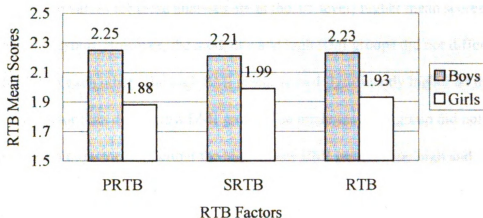


Figure 13. A comparison of mean RTB factor scores for boys and girls. PRTB= Physical Risk-Taking Behaviors; SRTB= Skill Risk-Taking Behaviors; RTB= total Risk Taking Behaviors.

Hypothesis 7- Athletes high in BMI will report higher levels of perceived risk of injury than athletes low or moderate in BMI. To assess this hypothesis, participants were categorized into high, moderate, and low BMI groups using a tertile split. The cut-off points were 21.12 and above for the high ($n = 86$), 18.77 to 21.11 for the moderate ($n = 82$), and 18.76 and below for the low ($n = 79$) BMI groups. Results of the MANOVA using Wilk's $\lambda = .93$, $F(12, 478) = 1.46$, $\eta^2 = .04$, $p = .14$, were not significant. However, Roy's $gcr = .07$, $F(6, 240) = 2.78$, $\eta^2 = .07$, $p < .05$, again, as recommended by Harris (1975), was significant. Further examination revealed that between subjects effects were evident for the 'general risk' ($F[2, 239] = 5.22$, $\eta^2 = .04$, $p < .01$) second-order, and 'uncontrollable' ($F[2, 239] = 4.00$, $\eta^2 = p < .05$) and 'overuse' ($F[2, 239] = 7.75$, $\eta^2 = .06$, $p < .01$) first-order factors. A closer examination of the data using Scheffe's post-

hoc tests, revealed that for 'general risk', the high and moderate BMI groups had significantly (all p values for these analyses are at the .05 level) higher mean scores than did the low BMI group. However, the moderate and high BMI groups did not differ significantly from each other. The high BMI group scored significantly higher on the 'controllable' factor than did the low BMI group. The moderate BMI group did not differ on the 'controllable' factor from either the high or low BMI groups. The high and moderate BMI groups had significantly higher mean scores on the 'overuse' factor than did the low BMI group. Again, the moderate and high BMI groups did not differ significantly from each other. A summary of the means for the RISSc factors of the three BMI groups is presented in Figure 14. In order to examine the potential influence of estimation of ability on the effect of BMI on perceived risk, a post-hoc ANOVA was conducted. The results revealed no significant differences in estimation of ability between the three BMI groups ($F [2, 245] = .47, p = .63$).

Hypothesis 8- BMI will demonstrate a trend with injury that approximates a U shape. A curvilinear trend analysis between BMI and injuries, nuisance injuries, and combined injuries was conducted to examine this hypothesis. Results indicated no significant trends between BMI and injury. The R^2 values were also low, further eroding support for a curvilinear relationship between BMI and injury. The relationship between BMI and injury was also examined using the case-control analysis described earlier. A high BMI score was the most significant ($OR = 3.84$) risk factor for injury. This finding suggests that BMI may directly influence the likelihood for injury.

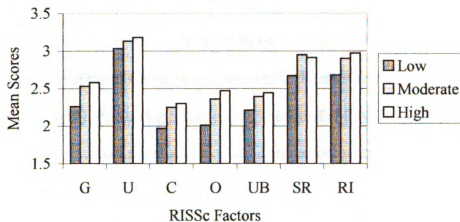


Figure 14. A comparison of mean RISSc factor scores among high, moderate, and low BMI groups. G= general risk, U= uncontrollable, C= controllable; O= overuse; UB= upper-body; SR= surface-related; RI= re-injury.

CHAPTER V

DISCUSSION

The purpose of this dissertation was to examine the inter-relationships among perceived risk of injury, risk-taking behaviors, estimation of ability, body size, and injury in youth sport. The results of this study have implications for theory and measurement of the perceived risk of injury construct, and for the enhancement of our understanding of the sport injury phenomenon among youth sport athletes.

This dissertation was the first study to examine the effects of perceived risk and risk-taking behaviors in youth sports. In general, the findings suggested that there were several consistent inter-relationships among these variables. However, several unexpected findings and relationships were also evident among the data. Six of the eight hypotheses proposed for this study were confirmed to varying degrees, providing initial support for the efficacy of perceived risk of injury and risk-taking behaviors as well as potential moderating factors in relation to the injury process.

As hypothesized, there was an inverse relationship between perceived risk of injury and risk-taking behaviors among over-estimators only. This finding suggests that over-estimation of ability is a moderator of the relationship between perceived risk of injury and risk-taking behaviors. Athletes who inaccurately perceive themselves to be high in ability are likely to have inflated confidence in attaining desired outcomes in a given situation (Bandura, 1997). Consequently, over-estimators may engage in more risk-taking behaviors as they are confident in a positive outcome (i.e., not being injured). However, it was not the over-estimators, but rather the under-estimators who had the higher risk for being injured in this study. This finding was true only for nuisance and

combined injuries. Perhaps, athletes with inaccurately low estimations of their abilities subsequently expect a negative outcome (i.e., injury) from participation in sports. This expectation is then substantiated by the occurrence of a relatively minor injury (i.e., nuisance injury), but only if it results in the under-estimator's withdrawal from competition. In contrast, it is possible that if accurate estimators or over-estimators incur the same nuisance injury, they may continue to play through the injury to negate its potential negative affect on their estimation of ability.

A positive relationship between estimation of ability and risk-taking behaviors was also evident in this study. This relationship was strongest between estimation of ability and SRTB. The SRTB factor of the RTB pertains to risk-taking behaviors that involve the performance of difficult and potentially injurious soccer skills. According to social-cognitive theory, athletes who are confident in their abilities to perform in a particular sport context, are more likely to attempt new or difficult skills in that sport than are athletes who are less confident in their abilities (Bandura, 1997). As such, the findings in relation to estimation of ability lent support to this contention. However, greater risk-taking behaviors did not translate into a greater incidence of injury. In addition, a series of Pearson correlations between estimation of ability and the RISSc factors failed to yield a negative relationship, as proposed by Bandura (1997). Together, these findings suggest that estimation of ability primarily affects athletes' decisions to engage in risk-taking behaviors, and not their perceived risk of injury or injury directly.

Only one of the analyses between risk-taking behaviors and injury supported the hypothesized positive relationship between these factors. The lack of support for a positive relationship between risk-taking behaviors and injury is in contrast to previous

research (Potts et al., 1995). This finding may have been, in part, due to the low numbers of injuries that occurred in this study. However, the case-control analyses also revealed no significant relationships between risk-taking behaviors and injury. The ORs suggested that there was, instead, a slightly reduced risk of injury associated with higher RTB scores.

The lack of a significant relationship between the factors of the RISSc and the RTB, with the exception for over-estimators, among this sample was unexpected. Further, the absence of a relationship between the RTB and injury eroded support for the potential use of the assessment of perceived risk and risk-taking to predict injury status. To further investigate this relationship, a post-hoc analysis of the relationship between the RISSc and RTB factors among injured athletes was conducted. The results indicated that no consistent or significant relationships existed between the RISSc and RTB factors among injured athletes. This finding suggests that the predictive validity of the relationship between the RISSc and RTB for injury status needs to be explored further.

Researchers (Williams & Andersen, 1998) contend that previous injuries are related to negative cognitive appraisals (i.e., perceived risk of injury) influencing the potential for injury. Specifically, if an athlete has previously experienced a particular injury, it is likely that (s)he will have some trepidation of being similarly injured in the future. The findings of the present study suggested that the number of previous injuries was slightly related to perceived risk, in particular, 'uncontrollable', 'upper-body', 'surface-related', and 're-injury' risk factors. However, the present study did not assess the relationship between specific previous injury types or severity and perceived risk of

injury, as Petrie and Falkstein (1998) have suggested. Focusing on previous injuries only from sports, as opposed to any activity, may also help to strengthen this relationship.

With regard to other factors that might influence perceived risk of injury and risk-taking behaviors, girls reported higher levels of perceived risk of injury than did boys. This finding was, as hypothesized, consistent across all six first-order and the 'general risk' second-order factors of the RISSc. This finding may reflect a real difference in perceived risk of injury between girls and boys. However, girls may instead be more accurate than boys in assessing risk of injury in sport. Additionally, it may be socially desirable for boys to perceive less risk of injury in sports, in accordance with the prevailing masculine stereotype for boys in sports (Coakley, 1994). Brustad (1993) has suggested that boys tend to underreport anxiety levels because it either is socially desirable to do so, or to retain self-confidence. Similar logic could be applied to the current findings in suggesting that boys underreported their levels of perceived risk, while girls were accurate in their reporting.

Another factor that may have influenced this finding is the socialization process of girls into sport. Parents, coaches, and peers influence this process to varying degrees. Parents, in particular, are the most influential socializing agents in the formative stages of a young athlete's development (Weiss, 2000). Female athletes traditionally have been socialized by parents and coaches away from the aggressiveness, physical contact, and risk-taking that are considered necessary in many sports. Title IX and other influences on girls and women in sport have helped to changed this process. However, parental socialization continues to negatively influence girls and to support boys in sport (Brustad,

1993). Therefore, the gender differences in perceived risk of injury may reflect the lingering influence of the socialization of girls into sports.

Gender differences were also apparent in self-reported risk-taking behaviors. Boys reported engaging in more risk-taking behaviors than girls. This finding supports the work of Morrongiello and Rennie (1998), who also reported that boys engaged in significantly more risk-taking behaviors than did girls. This gender difference may be reflective of the fact that boys engage in more risk-taking behaviors in soccer than girls. In support of this contention, Morrongiello and Rennie (1998) found that boys tended to attribute injuries more to luck and were more optimistic regarding positive outcomes related to taking risks. Hence, boys may believe that whether or not they engage in risk-taking behaviors is inconsequential to their potential for injury.

However, as the RTB was a self-report measure of risk-taking behaviors, boys may have reported higher levels of risk-taking because, again, it may have been socially desirable to do so. A comparison of responses to the RTB with either researcher-observed risk-taking behaviors or information from knowledgeable informants (i.e., parent, coach) would help to examine the accuracy of boys' reporting of risk-taking behaviors. Potts et al. (1995) conducted such a comparison and found that children's self-reported levels of risk-taking behaviors were consistent with parent's reports. Gender differences in reporting were, however, not addressed in the Potts et al. (1995) study. Speltz et al. (1990) demonstrated that self-reported risk-taking behaviors were a better predictor of injury than parent-reported risk-taking behaviors. Therefore, while comparing self-reported risk-taking to observed risk-taking may assess the accuracy of reporting, it

would not necessarily provide researchers with data that are any more useful in predicting injury.

Gender differences were not as apparent in the relationships among the predictor variables. In fact, the results of separate correlations among the predictor variables for boys and girls indicated that there were no differences related to gender in the relationships of these variables.

The findings in regard to BMI suggested that it, in part, influences levels of perceived risk of injury. Athletes with higher BMIs tended to perceive higher levels of risk of injury in soccer. The athletes with higher BMIs, by definition, would be heavier than their lower BMI counterparts. Adolescent boys and girls are constantly bombarded with negative social comparisons. This is particularly true among heavy or overweight individuals. As a result, athletes with high BMIs may perceive themselves to be less skilled, more awkward, and consequently more likely to be injured than athletes with lower BMIs. In contrast, athletes with lower BMIs may have been more agile and thus perceived themselves to be of higher ability than those athletes high in BMI. This, in turn, may have resulted in a lower perception of risk of injury among athletes with low BMIs. However, a post-hoc ANOVA revealed no differences between the three BMI groups ($F[2, 245] = .47, p = .63$), thus reducing the empirical support for this alternate explanation.

BMI also appears to be a significant risk factor for injury directly. The case-control analyses revealed that BMI was the most significant risk factor for injury among this sample of athletes. This result supports the findings of Gomez et al. (1998), who reported that a high BMI was associated with a greater number of lower extremity injuries among football linemen. In spite of this finding, the original hypothesis that BMI

would demonstrate a curvilinear (i.e., inverse-U shape) relationship with injury was not supported. The limited range of BMIs in this study may have influenced this finding, as the upper (BMI > 30) and lower (BMI < 15) ends of the BMI continuum were underrepresented among participants in this relatively homogeneous sample.

While age was not a significant risk factor for injury in this study, it did influence the interrelationships among several of the predictor variables. In particular, age affected the relationship of BMI and weight to risk-taking behaviors. The bivariate correlations (not controlling for age) were negative, but small in magnitude. However, the correlations became significant after controlling for age. This inverse relationship, controlling for age, suggests that there is a potential direct relationship between biological factors, such as age and body size, and risk-taking behaviors. Moreover, when age is controlled, it appears that athletes high in BMI do not engage in many risk-taking behaviors. Consequently, athletes low in BMI may be more likely to engage in risk-taking in soccer, possibly as a result of greater agility, speed, and skill levels. Overall, this finding also supports the notion that age should be controlled for in future studies involving body size variables.

Summary of Findings of Injury in Youth Sport

The findings from this can be summarized in a model of injury for youth sports. This model utilizes a comprehensive approach to explain injury among youth sport athletes, that includes not only psychological factors, but also physical/maturational characteristics, the sport context, and the influence of socialization. The model of injury in youth sports is depicted in Figure 15. The paths of the model that are indicated by a block arrow/line are representative of the relationships that were assessed in the current

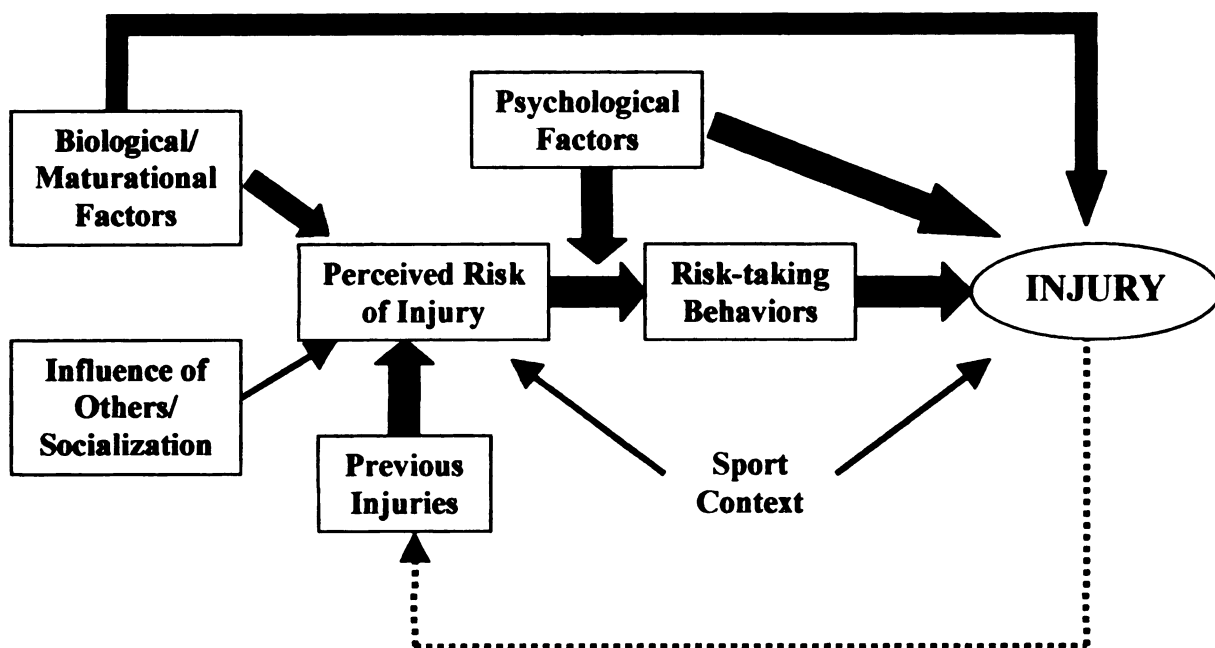


Figure 15. A model of injury in youth sport.

study. Perceived risk of injury was postulated to be a key component in the model. An athlete's perceived risk of injury was proposed to influence the athlete's decision to engage in risk-taking behaviors. This is in contrast to the contention of Horvath and Zuckerman (1993) who argue that risk-taking behaviors influence subsequent perceptions of risk. However, a youth sport athlete is not likely to have had much experience with injury, and consequently, would develop a perception of risk a priori to engaging in risk-taking behaviors. Still, the consequence of risk-taking behaviors (i.e., injury vs. no injury) in the model does feed back into the perception of risk of injury via the effects of previous injuries (see dotted arrow in Figure 15). For example, a young athlete who has previously been injured will be more likely to perceive risk in a similar environment, and

may then avoid risk-taking behaviors. Conversely, a young athlete who has engaged in risk-taking behaviors before, and not been injured, may perceived little risk of injury in a particular environment. As evidenced in the present study, an athlete's accuracy of estimation moderated the relationship between perceived risk of injury and risk-taking behaviors.

I hypothesize that two main factors were antecedents in this model (a) the 'influence of others/socialization', (b) 'biological/maturational factors'. These factors interacted with each other and subsequently affected the perceived risk of injury, risk-taking, and/or injury directly. The factors within the 'influence of others/socialization' component include coaches, parents, peers, officials, and cultural, institutional, and gender influences. The 'biological/maturational' component included height, weight, and body mass index, and biological sex. 'Psychological factors' (e.g., accuracy of estimation of ability) were proposed to be moderating factors of the perceived risk of injury-risk-taking behaviors relationship. Based on the direct relationship reported between under-estimation of ability and injury in this study, I speculated that 'psychological factors' will also directly influence injury. The factor included in the 'psychological factors' component was estimation of ability. Future research should also consider personality, life-stress, and social support.

Measurement Issues

Typically, multiple regressions and correlations are used to assess the relationships between psychological predictor variables and injury number or injury rates. However, these approaches are useful only with large sample sizes, where the potential for sampling error is reduced and the likelihood of injuries increased. Most sample sizes

in studies on the effects of psychological variables on injury in sport are relatively small (i.e., < 500 participants), and hence, do not provide an ideal context in which to conduct traditional bivariate and multivariate analyses. As mentioned earlier, an alternative to these analyses is the case-control analysis, which focuses on subject-related risk factors among those athletes with and without injuries (Schoutman et al., 1994). The findings from the case-control analyses in this study revealed that overestimation and underestimation of ability, and BMI were significant risk factors for injury. However, these relationships were not evident in other analyses, due in part to the low numbers of participants and injuries in this sample. Therefore, it seems pertinent for researchers to utilize case-control analyses, in addition to more traditional approaches, in future studies of subject-related risk factors for injury in sport.

From a measurement perspective, the results of the CFA and internal consistency analysis of participants' responses to the RISSc confirmed the validity and reliability of the scale among soccer players. However, the 're-injury' factor did not appear to be as reliable as the other five factors were. The 're-injury' factor contains only three items, which, according to Tabachnick and Fidell (1996), predisposes it to have internal consistency problems. Subsequently, researchers using the RISSc in the future should be cautious in the use of this factor. Readers should also note, however, that with homogeneous samples such as the present one, CFA results will not be as strong as in more heterogeneous samples (Tabachnick & Fidell, 1996). Should the 're-injury' factor continue to be unreliable in future studies, then its inclusion in the RISSc must be questioned.

Past research has provided initial evidence for the potential application of the RISSc in comparing differences in perceived risk of injury among athletes from different sports (Kontos et al., 2000). In fact, the scale was developed using responses from athletes representing over 20 sports, males and females, and recreational, competitive, and scholastic competition levels (Kontos et al., 2000). In the present study, which used a single sport sample, the 24 items of the RISSc again loaded onto the 6 first-order factors in a manner consistent with the initial study. Hence, the utility of the scale both across sports and within a single sport, in this case soccer, has now been substantiated.

In contrast, the results of the second-order factor analysis were not as expected. Specifically, the ‘uncontrollable’ factor loaded along with the other five first-order factors onto the ‘general risk’ second-order factor. In previous research (Kontos et al., 2000), the ‘uncontrollable’ factor did not load onto the second-order structure, and was treated as a distinct component within the perceived risk of injury construct. However, the present finding suggests that among soccer players, ‘uncontrollable’ risk is related to other types of risk within the ‘general risk’ second-order factor. Therefore, the hierarchical structure of the RISSc is, at this point, uncertain.

The initial analysis of the RTB using an EFA, revealed two significant factors: (a) PRTB, and (b) SRTB. The internal consistency of these factors was acceptable, and the factor loadings were intuitive. The strength of the association between the SRTB factor and estimation of ability also provided initial concurrent validity for the scale. In addition, several of the items that were eliminated from the scale appeared to be meaningful and contribute to the overall variation of scores, however, those items loaded onto a factor that was eliminated from the RTB. The validity of the RTB predicting injury

is questionable, as none of the RTB factors were related to subsequent injuries. Also, the applicability of the RTB is limited to soccer. Future self-reports of risk-taking behaviors should utilize a series of consistent stem phrases with concomitant changes in behaviors based on the sport context, or a more general risk-taking behavior assessment that allows for across-sport comparisons should be developed. Further, a social desirability scale should be employed in future administrations of both the RTB and RISSc to ensure that subjects are responding in a forthright manner.

Another measurement concern in this study pertains to the use of a single item to assess estimation of ability and subsequent calculations of over-estimation of ability. Researchers (Chase et al., 1994) have used single item assessments of self-efficacy before. However, a single item assessment of ability may be too unidimensional and not reflect the multifaceted aspects of ability in any one sport. Thus, the use of a single-item measures of estimation of ability, though convenient, may be a limitation of this study.

Body Size, BMI, and Injury Trends

From a descriptive standpoint, the data from this study on height, weight, and BMI were reflective of well-established age- and gender-related maturational differences. Below 12-years of age and coincidental with a typical 2-year earlier onset of maturation than boys (Malina & Bouchard, 1991), girls were both taller and heavier than were boys. After age 12.5 years, though, boys equaled, and in subsequent years surpassed girls in height. Weights of both boys and girls were similar, and continued to increase linearly from age 12 years on. These findings reinforce the well-established patterns of maturation among adolescent girls and boys.

The heights, weights, and BMIs among this sample were considerably higher than those reported for reference age groups in the U.S. (Kuczmarski et al., 2000). In addition, 10% of the sample was obese (i.e., above 85th percentile for BMI reference age group). These findings may reflect the alarming general trend toward adolescent obesity in the U.S., even among a seemingly physically active segment of the adolescent population. As such, we cannot assume that all adolescents who participate in sports such as soccer are attaining sufficient levels of energy output to positively affect body weight and BMI.

The injury data for this adolescent sample of competitive and recreational soccer players confirmed previous findings regarding injury in the sport of soccer. Specifically, the relatively low number of injuries (21) in this study was slightly higher than the number of injuries (19) reported in a prospective study of similar scope on youth soccer injuries over a season (Sullivan et al., 1980). The injury incidence rate in the present study (7.8/1000 exposures) was also comparable to the rate (7.4/1000 hours) found in a retrospective study of youth soccer injuries conducted over a season (Hoff & Martin, 1986). Hoff and Martin (1986) and Keller et al. (1987) reported similarly higher match than practice injury rates as did the present study. The distribution of injury types and locations in the current study was also consistent with previous research on injuries in youth soccer (e.g., Backous et al., 1988; Hoff & Martin, 1986).

The fact that most injuries in this study were the result of contact with another player was consistent with the suggestion that injuries in youth soccer are primarily acute in nature (Larsons et al., 1996). The acute nature of injuries in youth soccer necessitates that coaches be capable of recognizing and providing initial management of injuries. The large percentage (70%) of parents and coaches who managed treatment for injured

athletes in this study, further underscores the need for these individuals to be knowledgeable in basic first-aid and the initial treatment of sport injuries.

Conclusion

This initial study of perceived risk of injury, risk-taking behaviors, estimation of ability, and body size has provided support for most of the hypothesized interrelationships among these factors. It is also clear from the data that gender differences exist in both perceived risk of injury and risk-taking behaviors. Future research should attempt to understand the effects of social desirability and socialization influences on these differences. The proposed effect of risk-taking behaviors on injury was not present among this sample. Other factors emerged as significant risk factors for injury including BMI and underestimation of ability. Age, especially in relation to its influence on the effects of weight and BMI on risk-taking and injury, was also an important variable to emerge from this study. This study also provided further validation of the RISSc in its current form for use within a single sport context. While the RTB was internally consistent, and produced intuitively logical factors, its validity in assessing risk-taking behaviors needs to be substantiated with observed or informant measures. Lastly, the injury data from this dissertation added to the growing base of injury epidemiology data concerning the sport of youth soccer.

APPENDICES

APPENDIX A

Risk of Injury in Sports Scale (RISSc)

Please indicate how likely you think it is that the following events will happen to you while playing soccer.

WHAT DO YOU THINK ARE THE CHANCES THAT YOU WILL:

		Very Unlikely	Unlikely	Somewhat unlikely	Somewhat likely	Likely	Very Likely
1.	Injure yourself in a collision with an opponent?	1	2	3	4	5	6
2.	Have the same injury that someone else on your team recently had?	1	2	3	4	5	6
3.	Re-injure an area that you have recently injured?	1	2	3	4	5	6
4.	Be injured in a practice?	1	2	3	4	5	6
5.	Fall down and injure yourself?	1	2	3	4	5	6
6.	Be injured from a foul or 'cheap shot' by an opponent?	1	2	3	4	5	6
7.	Be injured by more aggressive opponents?	1	2	3	4	5	6
8.	Be injured running into an object on the field or court (e.g., goal posts, vault, boards, etc.)?	1	2	3	4	5	6
9.	Be injured by bigger or stronger opponents?	1	2	3	4	5	6
10.	Be injured from not 'taking a break' from your sport?	1	2	3	4	5	6
11.	Be injured trying to perform a skill that you have just learned?	1	2	3	4	5	6
12.	Injure yourself on a poor playing surface (e.g., wet or bumpy field, dusty floor, etc.)?	1	2	3	4	5	6
13.	Be injured from playing too many sports at the same time?	1	2	3	4	5	6
14.	Be injured performing a skill that is hard for you to do?	1	2	3	4	5	6

WHAT DO YOU THINK ARE THE CHANCES THAT YOU WILL (Circle your answers):

		Very Unlikely	Unlikely	Somewhat unlikely	Somewhat likely	Likely	Very Likely
15.	Injure your ankle?	1	2	3	4	5	6
16.	Be injured practicing too hard?	1	2	3	4	5	6
17.	Be injured by not paying attention to what you are doing?	1	2	3	4	5	6
6	Injure your neck or spine?	1	2	3	4	5	6
6	Be injured from competing too hard?	1	2	3	4	5	6
20.	Be injured by losing your focus while playing your sport?	1	2	3	4	5	6
21.	Trip and injure yourself?	1	2	3	4	5	6
22.	Injure yourself on a dangerous piece of equipment?	1	2	3	4	5	6
23.	Injure your arm or wrist?	1	2	3	4	5	6
24.	Injure your shoulder?	1	2	3	4	5	6

APPENDIX B

Risk-taking Behaviors Scale Validity Form

Directions: Please read each of the criteria below and in the spaces provided next to each item of the Risk Taking Behaviors Scale on the following page, rate how relevant each item is in terms of assessing risk-taking behaviors in soccer. If you rate any item below a 4, please provide your rationale for doing so, and any suggestions you have for improving the item.

<u>Rating</u>	<u>Description</u>
5	This is an EXTREMELY RELEVANT item for assessing risky behaviors in which a player might engage while playing soccer.
4	This a RELEVANT item for assessing risky behaviors in which a player might engage while playing soccer.
3	This is a MODERATELY RELEVANT item for assessing risky behaviors in which a player might engage while playing soccer.
2	This is a SLIGHTLY RELEVANT item for assessing risky behaviors in which a player might engage while playing soccer.
1	This is NOT A RELEVANT item for assessing risky behaviors in which a player might engage while playing soccer.

Risk-Taking Behaviors Scale

Please indicate how often you engage in the following behaviors while playing soccer. Please circle the number to the right of each behavior. **Be sure to answer each item.**

	Rating	Rationale
1. Line-up in the 'wall' to block a free kick?	1.	
2. Challenge aggressively for a ball?	2.	
3. Collide with an opposing player?	3.	
4. Block an opposing player's shot?	4.	
5. Go up for a header in a crowd?	5.	
6. Dribble the ball aggressively?	6.	
7. Head the ball?	7.	
8. Bicycle kick or other potentially dangerous volley?	8.	
9. Foul (trip, push, hold or strike) an opponent?	9.	
10. Slide tackle an opponent?	10.	
11. Tackle the ball away from an opposing player with physical contact?	11.	
12. Fall down?	12.	
13. Play aggressively?	13.	
14. Taunt or tease an opposing player?	14.	

APPENDIX C

Risk-Taking Behaviors Scale

Please indicate how often you engage in the following behaviors while playing soccer. Please circle the number to the right of each behavior. **Be sure to answer each item.**

How often do you:

	1	2	3	4
1. Volunteer to line-up in the 'wall' to block a free kick?*	Never	Occasionally	Sometimes	Frequently
2. Challenge aggressively for a ball?*	Never	Occasionally	Sometimes	Frequently
3. Purposely collide with another player?	Never	Occasionally	Sometimes	Frequently
4. Attempt to block another player's shot?*	Never	Occasionally	Sometimes	Frequently
5. Go up for a header in a crowd?	Never	Occasionally	Sometimes	Frequently
6. Dribble the ball aggressively in a crowd of players?	Never	Occasionally	Sometimes	Frequently
7. Attempt a diving header?	Never	Occasionally	Sometimes	Frequently
8. Attempt to perform a difficult skill (e.g., bicycle kick) before you have learned how to do it properly?	Never	Occasionally	Sometimes	Frequently
9. Foul (trip, push, hold or strike) another player?	Never	Occasionally	Sometimes	Frequently
10. Slide tackle another player?	Never	Occasionally	Sometimes	Frequently
11. Tackle the ball away from another player with physical contact?	Never	Occasionally	Sometimes	Frequently
12. Provoke another player by taunting or teasing them?	Never	Occasionally	Sometimes	Frequently

*Denotes items that were eliminated as a result of the exploratory factor analysis.

APPENDIX D

Demographic Information

Please circle the **Day/Month/Year** in which you were born?

Day				Month		Year
1	11	21	31	Jan	Jul	1985
2	12	22		Feb	Aug	1986
3	13	23		Mar	Sep	1987
4	14	24		Apr	Oct	1988
5	15	25		May	Nov	1989
6	16	26		June	Dec	1990
7	17	27				
8	18	28				
9	19	29				
10	20	30				

What is your **gender** (please check the appropriate box)?

MALE ☐ FEMALE ☐

Please rate **your overall skill level in soccer compared to other soccer players your age and gender in your soccer league** (please circle the appropriate number)?

Very Low	Low	Average	High	Very High
1	2	3	4	5

DO NOT WRITE BELOW THIS LINE!

Height_____cm

Weight_____lbs

Weight_____kg

APPENDIX E

Coach Information

Estimation of Players' Soccer Abilities

Please indicate the **overall soccer skill level** of each player on your team **in relation to other players of the same age and gender in your league** (please circle the appropriate skill level rating beside each player name/no.):

Player Name/No.	Very Low	Low	Average	High	Very High
1	1	2	3	4	5
2	1	2	3	4	5
3	1	2	3	4	5
4	1	2	3	4	5
5	1	2	3	4	5
6	1	2	3	4	5
7	1	2	3	4	5
8	1	2	3	4	5
9	1	2	3	4	5
10	1	2	3	4	5
11	1	2	3	4	5
12	1	2	3	4	5
13	1	2	3	4	5
14	1	2	3	4	5
15	1	2	3	4	5
16	1	2	3	4	5
17	1	2	3	4	5
18	1	2	3	4	5
19	1	2	3	4	5
20	1	2	3	4	5

Exposure Data

How long (**in minutes**) are your **matches**? _____ minutes

How long (**in minutes**) are your **practices**? _____ minutes

How many **days** do you **practice** per week? _____ days

Please indicate the **expected average playing time per match** and **starter/non-starter status** for each player on your roster:

Player Name/No.	Non-starter (please circle one)	Estimated playing time per match (in minutes)	Starter vs.
1			Starter Non-starter
2			Starter Non-starter
3			Starter Non-starter
4			Starter Non-starter
5			Starter Non-starter
6			Starter Non-starter
7			Starter Non-starter
8			Starter Non-starter
9			Starter Non-starter
10			Starter Non-starter
11			Starter Non-starter
12			Starter Non-starter
13			Starter Non-starter
14			Starter Non-starter
15			Starter Non-starter
16			Starter Non-starter
17			Starter Non-starter
18			Starter Non-starter
19			Starter Non-starter
20			Starter Non-starter

APPENDIX F

Previous Injuries Form

Everyone has minor injuries like bruises, scrapes, and blisters. In the questions below, we **do not** want you to record these minor injuries. Instead we want you to **record the more serious injuries** like broken bones, sprains/strains, serious cuts, and head, eye, or dental injuries, that you have had **in the past 12 months**. These injuries would have kept you out of the next day's physical activities. If you are not sure whether or not you should report an injury, please ask.

1. Have you been injured during the past 12 months?

YES ☐ NO ☐

(please check the appropriate box)

If you answered NO to Item #1, you are done with this form. If you answered YES to Item #1 go to Item #2.

2. How many times have you been injured in the past 12 months? (circle a number)

1 2 3 4 5 more than 5- see me

3. Please check the location, type, management, and treatment **for each injury** that you have had during the past 12 months? (please look at the example before completing the information).

Example #1

Location(put an 'x')	Type(check one)	Management(check one)	Treatment(check one)
☐	General (cuts, bruises)	☐	Surgery
☐	Fracture	☐	Cast, splint, sling, brace
☐	Sprain	☐	Crutches
☐	Strain	☐	Soft wraps
☐	Other _____	☐	Stitches
		☐	None

Injury #1

Location(put an 'x')	Type(check one)	Management(check one)	Treatment(check one)
☐	General (cuts, bruises)	☐	Surgery
☐	Fracture	☐	Cast, splint, sling, brace
☐	Sprain	☐	Crutches
☐	Strain	☐	Soft wraps
☐	Other _____	☐	Stitches
		☐	None

Injury #2

Location(put an 'x')	Type(check one)	Management(check one)	Treatment(check one)
☐	General (cuts, bruises)	☐ Hospitalized	☐ Surgery
☐	Fracture	☐ EMS (ambulance)	☐ Cast, splint, sling, brace
☐	Sprain	☐ Doctor	☐ Crutches
☐	Strain	☐ Parent/Coach	☐ Soft wraps
☐	Other _____	☐ None	☐ Stitches
		☐ Other _____	☐ None

Injury #3

Location(put an 'x')	Type(check one)	Management(check one)	Treatment(check one)
☐	General (cuts, bruises)	☐ Hospitalized	☐ Surgery
☐	Fracture	☐ EMS (ambulance)	☐ Cast, splint, sling, brace
☐	Sprain	☐ Doctor	☐ Crutches
☐	Strain	☐ Parent/Coach	☐ Soft wraps
☐	Other _____	☐ None	☐ Stitches
		☐ Other _____	☐ None

Injury #4

Location(put an 'x')	Type(check one)	Management(check one)	Treatment(check one)
☐	General (cuts, bruises)	☐ Hospitalized	☐ Surgery
☐	Fracture	☐ EMS (ambulance)	☐ Cast, splint, sling, brace
☐	Sprain	☐ Doctor	☐ Crutches
☐	Strain	☐ Parent/Coach	☐ Soft wraps
☐	Other _____	☐ None	☐ Stitches
		☐ Other _____	☐ None

Injury #5

Location(put an 'x')	Type(check one)	Management(check one)	Treatment(check one)
☐	General (cuts, bruises)	☐ Hospitalized	☐ Surgery
☐	Fracture	☐ EMS (ambulance)	☐ Cast, splint, sling, brace
☐	Sprain	☐ Doctor	☐ Crutches
☐	Strain	☐ Parent/Coach	☐ Soft wraps
☐	Other _____	☐ None	☐ Stitches
		☐ Other _____	☐ None

If you think that you have had more than 5 serious injuries in the past 12 months please see me.

APPENDIX G

Injury Form

Date of Injury _____

Date of Return _____

Participant Code # _____

Location(circle area)

Type(check one)

Management(check one)

Treatment(check one)

- ☐ General trauma
- ☐ Fracture
- ☐ Sprain
- ☐ Strain
- ☐ Miscellaneous

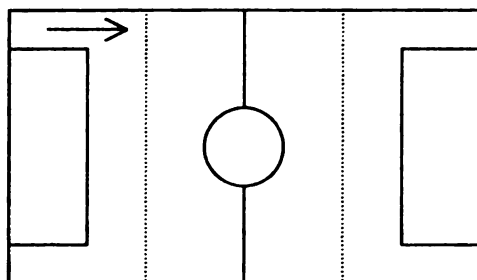
- ☐ Hospitalized
- ☐ EMS
- ☐ Physician
- ☐ Parent/Coach
- ☐ None
- ☐ Other

- ☐ Surgery
- ☐ Immobilization
- ☐ Assisted ambulation
- ☐ Functional wrap
- ☐ Stitches
- ☐ None

Field location (place an 'X' in area one)

Nature (check one)

Practice/Match (check one)



- ☐ Contact w/player
- ☐ Contact w/ball
- ☐ Contact w/surface
- ☐ Contact w/object
- ☐ Foul
- ☐ Non-contact

- ☐ Practice
- ☐ Match

Position

- ☐ Forward
- ☐ Midfield
- ☐ Defense
- ☐ GK

NOTES (weather, field conditions, opponents, importance of outcome, etc.)

APPENDIX H

Parent Consent Form

Dear Parent:

Hello! I am a doctoral candidate at Michigan State University in the Department of Kinesiology. I am currently working on a study entitled "The Effects of Perceived Risk of Injury, Risk-Taking Behaviors, and Physique on Injury in Sports." This study is being conducted under the supervision of Dr. Deborah Feltz, Chairperson of the Department of Kinesiology. This study will assess your child's perception of risk of injury, risk-taking behaviors, sport-related stress, and height and weight in relation to the injuries that they have while playing soccer this season.

The study will involve your child's participation in completing several questionnaires designed to learn more about your child's thoughts regarding injuries in sports. In addition, all participants will be asked to record information about their previous injuries, age, gender, and perceived skill level. We will also measure, using a beam-type scale, your child's height and weight. All of this information will be identified using identification numbers given to each participant at the beginning of the session. During the soccer season, we will observe and record injury data pertaining to your child. If your child is injured, we will interview you by phone to obtain information regarding the medical treatment and restriction of his/her participation in subsequent soccer matches.

Your child's identity and recorded information from this study will remain confidential and be analyzed using the individual identification numbers. Participants will remain anonymous in any reporting of the data from this study. In summary, your child's privacy will be protected to the maximum extent allowable by law.

In order for me to complete this study, I will need your written consent in the space below to allow your child to participate. Participation in the study is completely voluntary and your child can decide to discontinue participation at any time. If your child decides to discontinue participation, all data for your child will be destroyed.

Evening Phone No.: () - (VERY IMPORTANT!)

I, _____ agree to allow my child _____ to participate in this study.
Your name-printed Your child's name-printed

Your signature

Date

Thank you for your consent for your child's participation in this study. Please feel free to contact me or David E. Wright- Chair, University Committee on Research Involving Human Subjects at 517-355-2180, regarding this study should you have any questions.

Thank you,

Anthony P. Kontos, M.A., M.S.
Room 139 IM Sports Circle
Michigan State University
East Lansing, MI 48824
432-7121
kontosan@pilot.msu.edu

APPENDIX I

Participant Consent Form

This study is designed to assess the thoughts you have about being injured when playing sports. This study will also provide information concerning the events that might lead to injury in youth sport athletes.

For this study, you will be asked to complete several questionnaires regarding your thoughts on being injured in sports. You will also be asked to provide written information about your previous injuries, age, gender, perceived skill level. Your height and weight will also be measured using a scale. All injuries that you have during the season will be recorded and your treatment and restriction from play will also be monitored through information from your parents.

All data that you provide, and the results of this study will be confidential and anonymously reported. You will be assigned a coded identification number that will replace your name on all questionnaires that you complete. All questionnaires and individual injury data will be stored in a locked area accessible only to the investigators of the study. Only group data will be used in any reporting or future use of the information from this study. Group results will be made available to you on request.

Participation in this study is voluntary. You may choose not to participate at all, refuse to answer certain questions, or withdraw from the study at anytime, without penalty.

Any questions concerning participation in this study should be directed to Anthony Kontos, 517-432-7121 or David E. Wright- Chair, University Committee on Research Involving Human Subjects at 517-355-2180.

Thank you for your time and cooperation.

I have read the above description of this study. I understand my rights as a participant and agree to participate in this study.

Please Print: _____
First Name M.I. Last Name

Signature Date

APPENDIX J

Table J1. A Summary of Correlations among the Predictor and Outcome Variables

Variable	H	W	B	EA	OE	PI	G	U	C	O	UB	SR	RI	PRT	SRT	RT	CI	NI
<u>Body Size Factors</u>																		
Height (m: H)	1.00																	
Weight (kg: W)	.69*	1.00																
BMI (B)	.14*	.82*	1.00															
<u>Estimation of Ability (EA)</u>																		
Over-Estimation (OE)	.08	.07	.03	1.00														
	.04	.03	.02	.41*	1.00													
<u>Previous Injuries (PI)</u>																		
	.10	.17	.15	.24*	.24*	1.00												
<u>RISSc Factors</u>																		
General Risk (G)	.17*	.20*	.14*	.02	-.03	.15	1.00											
Uncontrollable (U)	.01	.04	.06	-.01	.06	.18	.60*	1.00										
Controllable (C)	.13*	.14*	.10	-.01	.01	.07	.88*	.49*	1.00									
Overuse(O)	.09	.17*	.16*	.06	.03	.04	.74*	.45*	.63*	1.00								
Upper-body (UB)	.13*	.15*	.10	-.02	-.03	.16	.73*	.41*	.55*	.38*	1.00							
Surface-related (SR)	.12	.14*	.10	-.01	-.11	.16	.84*	.54*	.65*	.48*	.58*	1.00						
Re-injury (RI)	.20*	.17*	.07	.06	-.04	.17	.74*	.53*	.49*	.41*	.52*	.64*	1.00					
<u>RTB Factors</u>																		
PRTB (PRT)	.17*	.06	-.06	.15*	.01	.22	-.05	.01	-.08	-.05	.07	-.04	-.01	1.00				
SRTB (SRT)	.12	.03	-.05	.36*	-.02	.01	-.03	-.09	-.05	-.04	-.01	-.07	.04	.38*	1.00			
RTB (RT)	.17*	.06	-.07	.29*	-.01	.16	-.05	-.04	-.08	-.05	.04	-.06	.01	.87*	.78*	1.00		
<u>Outcome Variables</u>																		
Combined Injuries (CI)	-.02	-.01	.01	.02	-.12	.08	.02	.01	.01	.07	-.08	.03	.06	-.09	.07	-.02	1.00	
Nuisance Injuries (NI)	-.03	-.03	-.01	.04	-.11	-.01	-.01	-.01	-.02	.04	-.07	.01	.03	-.08	.13*	.02	.88*	1.00
Injuries (I)	.01	.02	.03	-.02	-.06	.15	.05	.04	.06	.07	-.06	.05	.08	-.05	-.07	-.08	.54*	.07

*p< .05

APPENDIX K

Table K1. A Summary of Partial (Age) Correlations among the Predictor and Outcome Variables.

Variable	H	W	B	EA	OE	PI	G	U	C	O	UB	SR	RI	PRT	SRT	RT	CI	NI
Body Size Factors																		
Height (m: H)	1.00																	
Weight (kg: W)	.54*	1.00																
BMI (B)	.01*	.85*	1.00															
Estimation of Ability (EA)	-.05	-.11	-.09	1.00														
Over-Estimation (OE)	.06	.05	.03	.42*	1.00													
Previous Injuries (PI)	.05	.14	.12	.26*	.21*	1.00												
RISSc Factors																		
General Risk (G)	.16	.14	.09	-.01	.02	.14	1.00											
Uncontrollable (U)	-.06	.01	.06	.03	.12	.18	.55*	1.00										
Controllable (C)	.16	.11	.05	.02	.06	.05	.85*	.39*	1.00									
Overuse(O)	.05	.15	.17	.07	.08	.03	.74*	.41*	.59*	1.00								
Upper-body (UB)	.17	.08	-.01	-.04	.06	.19*	.69*	.41*	.44*	.32*	1.00							
Surface-related (SR)	.10	.09	.04	-.10	-.13	.15	.82*	.47*	.62*	.42*	.52*	1.00						
Re-injury (RI)	.13	.10	.06	.02	-.01	.17	.69*	.47*	.34*	.40*	.50*	.59*	1.00					
RTB Factors																		
PRTB (PRT)	-.01	-.20*	-.22*	.15*	.14	.15	-.08	.02	-.11	-.06	.12	-.13	-.08	1.00				
SRTB (SRT)	.04	-.15	-.21*	.32*	-.08	-.02	.03	-.05	-.03	-.06	-.05	-.04	.10	.40*	1.00			
RTB (RT)	.02	-.21*	-.26*	.26*	.06	.16	-.07	-.01	-.09	-.07	.05	-.11	.01	.88*	.79*	1.00		
Outcome Variables																		
Combined Injuries (CI)	-.14	-.05	.03	-.01	-.14	.09	.12	.09	.14	.04	-.10	.16	.16	-.24*	.03	-.15	1.00	
Nuisance Injuries (NI)	-.08	-.07	-.04	.05	-.11	.01	-.02	-.03	-.01	.07	-.15	.07	.08	-.14	.15	-.02	.80*	1.00
Injuries (I)	-.13	.02	.10	-.08	-.08	.14	.22*	.19*	.25*	.17	.03	.17	.16	-.22*	-.15	-.23*	.60*	.01

*p< .05

APPENDIX L

Table L1. A Comparison of RISSc Factor Score Means, Standard Deviations (SD), and Effect Sizes for Boys and Girls.

Gender	RISSc Factors						
	G	U	C	O	UB	SR	RI
Boys							
Mean	2.24	2.86	1.95	2.07	2.19	2.53	2.69
<u>SD</u>	0.63	0.89	0.72	0.76	0.89	0.84	0.95
Girls							
Mean	2.73	3.40	2.46	2.54	2.55	3.23	3.06
<u>SD</u>	0.67	0.77	0.85	0.81	0.85	0.82	0.88
<u>ES</u>	1.16	0.54	0.84	0.77	0.47	1.01	0.44

Note. G= General Risk; U= Uncontrollable Risk; C= Controllable Risk; O= Overuse;
UB= Upper-body; SR= Surface-related; RI= Re-injury.

APPENDIX M

Table M1. A Comparison of RTB Factor Score Means, Standard Deviations (SD), and Effect Sizes for Boys and Girls.

Gender	RTB Factors		
	SRTB	PRTB	RTB
Boys			
Mean	2.21	2.25	2.23
<u>SD</u>	0.76	0.76	0.63
Girls			
Mean	1.99	1.88	1.93
<u>SD</u>	0.62	0.58	0.48
<u>ES</u>	0.45	0.79	0.94

Note. SRTB= Skill Risk-taking Behaviors; PRTB= Physical Risk-taking Behaviors;
RTB= Total Risk-taking Behaviors.

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