THE PSYCHOMETRIC PROPERTIES OF THE INJURY-PSYCHOLOGICAL READINESS TO RETURN TO SPORT SCALE IN ADOLESCENT ATHLETES

THESIS

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CHAPTER I

INTRODUCTION

Introduction

Since 1990, participation in high school athletics has steadily increased. In the 2010-2011 season, over 7.5 million adolescents participated in various athletic activities.[1] With so many adolescents involved in sports, the longer they participate, the more likely that they will sustain an injury. For example, it was estimated that in the 2010-2011 season over 1.7 million injuries had occurred in the high school population.[2] As athletic trainers, we need to treat multiple aspects of the injury including the physical, emotional, and psychological components.

Athletic trainers are accustomed to treating the physical injury, and the majority of their education addresses the physical issues associated with athletic injuries. Of the 220 educational competencies in the 5th edition of the National Athletic Trainers' Association Athletic Training Education Competencies, only 5 address the assessment and treatment of psychological distresses that may stem from the physical injury. There is even less emphasis placed on psychological distress when returning an athlete to sport.[3] Because of the lack of emphasis placed on the psychological well being of the athlete, athletic trainers may make return-to-play decisions based on the physical readiness of the patient only. With the athletic training profession implementing evidence based practice,

it is important as professionals that we develop and utilize clinical outcome tools to assess all aspects of the injury to ensure a safe return. Unfortunately, most of the time only the physical component of the injury is addressed when making these return to play decisions, leaving the psychological aspect of injury vastly unaddressed. The disregard for the psychological aspect of injury may be due to several factors including the lack of conclusive research influencing professional decisions,[4] psychometrically sound assessment tools, and education.[3]

One such psychometrically sound assessment tool is the Injury-Readiness to Return to Sport (I-PRRS) scale. The I-PRRS is an outcome measurement tool that is used to assess an athlete's confidence in his/her ability to return to play. However, the I-PRRS is a new instrument and has only been assessed in collegiate aged athletes after sport injury. An extensive review of the literature failed to find psychological outcome assessment tools that measure an adolescent athlete's confidence in his/her return to play ability after a sports-related injury.

Purpose

This study was designed to test the psychometric properties of the I-PRRS in the adolescent population as well as determine the relationship between psychological and physical readiness to return to sport. To date, no research has been completed to assess the psychometric properties of the I-PRRS scale in injured adolescent athletes. Therefore, I assessed the reliability, validity, and sensitivity to change of the I-PRRS in adolescent athletes with acute musculoskeletal injuries. This will be completed by determining the internal consistency of the I-PRRS, concurrent validity of the I-PRRS

when compared to the Fear Avoidance Beliefs Questionnaire and Brunel Mood Scale, and responsiveness of the I-PRRSS as playing status of the participant changes. The second purpose was to determine the relationship between physical readiness and psychological readiness of adolescent participants returning to practice and competition. This was determined by comparing the Pediatric Quality of Life (PedsQL™) inventory™ (Physical Health Summary Score) with the I-PRRS scale.

Operational Definitions

1.) Acute Musculoskeletal Injury: An injury occurring to the joint, bone, or soft tissue that takes place at a specific frame in time and with an identified mechanism of injury. This may include strains, sprains, fractures, and tears of various tissues in the muscular or skeletal systems.

2.) Participation restriction: Severity can be based on the expected amount of time to heal. For the purpose of this research, athletes must be withheld from activity for at least 24 hours (within this timeframe they may only perform rehabilitation as designated by athletic trainer).

3.) Injury Length: An athlete must sustain an injury that withholds the individual from participation in full sport activity for at least 5 days. During the first 24 hours the subject may only perform rehabilitation activity as designated by the athletic trainer. The following 96 hours of activity the athlete may participate in limited sport activity as decided by the athletic trainer.

4.) Playing Status: There are three subcategories to playing status. The first phase that athletes must complete is termed "no play". This simply means the athlete can only complete rehabilitation activities as designated by the athletic trainer.

These activities may mimic those of which are performed in practice, but the athlete has not been released from the care of the clinician and continues to have restrictions. The second phase that must be completed by the athlete is designated as "full play within practice". The athlete will participate in practice with no restrictions. The final phase is "full play in competition" where the athlete may participate in competition without restrictions.

5.) Return to Play (RTP): Return to play will be defined as the time that the participant is able to return to full sport participation in practice and competitive situations. Return to play decision will be made by an athletic trainer or team physician.

6.) Athlete (single/dual season): Athletes involved in multiple sports may still be included in this study. However, for the purpose of data collection they will complete forms as if they were returning to the same sport in which the participant sustained the injury.

7.) Competition vs. Practice: The subject must participate in full practice without restrictions prior to the participation in competition to be eligible for this study. A competition will be defined as competition against an opposing team. Inter-squad completion against teammates will be considered practice for the purpose of this study.

8.) Collision/Contact/Non-Contact: The collision sport that will be included in this study is football. Contact sports include; men's soccer, women's soccer, men's basketball, and women's basketball. The non-contact sports that may be included in this study are volleyball, tennis, cheerleading, baseball, and softball. All sports

to be included are dependent on athletes who qualify, and whether the season falls within the data collection period.

Delimitations

1.) Only adolescent athletes between the ages of 13-18 will participate in this study.

2.) Athletes are being used for this study because of the psychological distresses associated with athletic injury. Due to the psychological stresses athletes undergo after injury a tool must be validated for proper evaluation.

3.) Injuries must be acute in nature. Chronic or mild traumatic brain injuries will not be accepted because they may have different psychological effects on the athletes. All acute musculoskeletal injuries will be accepted if they fall within the allotted time frame.

4.) Participants enrolled in this study are dependent on injury rate experience at each school. Data collection will only take place over the course of about 4 months which may not yield enough injury for proper data collection.

5.) Surveys used in this study are close ended and short in nature to prevent participants from becoming distracted or losing focus.

6.) Only certified athletic trainers or team physicians will be making return to play decisions which will decrease differences in decisions from other professionals.

7.) Only student athletes participating in interscholastic sports will be included in the study which may create results that would differ from the recreationally active population.

Limitations

1.) The types of sports that this study will include are limited to the sports hosted by the Hays Independent School District.
2.) Due to the psychological basis of the scales, external stressors that may affect the results cannot be controlled.
3.) Compliance of the participants is dependent on the individual and parents/guardians.
4.) The study is limited to adolescent athletes within central Texas.
5.) The amount of participants enrolled in the study directly relates to injury rate, consent, and adherence.

Assumptions

1.) It is assumed that patient reports of readiness to return to sport will not be influenced by external pressures from parents, coaches, or athletics staff.
2.) It is assumed that because multiple schools are being used socioeconomic class of the participants will not affect the results.
3.) It is assumed that participants will be honest and complete the surveys to the best of their abilities.
4.) It is assumed that participants will complete the study once enrolled.
5.) It is assumed that the type of rehabilitation program used will not affect the patient's responses.
6.) It is assumed that the participants will understand the wording of the surveys.

7.) It is assumed that data collected 24 hours after the injury, within 24 hours of full practice participation, and within 24 hours of full game participation will yield enough data to allow for adequate statistical analysis.

8.) It is assumed that the established validity and reliability of the instruments designed for the adolescent population is adequate.

Significance of the Study

We hope to answer several questions in this study to provide a higher standard of care for adolescent athletes. The intent of this study was to determine if the I-PRRS scale is psychometrically sound for use with adolescent athletes, and if the athlete's physical readiness reflected psychological readiness. These are important factors to understand when working with athletes and determining a safe return to play decision.

Physical readiness is not the only component of an athlete's injury that should be assessed in treating and making return to play decisions in a patient. In addition, psychological components should be addressed to treat the patient as a whole. Disablement models, which address the personal and societal limitations that occur with injury, are commonly used by the medical profession when treating patients. Disablement models include pathologies, functional limitations, and activity limitations. More recently environmental and personal factors are being addressed within treatment protocols to ensure all aspects of the patient's life are being cared for.[6]

The disablement models being used are the framework for the clinical outcomes assessments. With evidence based research becoming the standard in the health care profession, athletic trainers need outcomes instruments they can administer to their

patient population to show the effectiveness of therapy or intervention. If athletic trainers are using these tools it is essential they are psychometrically sound.

If the I-PRRS scale is psychometrically sound for use in the adolescent population, it could be useful as a part of the criteria for making return to play decisions. Clinicians will have the ability to objectively document an adolescent's progress and provide evidence when determining an individual's psychological readiness to return to sport. This scale may be used to help safely return adolescent athletes to participation when physical and psychological readiness have both been assessed and documented.

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CHAPTER II

LITERATURE REVIEW

Introduction

With over 7.5 million adolescents in the United States participating in athletic programs during the 2010-2011 seasons,[1] there are possible risks for incurring sport related injuries. For example, the overall injury rates for sport related injury in a typical high school athletics program during the 2010-2011 school year was 3.50 injuries per 1000 athletic exposures. One athletic exposure is equivalent to one athlete practicing at one practice or during one competition.[2] Injury rates are greater in competition than in practice, the largest injury rates occurred in football (12.30 per 1000 athletic exposures). The majority of these injuries occurred to the upper and lower extremities which accounted for 64.9% of all injuries. The remaining injuries occurred to the head, face, neck, or trunk.

Of all injuries, 88% were acute in nature and classified as strains, sprains, contusions, or fractures. Within the total injuries, 34% resulted in less than a week of lost time in practice or competition. Injuries requiring 1-3 weeks of inactivity accounted for 36% of the injuries and 6% of all injuries lasted longer than 3 weeks. The remaining 24% of injuries fell into one of three categories: 1) season/career ending injuries, 2) injuries where the athlete chose not to continue in the sport, or 3) injuries where the season ended before the athlete could return to play.[2] Similar injury rates have been

established in other work[3] indicating that despite the potential physical, social, and psychological benefit to participation in sport, adolescent athletes may face the possibility of the negative physical and psychosocial impacts of injury.

The physiological and physical manifestations of injury in the physically active have been documented and are understood theoretically through disablement models.[4] Disablement models help us categorize the physiological and physical manifestations of injury as impairments, functional limitations, and disability. Impairments are described as localized limitations in response to the pathologic condition like decreased strength or range of motion. These impairments contribute to functional limitations which can be exemplified through the inability to complete actions such as running at maximum speed. Functional limitations, in turn play a role in determining the level of patient disability. For example, the inability to run at maximum speed may prevent the aforementioned individual from participating in an activity like competing in the fastest heat of the 100m sprint.[4] Commonly, patient impairments and functional limitations are addressed by athletic trainers through therapeutic interventions including modalities and rehabilitation.

What is often less understood and addressed are the psychosocial factors that may impact injury. Research in the field of sport psychology has described many of the deleterious impacts of injury and investigated cognitive appraisals of injury,[5, 6] rehabilitation adherence,[7-9] and readiness to return to sport.[10, 11] In athletic training, much of the research in sport psychology has focused on interventions such as mental imagery, goal setting, positive self-talk, motivation, and relaxation.[12, 13] Unfortunately, little emphasis is placed on understanding a patient's psychological readiness to return to sport athletic training education. The 5th edition of the National Athletic Trainers' Association

(NATA) Athletic Training Education Competencies only has one competency that specifically addresses psychological readiness to return to sport.[14] Athletic trainers may have a limited understanding of the role of readiness to return to sport in the clinical decision making process. They may also have little knowledge in how to adequately assess a patient's psychological readiness to return to sport. This may be due to several factors including the lack of conclusive research to promote new standards for evidence based practice[12] the availability of psychometrically sound assessment tools, and limited education on the importance of measuring psychological readiness.[14]

Through this literature review I will provide an overview of the psychology of injury with emphasis on the documented differences between adolescents and adults. I will also describe the theoretical framework used to understand and define psychological readiness to return to sport. Finally, I will describe some instruments commonly used to measure psychological and health related quality of life changes as a result of injury.

Psychology of Injury

General Psychological Response to Injury

When an athlete is injured there are several psychological responses that the individual may experience. The ways athletes cope or react to the injury are dependent on multiple factors. Cognitive appraisal theories are widely used in research and state that individuals assess the extent of a stressful situation and determine the methods in which they will cope with these stresses. Individuals continuously adapt their efforts to manage the stresses of the situation as the perceptions of the situation changes. The methods used to cope with these stresses differ from person to person. Two types of

cognitive appraisals are primary and secondary appraisals. A primary appraisal is an individual's assessment of the situation, whereas, the secondary appraisal includes the assessment and the coping strategies the individual feels they can utilize to respond to the stresses.[15] The primary cognitive appraisal has three distinct constructs: cognitive response, emotional response and behavioral response. The cognitive response is described as how an athlete cognitively assesses the impact of the injury. The cognitive response will dictate the subsequent emotional and behavioral responses in the athlete.

Recent research has developed an integrated model of response to sport injury which incorporates three different psychological subcomponents including cognitive appraisal, emotional response, and behavioral response. There are personal and situational factors that play a role in cognitive appraisals. Numerous personal factors like injury, personality, coping skills, mood states, and age may all affect the cognitive appraisal of the injury. Situational factors affecting an individual's cognitive appraisal may include accessibility to rehabilitation and the level of competition. A few factors that may directly affect cognitive appraisal are cognitive coping, goal adjustment, and self-perceptions. These cognitive appraisals along with behavioral response and emotional response are the major components in recovery outcomes.[6]

Behavioral response to injury include adherence to rehabilitation, psychological skills, use of social networks, and risk taking.[5] Some influencing factors of behavioral response may be malingering, and use/disuse of social support. Emotional response affecting recovery outcomes may be the fear of unknown, tension, anger, depression, positive attitude, and grief.[6] Multiple studies on psychological emotional responses to injury have found that mood states change across time, but most athletes do not

experience clinical levels of depression. Athletes who experience serious injury requiring more than two weeks of inactivity also experience significant mood disturbances.[6] The research did not take into account the age of the athletes that were included within the review, and thus researchers may have noticed different trends. Athletes will not experience all of these emotional or behavioral responses just like the methods used to cope with injury may differ.

Researchers have found positive effects on emotional and behavioral responses over time. This may be due to athlete's secondary appraisals over time which allows the athletes to adapt and apply strategies during rehabilitation after an injury. A significant decrease in depression scores were reported over time with significant decreases from the onset of injury to 6 weeks post injury and an even larger decrease between the initial injury to 12 weeks post injury. Relationship between social support and decreased depressive symptoms has also been reported; however, coping abilities could not be related to depressive symptoms.[16]

Adolescent athletes have elevated injury-related distress levels regardless of their injury status. It has also been suggested that adolescent athletes may be more sensitive to the stimuli of injuries which may cause increased distress.[17] This is similar to findings of increased psychophysiological activity post injury in collegiate male athletes. Injured athletes were subjected to trauma-related video footage which was found to increase skin conduction reactivity and subjective distress.[18]

Psychological Response Differences between Adult and Adolescent Athletes

Healthcare providers may find their adolescent and adult patients have some similarities and differences in psychological responses. These differences may include coping skills,[19] self-efficacy,[20] injury-related distress levels,[17] sensitivity to injury stimuli,[17, 21] and length of emotional recovery.[16] Psychological differences and stage of maturation may need to be addressed when creating a rehabilitation program to optimize successful results for the designated population. Research suggests there may be a link between coping and the different levels of puberty. The levels of puberty include beginning-pubertal, mid-pubertal, advanced-pubertal, and the post-pubertal stage. In a study where coping was assessed using the Coping Inventory for Competitive Sport[22] inventory on 527 adolescent athletes the researchers found a relationship between puberty stages and coping.[19] However, cognitive, social, and emotional maturities were not examined in the same study. The chronological age of adolescents showed that use of mental imagery decreased in patients when their emotional venting increased. Chronological age and puberty did not share a relationship when compared to coping strategies, suggesting that chronological age does not matter, rather pubertal status is more important in adolescent coping strategies.[19] Coping style may play a significant role during the healing process with collegiate and elite athletes, which may influence the emotions of the individual suffering from the injury.[23, 24] Collegiate athletes participated in either an approach or avoidance coping strategy, with the athletes who used an avoidance coping strategies more likely to experience negative emotions during injury.[23]

Coping strategies may help athletes deal with their emotional response to injury, but it is important to understand the factors that influence emotional recovery. Some

research suggests that the emotional recovery in adolescents may be influenced by injury severity, high athletic identity, low positive stress, low social support, and high depressive symptoms. Adolescent athletes in the study who reported higher depressive symptoms were shown to have decreased positive stress and a greater athletic identity, where as those with lower depressive symptoms were linked to an increased social support.[16] In adults, immediately after injury, a negative mood state was reported. A reversal in mood state took place roughly around the halfway point in rehabilitation until the athlete was medically fit for activity.[25]

The pain experienced by adolescents also differs from their adult counterparts. Adolescents reported higher pain and catastrophizing levels 24 hours post anterior cruciate ligament (ACL) surgery when compared to the adult counterparts. These higher catastrophizing scores may be the reason why the adolescent population reported higher pain levels related to the feelings of helplessness and rumination. All of this could be related to history of injuries, inexperience in recovering from injuries, and the loss of their competitive status.[21]

Pre-operative ACL experiences differ between the adolescent and adult populations as well. The adolescent population within this study reported higher levels of mood disturbances. The same group also reported three cognitive and two behavioral processes of change, which means that adolescent athletes relied on cognitive strategies as opposed to behavioral strategies. The adults included in this study reported a lower psychological-readiness for ACL surgery, and found it more difficult to find the positives aspects of the surgical intervention.[26]

Self-Efficacy Theory

Background

Self-efficacy theory was developed by Albert Bandura in 1977, and is defined as ones beliefs in their abilities.[27] Self-efficacy has been investigated extensively in a variety of fields including psychology and education. Over the years researchers have further sub-divided self-efficacy into three categories: task, coping, and scheduling self-efficacy.[28] Unfortunately, the majority of studies do not make the distinction between the three self-efficacy subcategories within the research design.[8, 20, 29, 30] The differences in these categories will be further examined and explained. Two separate sections will address these design variations accordingly.

Task Efficacy, Coping Efficacy, & Scheduling Efficacy

Research on the subcategories is not extensive, but provides some insight for future research. Task efficacy can be described as the individual's confidence in their abilities to complete an assigned task. For example, task efficacy could be used to determine an individual's confidence to complete a task as simple as 20 push-ups. Coping efficacy is similar to task efficacy in regards to performing the exercise, but with coping efficacy there is an additional condition to the task. This may be an individual's ability to complete 20 push-ups while they are worried about the test they just took earlier in the day. The third category, scheduling efficacy, can be described by the individual's routine and regular behaviors. For example, does the individual complete push-ups within their daily routine, or is this something new that would need to be added. Researchers suggest scheduling may be a type of coping self-efficacy, however, the evidence is not conclusive at this point [28].

Scheduling and coping efficacy may be linked to an individual's intensity and adherence to an exercise program.[28, 31] Studies have found more evidence for scheduling and coping efficacy constructs, but the evidence on task efficacy is weaker.[28] A study examining task efficacy found evidence of predicting behavioral intention when participants had a variety of exercises to chose from.[31] This suggests that when patients are allowed to decide on the type of exercise that they would complete, they may have greater intentions of finishing the exercise. Athletes with a history of three or more injuries have been linked with greater task efficacy resulting in more confidence in their performance,[9] but research also suggests that task efficacy alone may not promote adherence to an exercise program. Rather the combination of task efficacy and scheduling efficacy may indicate the greatest success for adherence.[28] Unfortunately, research is not conclusive at this point because of the limited amounts of research and the contradictory nature of the findings.

Efficacy

Research that does not categorize self-efficacy into task, coping and scheduling efficacy has found that interventions, age, gender and activity level all affect general self-efficacy. A study where the intervention focused on goal setting or social support found higher self-efficacy in those that received an intervention than participants in a control group. The goal-setting group has the highest levels of self-efficacy reported within the study.[29] Individuals with lower self-efficacy scores prior to reconstructive anterior cruciate ligament (ACL) surgery suggests their return may come with complications in relation to physical activity, symptoms, and muscle function 1 year after the surgery.[30] It is important to mention that many patients have low self-efficacy early on in

rehabilitation and significant differences can be seen with gender, age, and prior physical activity at the early stages of rehabilitation. Younger individuals and men reported higher self-efficacy scores pre-operatively when compared to older patients and females.[20] Self-efficacy, self motivation, and intention predicted clinic rehabilitation adherence and attendance to rehabilitation, but they were not good predictors of home-based rehabilitation adherence.[8] This is important for clinicians because it may offer insight to adherence obstacles faced with certain patients.

Measuring Readiness to Return to Sport, Mood States, Health-Related Quality of Life, and Fear Avoidance

There are four scales that may be administered in the adolescent population to address physiological and psychological factors related to injury. Since injury could affect the physical and psychosocial aspects of an individual's life, it is important to understand the patient's perceptions of each. Since changes in activities of daily living, health-related quality of life, fear avoidance and psychological readiness to return to sport are lived experiences, patient-reported instruments are appropriate to use. Each tool described below addresses various areas, and are therefore useful in determining the underlying cause of any issue that may arise.

Injury-Psychological Readiness to Return to Sport

The Injury-Psychological Readiness to Return to Sport (I-PRRS) is a scale that was developed to measure an athlete's confidence or psychological readiness for return to play after an injury had been sustained. Self-efficacy theory is the driving theory for this scale.[10] Self-efficacy and confidence are believed to decrease in injured athletes prior to

returning to play.[32] This led to the development of the I-PRRS questionnaire which may help clinicians in assessing an individual's psychological readiness prior to return to play.[10]

The questionnaire was developed by a panel of 7 experts using the Delphi method and item content relevance analysis methods by Dunn et al.[33] The panel consisted of four certified athletic trainers and three National Collegiate Athletic Association Division III coaches who had expertise with sport psychology or experience with injury. Originally 22 items were submitted before the scale was narrowed down to 10 items. From these 10 items, 6 were found to have adequate content validity (V) coefficients and were thus included within the final version of the scale.

Once content validity was established the scale was administered to 22 collegiate athletes and there is preliminary evidence suggesting the questionnaire is reliable and provided good measures of internal consistency ranging from 0.78 to 0.93 depending on which point of the healing process the instrument was administered. Pearson product moment correlations ranged from r=0.57 to r=.78 when comparing the I-PRRS scores and Total Mood Disturbance (TMD) scores.[10]

The six items in the I-PRRS address ability, pain, desire, and a few other areas related to confidence. Each item is assigned a value ranging between 0 and 100 on a scale of 10. Six items are then summed and divided by 10 to give a maximum score of 60. A score of 60 meant the athlete had complete confidence, 40 was attributed to moderate confidence, and 20 meant the athlete had low confidence.[10]

Fear-Avoidance Beliefs Questionnaire

The Fear-Avoidance Beliefs Questionnaire (FABQ) was originally designed to measure fear and avoidance experienced by patients suffering from chronic low back pain. The FABQ helps clinicians determine if their patients are changing their lifestyles and behaviors due to the fear of creating or worsening the pain. Researchers have suggested that the terminology within the scale can be changed to better suit individuals with other types of chronic pain [34].

The FABQ contains 2 scales which address physical activity or work related issues. The first scale consists of 7 items of which are given a point value of 0-6, and addresses work related fears. A total maximum score for this scale can be equivalent to 42. The second scale is a 4 item scale with a maximum score of 24, and addresses fears of returning to physical activity. The higher the score the more psychological distress or greater the fear and avoidance beliefs are. All 16 items on the FABQ provided acceptable levels of test-retest reproducibility. A principal component analysis confirmed the 2 factor structure of the FABQ. The internal consistency for scale 1 is 0.88 and the second scale has been reported to have an internal consistency of 0.77.[34] The construct validity of the scale has been demonstrated for patients with upper extremity injury (0.42 and 0.32)[35], low back injury (0.51 and 0.76).[36]

The Brunel Mood Scale

The Brunel Mood Scale (BRUMS), formally known as The Profile of Mood States-Adolescents (POMS-A) questionnaire, was derived from the Profile of Mood States (POMS) created by McNair et al.[37] in 1971. The POMS-A measures adolescent

changes in mood states with 6 subscales: fatigue, vigor, anger, depression, tension, and confusion. Research has found that the shorter version of the POMS has more reliability due to the elimination of psychometrically unsound items.[38] Content validity for POMS-A has been established utilizing an expert panel. Confirmatory factor analysis tested the factorial validity of the scale (Goodness-of-fit index = 0.90, CFI = .916, RMSEA = .067) and criterion validity was established using Pearson product-moment correlations (r= 0.52 to 0.82).[39]

The BRUMS is a 24–item questionnaire ranked on a 0-4 Likert scale.[39] To score the BRUMS four items were assigned to each subscale which could have a score ranging from 0-16. A total mood disturbance score for the BRUMS could range from -16 to 100 when vigor is included in the calculations. To calculate total mood disturbance; depression, fatigue, anger, tension, and confusion are summed. Vigor is then subtracted from the total to give a total mood disturbance score. Although the general population was used in this study, and has not been validated in the athletic population the BRUMS may still be the best variation of POMS to administer to adolescents.

Pediatric Quality of Life Inventory™

The PedsQL™ was designed originally for pediatric patients diagnosed with cancer.[40] The questionnaire was designed to assess health related quality of life and was later reconstructed, which allowed clinicians to administer the questionnaire to the general pediatric population. This tool has the capabilities of measuring physical, mental, social health, and school functioning.[41] Varni and colleagues used the World Health Organization guidelines when designing this assessment tool.[42] The PedsQL™ 4.0 is a

23 item inventory which can be administered to the pediatric population who have acute and chronic health conditions.[43] Each item is ranked on a 0-4 Likert scale. When computing the scores for the PedsQL™ 4.0 an inverse linear system is applied. The new values assigned are then summed (0=100, 1=75, 2=50, 3=25, 4=0) and divided by the number of answered questions. This accounts for missing data within the questionnaires; however, if more than half of the questions are not answered the instrument cannot be computed. [44]

The valid ages for this study are in pediatric patients range from ages 8-18 when the original PedsQL™ was designed. The test showed reliability in the Physical Health Summary Score ($\alpha = .80$) and Psychosocial Health Summary Scores ($\alpha = .83$). The Psychosocial Health Summary was also broken down into 3 smaller categories including the Emotional Functioning Scale ($\alpha = .73$), Social Functioning Scale ($\alpha = 71$), and School Functioning Scale ($\alpha = .68$) The Physical Health scale is equivalent to the Physical Health Summary Score.[43] Validity of the Psychosocial Health Summary score was assessed with a factor analysis and construct validity was assessed using a known-groups method where scores between participants classified as healthy, acutely injured and chronic health conditions were compared. The factor analysis showed a five factor structure with School Functioning split into two different factors. Healthy individuals displayed significantly higher scores on the PedsQL™ when compared to acutely and chronically ill adolescents ($F_{2,913}=15.05$, $p=0.001$). The PedsQL™ takes 4-5 minutes to complete.

Conclusion

With the increased emphasis on outcomes assessment and evidence based practice in athletic training, it is important to use psychometrically sound instruments to measure a patient's status and change over time. Athletic trainers can treat the patient as a whole person when we have a better understanding of the physical, psychological and sociological limitations that patients are experiencing.

The I-PRRS questionnaire was developed utilizing the self-efficacy theory.[10] Through the validation of the I-PRRS in adolescent athletes it may be possible to assess their confidence when making return to play decisions. In addition, clinicians may utilize psychological interventions as part of the treatment process. The athletic training profession needs to continue its research in the areas of psychological and sociological wellness of our athletes to ensure they are being treated as a whole and not as an injury.

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CHAPTER III

METHODS

Participants

The participants included in this study were adolescent athletes between the ages of 13-18 participating in a sanctioned interscholastic athletics programs in a central Texas school district. Due to the nature of this study, only English speaking athletes were included to ensure comprehension of the instruments being administered. Injuries included in this study occurred to the joint, bone, or soft tissue and had an identified mechanism of injury. This included strains, sprains, contusions, and tears of various tissues in the muscular or skeletal systems. Mild traumatic brain injuries or chronic injuries were not included in this study.

The participant sustained an injury that required restricted sport participation for at least 5 days. During the first 24 hours post injury, each participant only performed rehabilitation activity as designated by the athletic trainer. In the following 96 hours of activity, the athlete participated in limited sport activity as determined by the supervising athletic trainer. Return to play decisions were made by the athletic trainer, and were based on the athletic trainer's discernment of the participant's ability to withstand the demands of the sport during practice and competition.

Sports included in this study fell under the category of collision, contact, and non-contact sports. The collision sport that was included in this study is football. Contact sports include men's soccer, women's soccer, and men's basketball. The non-contact sports included in this study were cheerleading, powerlifiting, dance, track and field, and baseball. The participants were allowed to compete in multiple sports; however, for the purpose of data collection they completed all paperwork as if they were returning to the same sport in which they sustained the injury. If a participant had practiced during athletic periods in the school day, they were included in the study even if their competition season had ended.

Instrumentation

Demographic data collected for this study included age, gender, previous surgery, and history of previous injury, as well as a current description of the injury. The athletic trainer responsible for making decisions regarding treatment, rehabilitation and return to play was asked to complete a demographic form describing the injured body part, injury type, injury severity, and participation status. All information remained confidential and locked up within a designated cabinet in the athletic training room. A total of 4 instruments were administered on 3 separate occasions: 1.) within 24 hours of the injury, 2.) within 24 hours of being cleared for unrestricted practice activity, and 3.) within 24 hours of being cleared for unrestricted competition. To fully complete the study, the participant needed to return to an unrestricted practice and competition. However, data was included in the statistical analysis as long as the participant completed at least the first two administrations of the instruments. Collectively, all instruments took approximately 9-11 minutes to complete. The instruments can be found in the Appendix.

Injury-Psychological Readiness to Return to Sport (I-PRRS)

The I-PRRS is a 6-item questionnaire that measures an athlete's perceived confidence in their return to sport capabilities. Participants rate each item on a scale of 0-100 with 10 point intervals. A higher score indicates a greater level of confidence. The 6 items are then summed up and divided by 10. A score of 60 signifies complete confidence in one's ability to perform, 40 is moderate confidence, and 20 is low confidence in their abilities to perform. Glazer reported internal consistency of the I-PRRS ranging from 0.78 to .93 depending on the point of injury at which the test was administered.[1] Pearson product moment correlations of the I-PRRS with the Profile Mood States questionnaire ranged from r=0.57 to r=.78.[1] The I-PRRS typically takes 2-3 minutes to complete.

Fear-Avoidance Belief Questionnaire (FABQ)

The FABQ contains 2 scales which address physical activity or work related issues. The first scale consists of 7 items of which are given a point value of 0-6, and addresses work related fears. The second scale is a 4 item scale with a maximum score of 24, and addresses fears of returning to physical activity. A higher score indicates greater levels of fear-avoidance beliefs. A principal component analysis confirmed the 2 factor structure of the FABQ. The second scale of the FABQ demonstrates adequate internal consistency (α=0.77).[5] Only the second section of the FABQ was used for this study. The FABQ takes less than 1 minute to complete.

Brunel Mood Scale (BRUMS)

The BRUMS utilizes 24 words measured on a 5 point Likert scale and helps determine fatigue, vigor, tension, depression, anger, and confusion. The words used within this scale are valid and reliable for use in the adolescent population. Content validity for this scale, when it was formally known as Profile of Mood States for Adolescents (POMS-A), has been established utilizing an expert panel. Confirmatory factor analysis tested the factorial validity of the scale (Goodness-of-fit index = 0.90, CFI = .916, and RMSEA = .067). Researchers established criterion validity using Pearson product-moment correlations with r values ranging from 0.52 to 0.82.[3] This scale is estimated to take around 2 minutes to complete.

Pediatric Quality of Life Inventory™ 4.0 (PedsQL)™

The last questionnaire, the PedsQL™, will measure how injury or illness affects the participant's health-related quality of life. The questionnaire consists of 23 questions that create 4 separate scales (Physical Health, Mental Health, Social Health, and School Functioning). The PedsQL™ was designed for children ages 5-18 and has been shown to be reliable. The Physical Health Summary Score (α = .80) and Psychosocial Health Summary Scores (α = .83) have demonstrated adequate internal consistency. The Psychosocial Health Summary was also broken down into 3 smaller categories including the Emotional Functioning Scale (α = .73), Social Functioning Scale (α = 71), and School Functioning Scale (α = .68).[4] Validity of the scale was assessed with a factor analysis and construct validity was assessed using a known-groups method where scores between participants classified as healthy, acutely injured and chronic health conditions were

compared. The factor analysis showed a five factor structure with School Functioning split into two different factors. Healthy individuals displayed significantly higher scores on the PedsQL™ when compared to acutely and chronically ill adolescents ($F_{2,913}$=15.05, p=0.001).[4] The PedsQL™ takes 4-5 minutes to complete.

Protocol

After an adolescent athlete has sustained an acute injury, they were recruited to participate in the study by the certified athletic trainers hired through the school district. Once the inclusion criterion had been met, a packet containing an IRB approved consent and an assent form was sent home the day of the initial injury evaluation for both the parent/guardian and injured athlete to sign. This form explained the purpose and expectations of the study, while letting the participant know that their participation was not mandatory. This form also informed the participant that they may withdraw from the study at any time for any reason without being questioned. The packet contained an informative letter, demographic form, and all four instruments (I-PRRS, POMS-A, PedsQL™ 4.0, and FABQ PAS). This will help ensure the instruments are completed within 24 hours of initial injury.

Participants then participated in treatment and rehabilitation program as designated by their athletic trainer. Athletic trainers were advised to treat the patient and make return to play as they normally would without consideration to the athlete's participation in the study. When the athletic trainer determined that it was safe for return to practice without restrictions, the participant completed the four instruments within a 24

hour window prior to the first unrestricted practice. The participant again completed the same instruments within 24 hours prior to returning to full participation in competition.

Data Analysis

The psychometric properties of the I-PRRS were established using a single group design. To determine the reliability of the I-PRRS, internal consistency was analyzed with a Cronbach alpha of the I-PRRS total score. A suitable Cronbach alpha is > 0.70 with the item-total correlation of each item being above 0.20.[2] To establish concurrent validity of the I-PRRS, I-PRRS total scores were correlated with the FABQ PAS total scores with a Pearson product-moment correlation with the scores from each of the three instrument administrations. To explore the relationship between the participant's perceived readiness to return to sport and their health-related quality of life, we used a Pearson product-moment correlation with the I-PRRS and PedsQL™ 4.0 Physical Health scores from each of the three instrument administrations.

We assessed the sensitivity to change of the I-PRRS to detect change in participant playing status. Sensitivity to change was assessed with a Cohen's d to determine important changes. A small effect size is 0.2, medium effect size is 0.5, and a large effect size is 0.8.[2] We will assess the effect size between the participants I-PRRS score and the following instrument administrations: 1) within 24 hours of injury and within 24 hours of unrestricted practice, 2) within 24 hours of unrestricted practice and within 24 hours of unrestricted game participation, and 3) within 24 hours of injury and within 24 hours of full game participation.

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CHAPTER IV

MANUSCRIPT

Introduction

Participation in high school athletics has increased steadily since 1990.[1] In the 2010-2011 season, over 7.5 million adolescents participated in some kind of athletic activity and in the same season [1] over 1.7 million injuries occurred in the high school athletic season.[2] The manner in which adolescents perceive and cope with injury is pertinent to the athletic trainers working with the injured adolescents.

Research in the field of sport psychology has described many of the deleterious effects of injury and investigated cognitive appraisals of injury,[3, 4] rehabilitation adherence,[5-7] and readiness to return to sport.[8, 9] Numerous personal factors play a role in an individual's cognitive appraisal of an injury. Cognitive appraisals along with behavioral responses and emotional responses are the major components in recovery outcomes.[4] Some of these factors include injury, personality, coping skills, mood states, and age. In athletic training, much of the research related to sport psychology has focused on interventions such as mental imagery, goal setting, positive self-talk, motivation, and relaxation.[10, 11]

The manner in which adolescent athletes perceive injury differs from their adult counterparts, including collegiate athletes or even older recreational athletes. For example, numerous studies have shown psychological differences between the way

adolescents and adults respond to injury. Some of these differences include decreased coping skills,[12] varying levels of self-efficacy,[13] higher levels of injury-related distress levels,[14] increased sensitivity to injury stimuli,[14, 15] and greater length of emotional recovery for adolescent athletes.[16] Coping strategies may help athletes deal with their emotional response to injury. In regards to adolescents, their emotional recovery may be influenced by numerous factors. These factors include injury severity, athletic identity, low positive stress, low social support, and high depressive symptoms.[16] Thus, athletic trainers need to have a deep understanding of how adolescent athletes perceive and cope with their injuries to adequately deal with the patient.

Most athletic trainers working with athletic populations may be accustomed to treating the physical aspect of an injury, but they may not be proficient or confident with addressing the psychological impacts of injury. Research suggests that years of experience and length of certification do not play a role in athletic trainer's confidence levels when dealing with the psychological impacts of injury.[17] Recent research shows that many certified athletic trainers feel their education had not prepared them for dealing with mental skills training as well as counseling and social support.[18] However, Hamson-Utley et al. found that athletic trainers and physical therapist generally have positive perceptions of the effectiveness of psychology in sport.[10] With greater emphasis on psychosocial competencies in the 4th and 5th editions of the National Athletic Trainers' Association Athletic Training Educational Competencies[19] (Competencies) these statistics are likely to change. For example, the Competencies include knowledge and skills related to assessing and treating psychological distresses that may stem from the physical injury and understanding the effects of psychological distress when returning

athlete patient to sport.[19] In a recent study, roughly half of athletic training students (50.6%) had taken a course in sport psychology or received psychological skill training in their entry-level education program.[20]

Unfortunately, athletic training student education may place little emphasis on understanding a patient's psychological readiness to return to sport in athletic training education. Because of this, athletic trainers may have a limited understanding of the role of readiness to return to sport in the clinical decision making process. They may also have a limited understanding of how to adequately assess a patient's psychological readiness to return to sport. This may be due to several factors including the lack of conclusive research in sport psychology to promote new standards for evidence-based practice[10] the availability of psychometrically sound assessment tools, and limited education on the importance of measuring psychological readiness.[19] As evidence-based practice is accepted and utilized the profession must develop and utilize clinical outcomes tools to assess all aspects of the injury to ensure a safe return to sport.

The Injury-Readiness to Return to Sport (I-PRRS) scale is an outcome measurement tool used to assess an athlete's confidence in his/her ability to return to sport. Previous research using this scale has been performed on college-aged athletes and the instrument was found to be psychometrically sound for use in this population. Due to the psychological difference noted between adolescent and adult athletes, it is important to assess the psychometric properties of the I-PRRS in an adolescent population. The purpose of this study was twofold: 1.) to assess the psychometric properties of the I-PRRS in injured adolescent athletes including internal consistency, concurrent validity, and sensitivity to change and 2.) to determine the relationship between an athlete's

physical readiness and psychological readiness to return to sport in practice and competition situations.

Methods

Participants

The participants included in this study were adolescent athletes between the ages of 13-18 participating in a sanctioned interscholastic athletics programs in a central Texas school district. We included participants who had sustained an injury that restricted sport participation for at least 5 days and negated all participation in sport for at least 24 hours after the injury. We included injuries that occurred to the joint, bone, or soft tissue with an identifiable mechanism of injury. This included strains, sprains, fractures, and tears of various soft tissues. Mild traumatic brain injuries or chronic injuries were not included in this study. Due to the nature of this study, only English speaking athletes were included to ensure comprehension of the instruments being administered.

Instruments

The I-PRRS is a 6-item questionnaire that measures an athlete's perceived confidence in their return to sport capabilities. Since there are limited scales measuring an athlete's readiness to return to sport, researchers developed the I-PRRS to measure athletes psychological perceived readiness to return to sport. The participants answered each question using a 10cm long visual analog scale (VAS) to rate their perceived confidence in return to sport (Table 1). A score of 0 indicated no confidence where a 10 indicated complete confidence. The marks on the VAS were measured to the nearest 10^{th} centimeter and were then multiplied by 10 to give a whole number. A total score could be calculated by adding all 6 items and then dividing by 10 providing a score that could

range from 0-60 points. A score of 20 or below indicates an athlete has little to no confidence, a score from 20 to 40 indicates moderate confidence, and a score ranging from 40-60 is indicative of complete confidence.[21] The I-PRRS is a very simple test to administer and only takes a few minutes to complete.[8]

The Fear Avoidance Belief Questionnaire (FABQ) is an instrument with 2 subscales: Work and Physical Activity. The FABQ has been used in previous studies to determine a patient's beliefs about how physical activity and work would affect their low back pain.[22] For the purpose of this study we only used the Physical Activity Scale (PAS) which contained 4 items to measure the participants' fears of returning to physical activity.[22] Only this scale was selected because the majority of our adolescents could not relate to the subscale addressing work related issues. Each question on the FABQ is scaled from 0 to 6, with a 0 indicating no fear, and a 6 indicating significant fear. The FABQ PAS total score ranges from 0-24 points, a higher score indicates a greater level of fear-avoidance beliefs. The FABQ PAS demonstrates adequate internal consistency (α=0.77).[22] The construct validity of the scale has been demonstrated between the Disabilities of the Arm Shoulder and Hand and FABQ Work and Physical Activity subscales for patients with upper extremity injury ($r = 0.51$ and 0.42 respectively)[23] and between the Roland and Morris Disability Questionnaire and FABQ Work and Physical Activity subscales in patients with low back injury ($r = 0.63$ and 0.51).[24] This test requires less than a minute to complete.

The Brunnel Mood Scale (BRUMS) utilizes 24 words measured on a 5 point Likert scale to determine Fatigue (n=4 questions), Vigor (n=4 questions), Tension (n=4 questions), Depression (n=4 questions), Anger (n=4 questions), and Confusion (n=4

questions) subscales. The scores for each subscale are added and range from 0-20.[25] The total score can be calculated by adding fatigue, tension, depression, anger, and confusion, then subtracting vigor from the sum providing total scores can range from -20 to 100 with a lower score indicating lower mood disturbances. The BRUMS is a variation of the Profile of Mood States for Adolescents and is valid and reliable for use in the adolescent population. Confirmatory factor analysis tested the factorial validity of the scale (Goodness-of-fit index = 0.90, CFI = .916, and RMSEA = .067). Researchers established criterion validity using Pearson product-moment correlations with r values ranging from 0.52 to 0.82.[25] This scale is estimated to take around 2 minutes to complete.

The last questionnaire, the Pediatric Quality of Life Inventory™ 4.0 (PedsQL™), measures the effects of injury or illness on health-related quality of life. The questionnaire consists of 23 questions that create 4 separate subscales (Physical Health, Mental Health, Social Health, and School Functioning). The Physical Health scale has 8 questions, the Mental Health scale has 5 questions, the Social Health scale has 5 questions, and the School Functioning scale has 4 questions. The Physical Health Summary Score (α = .80) is created by adding the items in the Physical Health scale score. The Psychosocial Health Summary Score (α = .83) is the combination of the mental health, social health, and school functioning scores. Each question could be rated from 0 to 4 with answers ranging from completely disagree to completely agree. These items are scored as an inverse relationship with 0=100, 1=75, 2=50, 3=25, and 4=0. The items are then totaled within the category and divided by the number of items within that specific category. The PedsQL™ was designed for children ages 5-18 and has been shown to be reliable. The Emotional Functioning Scale (α= .73), the Social Functioning

Scale (α = 71), and the School Functioning Scale (α = .68) have also shown to be reliable.[26] Validity of the scale was assessed with a factor analysis and construct validity was assessed using a known-groups method where scores between participants classified as healthy, acutely injured and chronic health conditions were compared. The factor analysis showed a five factor structure with School Functioning split into two different factors. Healthy individuals have displayed significantly higher scores on the PedsQL™ when compared to acutely and chronically ill adolescents ($F_{2,913}$=15.05, p=0.001).[26] The PedsQL™ takes 4-5 minutes to complete.

Protocol

We recruited participants from 2 sites (1 high school and 1 middle school) after sustaining an acute musculoskeletal injury in sport. Potential participants were identified by a one of three certified athletic trainers and initial contact and recruitment of the potential participant was conducted by the primary investigator (JP). Participants who were enrolled in the study received a packet containing participation information, a parent consent form, a participant assent form, and the aforementioned questionnaires. The athletic trainer responsible for making decisions regarding treatment, rehabilitation and return to play was asked to complete a demographic form describing the injury type, injury severity, and participation status of the participant. All information remained confidential and locked within a designated cabinet in the athletic training room. The 4 instruments were administered on 3 occasions: 1.) within 24 hours of the injury, 2.) within 24 hours prior to being cleared for full practice activity, and 3.) within 24 hours prior to being cleared for full competition activity. In order to fully complete the study, the participant completed all three administrations of the instruments. However, data

were included in the statistical analysis as long as the participant completed at least the first two administrations of the instruments.

During the first 24 hours of injury, the participants were allowed to perform rehabilitation activity as designated by the supervising athletic trainer. In the following 96 hours of activity the athlete was allowed to participate in limited sport activity. The return to play decision was made by the supervising athletic trainer, and was based on the athletic trainer's discernment of the participant's ability to withstand the demands of the sport during practice and game-like activities. The participants were allowed to participate in multiple sports; however, for the purpose of data collection they completed all paperwork as if they were returning to the same sport in which the injury was sustained.

Statistical Analysis

The psychometric properties of the I-PRRS were established using a single group design. To determine the reliability of the I-PRRS, internal consistency was analyzed with a Cronbach alpha of the I-PRRS total score. A suitable Cronbach alpha is > 0.70 with the item-total correlation of each item being above 0.20.[21]

To establish concurrent validity of the I-PRRS, I-PRRS total scores were correlated with the BRUMS total scores and FABQ PAS score with a two-tailed Pearson product-moment correlation for each of the three instrument administrations.

The sensitivity to change of the I-PRRS was assessed with a Friedman's Two-Way ANOVA since the data did not meet the assumptions of normality required to use a repeated measures ANOVA (Shapiro-Wilk, $p<.05$). The Friedman's test was performed using converted rank scores for the I-PRRS for all participants that completed all three

instrument administrations. Sensitivity to change was also assessed with a Cohen's d to determine clinically important changes. We used Cohen's guidelines to assess the magnitude of the effect size where a trace effect size is <0.20, small effect is 0.20-0.49, medium effect is 0.50-0.79, and a large effect size is >0.80.[21] We assessed the effect size between the participants I-PRRS score and the following instrument administrations: 1) within 24 hours of injury and within 24 hours of unrestricted practice, 2) within 24 hours prior to unrestricted practice and within 24 hours prior to unrestricted competition participation, and 3) within 24 hours of injury and within 24 hours prior to full competition participation.

To explore the relationship between the participant's perceived readiness to return to sport and their physical readiness, we used Pearson product-moment correlation with the I-PRRS scores and PedsQL™ 4.0 Physical Subscale scores for each of the three instrument administrations. We expected to see a strong, direct relationship between both scales since the PedsQL™ Physical Subscale is reversed scored and linearly transformed to a 0-100 scale.

Results

Participants

A total of 21 athletes participated in this study (10 males, 11 females; age =15.71±1.35). Of the participants that entered the study, 15 participants completed all three administrations of the paperwork. Tables 2, 3, 4, and 5 describe frequencies by sport, injury location, injury type, and injury severity of the participants. Tables 6 and 7 provide the number of days between the listed data collection periods as well as mean, standard deviation, and the range of scores at each administration for all instruments.

Reliability

The Cronbach α score of the I-PRRS instrument for all three administrations were suitable: at initial injury (n=21) α= 0.891, within 24 hours prior to practice (n=21) α= .946, and within 24 hours prior to return to competition (n=15) α = .957. All items demonstrated an item-total correlation >0.20 at each administration period so all items remained (see table 8).

Validity

The concurrent validity of the I-PPRS was assessed by examining the strength of the relationship between the I-PRRS total score with the total scores from the BRUMS and FABQ PAS with a Pearson product moment correlation. There was an extremely low, inverse relationship between the I-PRRS and BRUMS scores within 24 hours injury (r=-.128, p = .581), a moderate, statistically significant, inverse relationship between the I-PRRS and BRUMS within 24 hours of practice (r=-.521, p = .008), and a moderate inverse relationship between the two scores within 24 hours of return to competition (r=-.411, p=.064). There was a high, statistically significant, inverse relationship between I-PRRS and FABQ scores within 24 hours of injury (r=-.744, p<.001), within 24 hours prior to return to practice (r=-.801, p<.001) and within 24 hours prior to return to competition (r=-.715, p=.003).

Sensitivity to Change

The Friedman's Two-Way ANOVA for the three administrations of the I-PRRS was statistically significant ($\chi 2$ (2) = 21.59, p<.001). Median (IQR) scores for I-PRRS at injury, practice and competition were 28.10 (16.8 - 41.3), 52.9 (47.8 – 55.40), and 58.20 (46.30-60.00) respectively. Readiness to return to sport, as measured by the mean I-PRRS

scores, was significantly lower within 24 hours of injury than the scores recorded within 24 hours of an unrestricted practice (p = .004)) and the scores recorded within 24 hours of returning to competition (p<.001). As predicted the effect sizes between injury to practice (d=1.46, 95% CI = -4.51 to 9.81) and injury to competition (d = 1.94, 95% CI = -2.13 to 10.29) were large, whereas the effect size between practice to competition was small (d = 0.32, 95% CI = -3.75 to 6.28). However, all confidence intervals crossed zero indicating questionable clinical significance of the effect sizes.

Physical Readiness of Participants

We assessed the relationship between the participant's physical readiness as measured by the Physical Subscale Score of the PedsQL™ and psychological readiness as measured by the I-PRRS scores with the practice and competition scores. There was a very high positive relationship between physical and psychological readiness (r=.801, p<.001) at practice and a high positive relationship between physical and psychological readiness (r=.724, p=.002) at competition. The variation in psychological readiness to return to sport scores at practice and competition (r^2 = .641 and r^2 = .524) were largely accounted for the physical readiness of the participants as measured by the PEDSQL Physical Subscale score.

Discussion

The purpose of this study was to assess the psychometric properties of the I-PRRS in an adolescent population with musculoskeletal injuries sustained by participation in sport. Additionally, we assessed the relationship between psychological readiness to return to sport and self-reported physical health status, as we believed it to be important to test the I-PRRS's psychometric properties in an adolescent population to help

determine if this quick and simple assessment is a tool clinicians can use for the assessment of confidence in return to sport in this population. Preliminary research has shown reliability and validity of the I-PRRS in young adults.[8] Early investigation of this tool by Galzer was performed on 22 collegiate athletes (18 male, 4 female) and determined the internal consistency of the I-PRRS (after injury α=0.93, before practice α=0.92, before competition α=0.78, and after competition α=0.80).[8] Concurrent validity was assessed through Pearson product moment correlation analyses with the BRUMS and negative correlations were found at each time interval (after injury r=-0.62, p=0.002, before practice r=-0.78, p<.001, before competition r=-0.59, p=0.004, after competition r=-0.57, p=0.005). Glazer also provided preliminary evidence of external validity through Pearson product moment correlation analyses of the athlete's responses and athletic trainer's responses to the I-PRRS.[8] Given the results, the investigators suggested that the I-PRRS may be a beneficial tool in determining the psychological readiness to return to sport among collegiate athletes, and may help athletic trainers decide an appropriate time for return to sport.

In our study we established appropriate internal consistency values for the I-PRRS on all three administrations of the instrument. Our values ranged from 0.891 to 0.957 and all item-total correlations were well above the required 0.20. These high internal consistency values indicate that the items on the I-PRRS, which are all proposed to measure the same construct "readiness to return to sport", produce similar scores. The next step in the assessment of the reliability of the I-PRRS should be to assess the test re-test reliability of the instrument. We did not assess the test re-test reliability of the

I-PRRS in this injured population because of the expected variability of scores based on the nature of acute injuries.

Concurrent validity was assessed through the comparison of the I-PRRS to the FABQ PAS and BRUMS. We chose to use the FABQ PAS scale as part of the validity assessment because of the known relationship between fear-avoidance behaviors and confidence.[27, 28] Previous research has compared fear-avoidance behaviors and confidence, and have found that athletes reported lower confidence and increased fear of return to play.[28] For example, a model showing changes in psychosocial factors after ACL reconstruction suggests that those with elevated pain catastrophizing and fear of movement or re-injury are more likely to suffer from chronic disability than those with lower pain catastrophizing or fear of movement.[29] This increased pain catastrophizing and fear of movement can also lead to depression, disability, and higher pain levels. Researchers are just beginning to link fear of pain and re-injury with functional outcome in musculoskeletal conditions.[27,28,29] Although this type of research has been widely unaddressed, our findings suggest that it may be best that we use fear avoidance as the outcome measurement tool to test for the concurrent validity of the I-PRRS to assess confidence in returning to sport.[30]

When we compared the I-PRRS scores to the FABQ PAS scores , the I-PRRS concurrent validity could be established within 24 hours of injury ($r=-.744$, $p<.001$), within 24 hours prior to return to practice ($r=-.801$, $p<.001$) and within 24 hours prior to return to competition ($r=-.715$, $p=.003$). However, when we compared the I-PRRS and BRUMS, like in the original validation of the scale in the collegiate population, we obtained substandard results. When validity was initially established with the I-PRRS in

the collegiate setting, researchers used the Profile of Mood States (POMS) to assess the concurrent validity of the I-PRRS. The BRUMS is the adolescent version of the POMS. The researchers decided to compare the POMS and I-PRRS because they found depressed mood states are associated with low self-efficacy.[8] Perhaps measuring total mood disturbances is not the best way to establish validity of the I-PRRS in the adolescent population.

As suggested by the literature research of Wiese-Bjornstal et al,[4] post-injury mood disturbances fluctuate. Their extensive research of literature found athletes with mild and moderate injuries had less mood disturbances. In many cases these athletes had less mood disturbances even when compared to the norms of uninjured population. There were only serious declines in mood disturbances when comparing severe injuries to the normative data of non-injured individuals.[4] This raises a significant point because no athletes who sustained serious injuries were included in our study, which may explain why we could not confirm concurrent validity with the BRUMS. Since our study deals with the adolescent population, it may be best to use a scale like the FABQ PAS to assess the concurrent validity of the I-PRRS. This is because it may be assumed that as the athletes' fear decreases, their confidence levels should increase. Currently there is no known research validating the FABQ PAS in the adolescent population, thus, a definitive conclusion cannot be drawn from these statistical results. Further research is needed before we can fully describe the nature of the relationship between these two scales.

The I-PRRS was found to be sensitive to change because scores on the I-PRRS changed significantly as playing status changed. Sensitivity to change was also assessed with a Cohen's d to determine important changes. In particular, the I-PRRS instrument

was sensitive in detecting changes between injury and return to practice scores and between injury and return to competition scores. Sensitivity to change is important to assess because clinicians need to know not only if the tool can measure a desired construct, but they also need to know if it detects change as a patient's status changes.[21] It is important to see this change over time because it can be used for documentation purposes. Since the I-PRRS has been shown to be sensitive to change, athletic trainers can now document this progression over time.

We also established the relationship between physical and psychological readiness in adolescent athletes. To explore the relationship between the participant's perceived readiness to return to sport and their physical health status, we calculated Pearson product-moment correlations with the I-PRRS scores and PedsQL™ 4.0 Physical Subscale scores for each of the three instrument administrations. The correlation coefficients ranged from 0.641 to 0.801 and were all statistically significant. In addition, 64.1% and 52.4% of the variation in I-PRRS scores were accounted for by physical readiness of the participants as measured by the PedsQL Physical Subscale score. There is equivocal research regarding the relationship between physical and psychological readiness. Early research in sport psychology indicated a poor to moderate relationship between a patient's physical and psychological readiness.[31] Some research has suggested that physical and psychological readiness may not occur at the same point in time. However, some recent research suggests that patients who do not reach activity levels that they were able to achieve prior to injury were more likely to have greater levels of fear of re-injury.[32] The inability to reach pre-injury activity levels can encourage re-injury anxiety or apprehension about an inability to reach activity expectations, which in turn

can lower readiness to return to sport.[33] If this scale is a valid and reliable tool when compared to the FABQ PAS it is possible that the I-PRRS can also detect increased fear of return to play or decreased confidence.

Limitations

Participant recruitment proved to be difficult in the adolescent population in regards to adherence. Participant recruitment was also limited due to the time constraints of an academic program. Multiple athletes had injuries that required much more rehabilitation time than the study allowed for, which ultimately reduced the statistical power of the study, and the generalizability of our results. Future research should include a wider range from the adolescent population. The majority of the participants in the study were from a single high school, with only one participant from a feeder middle school. Future studies should recruit participants from greater geographical regions, ethnic diversity, and socio-economic diversity to be more representative of the adolescent athlete population. This assessment tool is new, and more work should be completed to assess the psychometric properties of the instrument and to assess for differences in the adolescent population based on factors such as injury severity and gender. We can only generalize our findings with the I-PRRS to adolescent athletes with mild and moderate musculoskeletal injuries so more work should be completed in patients with severe injuries.

We suggest making minor modifications to the wording of the I-PRRS to remind adolescent participants that each item needs to be answered in relation to their injury. We found anecdotally that this particular adolescent population took the questions literally, and tended to answer without regards to their injury. For example, some participants

reported "100% confidence" in their abilities when they were unable to perform daily tasks with normal gait patterns. Future researchers may want to consider modifying the instructions for the I-PRRS in the adolescent population. If the items on the I-PRRS are read generally by patients rather than in direct relationship to their injury, it is more likely that the I-PRRS measures an individual's trait confidence as opposed to their state confidence. An athlete's trait confidence can be closely related with self-confidence whereas state confidence is more closely related to self-efficacy. Perhaps our adolescent athletes feel the questions are solely involving their state-sport confidence and completely disregarding their injury in relation to their trait-sport confidence.[34]

Conclusion

In conclusion, the I-PRRS is a reliable and sensitive instrument. The scales validity has also been shown when comparing the I-PRRS and FABQ PAS, but when the I-PRRS is compared to the BRUMS, the results are not significant. Further research needs to be done to identify which instrument is most closely related in determining the validity of the I-PRRS. The I-PRRS, in conjunction with a thorough return to play protocol, can also help clinicians determine that adolescent athletes with musculoskeletal injuries are being returned to play when they are both physically and psychologically ready.

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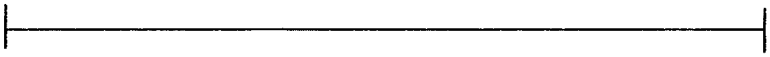
Table 1 Visual Analog Scale for I-PRRS

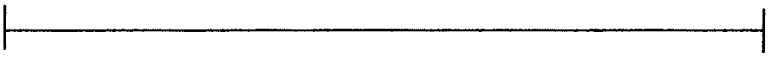
1. My overall confidence to play

2.My confidence to play without pain is

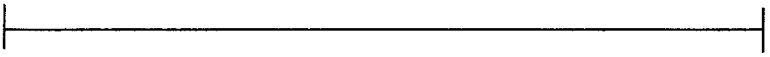


3. My confidence to give 100% effort is

4. My confidence to not concentrate on the injury is



5. My confidence in the injured boy part to handle the demands of the situation is



6. My confidence in my skill level/ability is

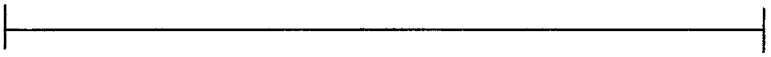


Table 2- Participants by Sport (Frequencies)

Sport	n (%)
Football	2(9.5)
Cheerleading	2(9.5)
Boys Basketball	1(4.8)
Boys Soccer	1(4.8)
Girls Soccer	5(23.8)
Baseball	2(9.5)
Track and Field	6(28.6)
Powerlifting	1(4.8)
Dance	1(4.8)
Total	21(100)

Table 3-Injury Location (Frequencies)

Location	n (%)
Ankle	11(52.4)
Knee	2(9.5)
Hip	1(4.8)
Elbow	1(4.8)
Quadricep	2(9.5)
Groin	1(4.8)
Foot	3(14.3)
Total	21(100)

Table 4-Injury Type (Frequencies)

Type	n (%)
Strain	5(23.8)
Sprain	11(52.4)
Contusion	3(14.3)
Hyperextension	1(4.8)
Dislocation/Subluxation	1(4.8)
Total	21(100)

Table 5-Injury Severity (Frequencies)

Severity	n (%)
Mild	16(76.2)
Moderate	5(23.8)

Table 6-Days Injured (Frequencies)

Number of Days	Injury to Practice (n)	Practice to Competition (n)	Injury to Competition (n)
1-7	5	9	0
8-14	8	1	8
15-28	6	4	4
>28	2	1	3
Total	21	15	15

Table7-Instrument Mean, Standard Deviation, and Score Ranges for the instruments

Instrument	Injury	Practice	Competition
I-PRRS	28.82±17.21 1.90-57.50	50.72±10.66 12.00-60.00	52.78±8.04 36.20-60.00
FABQ PAS	15.5±5.26 2.0-24.0	4.15±5.80 0.00-20.00	3.73±4.42 0.00-13.00
PedsQL Physical Scale	64.09±23.97 3.13-100.00	86.91±16.67 28.13-100.00	87.67±17.06 36.87-100.00
BRUMS	13.61±13.32 -2.00-57.00	-.76±8.46 -11.00-22.00	-0.33±7.83 -15.00-16.00

Table 8-Item Total Correlation of the I-PRRS

Item	Injury			Practice			Game		
	Mean	**Item-Total Correlation**	**Alpha If Item Removed**	**Mean**	**Item-Total Correlation**	**Alpha If Item Removed**	**Mean**	**Item-Total Correlation**	**Alpha If Item Removed**
My overall confidence to play	41.22±31.97	.728	870	86.65±21.22	.938	.925	86.30±23.94	.987	.944
My confidence to play without pain	46 55±42.62	.688	.878	80.72±23.63	.836	.935	79.86±33.05	.687	.935
My confidence to give 100% effort	56.56±38.71	.777	.860	86.79±23.70	.896	.928	89.11±24.13	.915	.956
My confidence to not concentrate on the injury	41.70±30.08	.692	.876	79.34±29.87	.630	969	84.32±27.76	.804	.944
My confidence in the injured body part to handle the demands of the situation	49.68±37.29	.615	.887	83 15±22.46	.910	.927	84.38±24.71	995	.977
My confidence in my skill level/ability	53.49±35.46	.797	.858	85.49±21.49	.910	.928	87.51±24.37	.914	937

APPENDIX

Demographics

Name (Last, First):_____

Age:_____

Have you previously been injured? Yes or No

If so, about how long did you have to sit out for?_____

Did you ever have surgery?_____

If so, what did you have surgery on?_____

Office Use Only

Injured Body Part: _____

Injury:_____

Severity:_____

Subject I.D. _____

Instructions: For each statement please circle the number from 0 to 6 to say how much physical activity such as bending lifting walking or driving affect or would affect your injury.

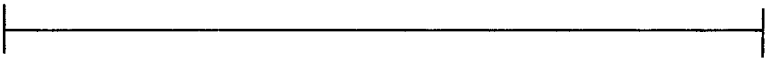
	Completely Disagree			**Unsure**			**Completely Agree**
Physical activity makes my pain worse.	**0**	**1**	**2**	**3**	**4**	**5**	**6**
Physical activity might harm my injury.	**0**	**1**	**2**	**3**	**4**	**5**	**6**
I should not do physical activities which (might) make my pain worse.	**0**	**1**	**2**	**3**	**4**	**5**	**6**
I cannot do physical activities which (might) make my pain worse.	**0**	**1**	**2**	**3**	**4**	**5**	**6**

Instructions: On the scale, please make a mark indicating your level of confidence An example can be seen below.

1. My overall confidence to play

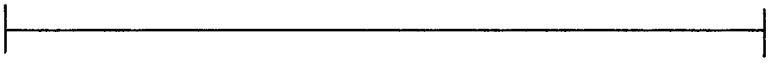
2. My confidence to play without pain is

3. My confidence to give 100% effort is



4. My confidence to not concentrate on the injury is

5. My confidence in the injured body part to handle the demands of the situation is



6. My confidence in my skill level/ability is

Instructions: The following is a list of things that might be a problem for you. Please tell us how much of a problem each one has been for you during the past ONE month by circling the appropriate number. There are no right or wrong answers. If you do not understand a question, please ask for help.

About My Health and Activities (problems with...)	**Never**	**Almost Never**	**Some-times**	**Often**	**Almost Always**
1. It is hard for me to walk more than one block	0	1	2	3	4
2. It is hard for me to run	0	1	2	3	4
3. It is hard for me to do sports activity or exercise	0	1	2	3	4
4. It is hard for me to lift something heavy	0	1	2	3	4
5. It is hard for me to take a bath or shower by myself	0	1	2	3	4
6. It is hard for me to do chores around the house	0	1	2	3	4
7. I hurt or ache	0	1	2	3	4
8 I have low energy	0	1	2	3	4

About My Feelings (problems with...)	**Never**	**Almost Never**	**Some-times**	**Often**	**Almost Always**
1. I feel afraid or scared	0	1	2	3	4
2. I feel sad or blue	0	1	2	3	4
3. I feel angry	0	1	2	3	4
4. I have trouble sleeping	0	1	2	3	4
5. I worry about what will happen to me	0	1	2	3	4

How I Get Along with Others (problems with...)	**Never**	**Almost Never**	**Some-times**	**Often**	**Almost Always**
1. I have trouble getting along with other kids	0	1	2	3	4
2. Other kids do not want to be my friend	0	1	2	3	4
3. Other kids tease me	0	1	2	3	4
4. I cannot do things that other kids my age can do	0	1	2	3	4
5. It is hard for me to keep up when I play with other kids	0	1	2	3	4

About School (problems with...)	**Never**	**Almost Never**	**Some-times**	**Often**	**Almost Always**
1. It is hard to pay attention in class	0	1	2	3	4
2. I forget things	0	1	2	3	4
4. I miss school because of not feeling well	0	1	2	3	4
5 I miss school to go to the doctor or hospital	0	1	2	3	4

Instructions: Below is a list of words that describe feelings. Please read each one carefully. Then circle the number that best describes HOW YOU FEEL RIGHT NOW. Make sure you answer every question.

	Not at all	**A little**	**Moderately**	**Quite a bit**	**Extremely**
1.) Panicky	0	1	2	3	4
2.) Lively	0	1	2	3	4
3.) Confused	0	1	2	3	4
4.) Worn out	0	1	2	3	4
5.) Depressed	0	1	2	3	4
6.) Downhearted	0	1	2	3	4
7.) Annoyed	0	1	2	3	4
8.) Exhausted	0	1	2	3	4
9.) Mixed-up	0	1	2	3	4
10.) Sleepy	0	1	2	3	4
11.) Bitter	0	1	2	3	4
12.) Unhappy	0	1	2	3	4
13.) Anxious	0	1	2	3	4
14.) Worried	0	1	2	3	4
15.) Energetic	0	1	2	3	4
16.) Miserable	0	1	2	3	4
17.) Muddled	0	1	2	3	4
18.) Nervous	0	1	2	3	4
19.) Angry	0	1	2	3	4
20.) Active	0	1	2	3	4
21.) Tired	0	1	2	3	4
22) Bad tempered	0	1	2	3	4
23.) Alert	0	1	2	3	4
24.) Uncertain	0	1	2	3	4

VITA

Joshua Plate was born in Appleton, Wisconsin, on March 8, 1988, the son of Steven and Tani Plate. After completing his high school education in the town of Brillion, Wisconsin in 2006, he entered Concordia University of Wisconsin in Mequon, Wisconsin. He received a Bachelors of Science degree in Athletic Training from Concordia University in May 2010. In August 2010, he entered the Graduate College of Texas State University-San Marcos.

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