

GRANQUIST, MEGAN D., PhD. Development of a Preliminary Rehabilitation Adherence Measure for Athletic Training. (2008)

Directed by Drs. Diane L. Gill & Renee N. Appaneal. 181pp.

The present investigation aims to 1) identify indicators (i.e., behaviors) of sport injury rehabilitation adherence that are relevant to collegiate athletic training and 2) develop a preliminary rehabilitation adherence measure for athletic training (RAdMAT) based on these indicators. Three steps are included in the development of the RAdMAT. First, certified athletic trainers currently practicing in the collegiate setting (n=7) identified clinically relevant indicators of sport injury rehabilitation adherence and these indicators were used to generate preliminary items for the measure. Second, an expert panel (i.e., sport injury/rehabilitation researchers, athletic training educators/faculty/staff) (n=12) reviewed the preliminary items and provided feedback pertaining to content and clarity of items. Expert ratings were used to revise the draft measure and provide an initial assessment of content validity. In step three, the 25-item preliminary RAdMAT was administered to a larger sample of certified athletic trainers to provide data for initial reliability and validity analyses (n=164). Results indicate the preliminary 25-item RAdMAT had good internal consistency but factor analyses reduced the measure to 16 items and suggested three sub-scales (attendance/participation, communication, attitude/effort). The resulting 16-item RAdMAT subscales and total all have good internal consistency and clearly discriminate among adherence levels. All individual items have good item-total correlations and contribute to internal consistency of their respective subscales and the total and all items discriminate among adherence levels. The RAdMAT has both a conceptual base and a base in clinical athletic training practice that

make it particularly relevant and appropriate for use in athletic training settings. With only 16 items in a simple format, the RAdMAT is also relatively easy to use, whether by athletic trainers in clinical practice or for research purposes. Future investigations are needed to further establish the measure's psychometric properties and usefulness in research and practice.

DEVELOPMENT OF A PRELIMINARY REHABILITATION ADHERENCE  
MEASURE FOR ATHLETIC TRAINING

by

Megan D. Granquist

A Dissertation Submitted to  
the Faculty at The Graduate School at  
The University of North Carolina at Greensboro  
in Partial Fulfillment  
of the Requirements for the Degree  
Doctor of Philosophy

Greensboro  
2008

Approved by

---

Committee Co-Chair

---

Committee Co-Chair

© 2008 by Megan D. Granquist

APPROVAL PAGE

This dissertation has been approved by the following committee of the Faculty of  
The Graduate School at The University of North Carolina at Greensboro.

Committee Co-Chair

\_\_\_\_\_  
Dr. Diane L. Gill

Committee Co-Chair

\_\_\_\_\_  
Dr. Renee Newcomer Appaneal

Committee Members

\_\_\_\_\_  
Dr. Sandra J. Shultz

\_\_\_\_\_  
Dr. Beverly J. Levine

\_\_\_\_\_  
November 3, 2008  
Date of Acceptance by Committee

\_\_\_\_\_  
November 3, 2008  
Date of Final Oral Examination

## TABLE OF CONTENTS

CHAPTER	Page
I. INTRODUCTION .....	1
Construct and Measurement of Rehabilitation Adherence .....	4
Operational Definitions.....	6
Statement of the Problem.....	7
Purposes and Objectives .....	7
II. REVIEW OF THE LITERATURE.....	10
Adherence Models .....	10
Biopsychosocial Model of Rehabilitation.....	11
Role of Adherence .....	12
Constructs of Adherence.....	13
Adherence in Medicine and Health.....	13
Exercise Adherence .....	13
Adherence in Community-Based Sports Medicine	
Clinic Rehabilitation .....	14
Adherence in Athletic Training Rehabilitation.....	15
Indices and Measures of Adherence .....	15
Adherence in Medicine and Health.....	16
Exercise Adherence .....	16
Adherence in Community-Based Sports Medicine	
Clinic Rehabilitation .....	17
Adherence in Athletic Training Rehabilitation.....	18
Instruments to Measure Rehabilitation Adherence Behaviors.....	19
Sports Medicine Observation Code (SMOC) .....	20
Sport Injury Rehabilitation Adherence Scale (SIRAS) .....	22
Research on Sport Injury Rehabilitation Adherence .....	27
Antecedents to Rehabilitation Adherence.....	28
Community-Based Sports Medicine	
Clinic Rehabilitation .....	29
Athletic Training Room Rehabilitation .....	33
Adherence: The Mediating Variable in Rehabilitation.....	36
Sport Injury Rehabilitation Outcomes .....	38
Rehabilitation Adherence Interventions .....	41
Limitations of Existing Research.....	43
Summary .....	44

	Page
III. METHODS .....	47
Step 1: Item Generation .....	48
Participants.....	48
Measure.....	49
Procedures.....	50
Analysis.....	51
Step 2: Expert Review .....	52
Participants.....	52
Measure.....	53
Procedures.....	53
Analysis.....	54
Step 3: Athletic Trainer Survey .....	54
Participants.....	55
Measures .....	55
Procedures.....	56
Analyses .....	57
IV. RESULTS .....	59
Step 1: Item Generation .....	59
Step 2: Expert Review .....	64
Step 3: Athletic Trainer Survey .....	68
Data Reduction.....	69
Item and Scale Descriptives.....	70
Comparisons of Most, Least and Average Adherent	
Athlete Data .....	72
Factor Structure of the RAdMAT .....	73
Suggested Structure and Items for RAdMAT.....	79
Additional Results.....	82
Results Summary .....	83
V. DISCUSSION .....	84
Objective 1 .....	85
Expected Outcome 1 .....	85
Objective 2 .....	88
Expected Outcome 2 .....	89
Strengths and Limitations .....	93
Future Research with the RAdMAT .....	95
Summary and Practical Implications .....	97

	Page
REFERENCES .....	99
APPENDIX A. INITIAL SURVEY FOR REHABILITATION ADHERENCE BEHAVIORS.....	103
APPENDIX B. E-MAIL TO PARTICIPANTS FOR ITEM GENERATION .....	106
APPENDIX C. COMPILED ADHERENCE BEHAVIORS FOR PARTICIPANT ACCURACY CHECK.....	108
APPENDIX D. REHABILITATION ADHERENCE MEASURE FOR ATHLETIC TRAINING: DRAFT VERSION FOR REVIEW .....	110
APPENDIX E. E-MAIL TO EXPERTS FOR REVIEW .....	115
APPENDIX F. REHABILITATION ADHERENCE MEASURE FOR ATHLETIC TRAINING: REVISED DRAFT VERSION FOR REVIEW .....	117
APPENDIX G. PRELIMINARY REHABILITATION ADHERENCE MEASURE FOR ATHLETIC TRAINING.....	119
APPENDIX H. E-MAIL TO PARTICIPANTS: PRELIMINARY REHABILITATION ADHERENCE MEASURE FOR ATHLETIC TRAINING .....	121
APPENDIX I. REHABILITATION ADHERENCE QUESTIONS .....	123
APPENDIX J. STEP 1: ITEM GENERATION RESPONSES .....	126
APPENDIX K. STEP 2: EXPERT REVIEW RATINGS & COMMENTS.....	132
APPENDIX L. UNIVARIATE F TESTS & CONTRASTS .....	150
APPENDIX M. FACTOR STRUCTURE FOR “LEAST ADHERENT” AND “AVERAGE” ADHERENT ATHLETE DATA .....	154
APPENDIX N. FORCED FACTOR ANALYSES: 25 ITEMS .....	158
APPENDIX O. FORCED FACTOR ANALYSIS: 16 ITEMS .....	164
APPENDIX P. FACTOR ANALYSIS: LEAST & AVERAGE DATA .....	167

	Page
APPENDIX Q. CORRELATION MATRIX .....	173
APPENDIX R: PARTICIPANT COMMENTS .....	175

## CHAPTER I

### INTRODUCTION

An estimated 380,000 student-athletes participate in the National Collegiate Athletic Association (NCAA) across 23 sports at more than 1000 institutions nationwide (Jones & Levine, 2006). Injury is a common occurrence in athletics. The NCAA's Injury Surveillance System (ISS) injury data from the 1988-89 to 2003-4 seasons across 15 sports (men's: baseball, basketball, fall football, ice hockey, lacrosse, soccer, wrestling; women's: basketball, field hockey, gymnastics, lacrosse, soccer, softball, volleyball) have been summarized (Hootman, Dick, & Agel, 2007). During this 15-year span, 72,316 injuries were reported during games (an average of 13.79 injuries per 1000 athlete-exposures), and 109,160 injuries were reported during practice (an average of 3.98 injuries per 1000 athlete-exposures). An athlete-exposure is defined: "as 1 athlete participating in 1 practice or game" (Hootman et al., 2007, p. 311). A reportable injury was one that "(1) occurred as a result of participation in an organized intercollegiate practice or contest; (2) required medical attention by a team certified athletic trainer or physician; and (3) resulted in restriction of the student-athlete's participation for one or more days beyond the day of injury" (Hootman et al., 2007, p. 311). Considering that an athlete must report the injury to medical staff, miss a practice and/or competition, and the medical staff must report the injury (either via paper or electronic form) to ISS to be counted, these rates may be an underestimate of actual injury prevalence. Further, it is

logical to assume that many of these athletes with injuries required some degree of sport injury rehabilitation in order to return to full function.

Rehabilitation adherence (e.g., attendance, participation, exercise completion) may play a crucial role in attaining optimal rehabilitation outcomes. Rehabilitation adherence is commonly accepted in athletic training and sport psychology as a critical component for successful sport injury rehabilitation outcomes (Arnheim & Prentice, 2000; Bassett, 2003; Bassett & Prapavessis, 2007; Fisher, Mullins, & Frye, 1993; Flint, 1998; Kolt, Brewer, Pizzari, Schoo, & Garrett, 2007; Taylor & May, 1996; Udry, 1997). Poor rehabilitation adherence (e.g., athlete working either too little or too much) may decrease overall rehabilitation outcomes (e.g., functional ability, strength, range of motion) (Brewer, 1998; Brewer, Van Raalte, Cornelius et al., 2000) and may increase the chance of re-injury (Arnheim & Prentice, 2000).

Collegiate athletes normally receive sport injury rehabilitation services through their college or university's athletic training room, rather than a community-based sports medicine rehabilitation clinic (e.g., physical therapy or physiotherapy). The athletic training room is most often located on campus near the athletic facilities and is staffed by certified athletic trainers who are health care professionals trained in the prevention, recognition, management and rehabilitation of injuries. Athletic training services are generally free of charge to athletes and athletic training room hours are usually offered around athletic practice and game schedules.

Despite the ease of access for athletes to receive rehabilitation services, poor adherence is anecdotally reported as a common occurrence and recognized as a major

problem affecting rehabilitation in the athletic training setting (Fisher, Mullins et al., 1993; Fisher, Scriber, Matheny, Alderman, & Bitting, 1993). Byerly, Worrell, Gahimer and Domholdt (1994) reported that among 44 Division II collegiate athletes, 63% were non-adherent in rehabilitation based on attendance and athletic trainer ratings of athlete participation. As discussed previously, these less than optimal adherence rates in the collegiate athletic training setting likely influence rehabilitation outcomes.

Beyond the athletic training setting, sport injury rehabilitation adherence rates within community-based sports medicine rehabilitation settings (e.g., physical therapy or physiotherapy clinics) range from 40-91% (Brewer, 1998). In one study, physiotherapists reported 55% of patients were not fully adherent with prescribed home modalities, and 51% of these patients were not fully adherent with prescribed rest from activity (Taylor & May, 1996). In the same study, 60% of physiotherapy patients reported they were not fully adherent with prescribed home modalities (e.g., cryotherapy), and 54% reported they were not fully adherent with prescribed rest (Taylor & May, 1996). Udry (1997) found adherence rates for athletes receiving community-based sports medicine rehabilitation following anterior cruciate ligament (ACL) reconstruction to be 79%, with highest adherence rates at the beginning of rehabilitation. Adherence rates below 100% pose a real problem in sport injury rehabilitation in both athletic training and community-based sports medicine settings and this research suggests that rehabilitation outcomes in these settings may be less than optimal.

## Construct and Measurement of Rehabilitation Adherence

Sport medicine literature provides anecdotal evidence and clinical support for the role of adherence and although the problem of poor adherence is widely recognized, the definition and measurement of rehabilitation adherence has been inconsistent. There is not a clear conceptual model or definition of rehabilitation adherence, also termed compliance (Bassett, 2003), in the sports medicine or sport psychology literature. A widely accepted definition of adherence among practitioners who use exercise as rehabilitation from disease is “an active, voluntary collaborative involvement of the patient in a mutually acceptable course of behavior to produce a desired preventative or therapeutic result” (Meichenbaum & Turk, 1987, p. 20). Adherence in general medicine and health has been defined as “the degree to which patient behaviors coincide with the recommendations of health-care providers,” (Vitolins, Rand, Rapp, Ribisl, & Sevick, 2000). Combining Meichenbaum and Turk’s and Vitolins et al.’s definitions provides a comprehensive conceptual definition of rehabilitation adherence for use in the collegiate athletic training environment. It is clear from these definitions that adherence in the sport injury rehabilitation setting involves the athlete demonstrating behaviors that coincide with the recommendations of their health-care provider, who, in the athletic training setting is the athletic trainer.

Given the lack of a consistently agreed upon definition of rehabilitation adherence, it’s not surprising that measurement is problematic. One of the major problems with measuring rehabilitation adherence is the lack of an accepted standard for measurement; there is no ‘gold’ standard by which to rate adherence. Researchers have

yet to systematically identify the behaviors that constitute rehabilitation adherence. In the athletic training setting, limited research has measured adherence using both attendance and athletic trainer ratings of athletes' participation, rehabilitation completion, following instructions/advice, and receptivity to changes in rehabilitation (Albinson & Petrie, 2003; Byerly, Worrell, Gahimer, & Domholdt, 1994). In community-based sports medicine rehabilitation clinics, adherence has been measured in a variety of ways via patient self-report and practitioner report including patients' attendance, exercise/rehabilitation completion, following instructions/advice, receptivity to changes in rehabilitation, compliance with home care instructions, and activity restrictions (Bassett & Prapavessis, 2007; Brewer et al., 2003a; Brewer, Van Raalte, Cornelius et al., 2000; Scherzer et al., 2001; Taylor & May, 1996). Likely there are other indices of rehabilitation adherence specific to athletic training settings that have yet to be identified.

To date, only one measure of rehabilitation adherence has been developed and published for use with sport injury: the Sport Injury Rehabilitation Adherence Scale (SIRAS) (Brewer, Van Raalte, Petitpas et al., 2000). The SIRAS was created from literature on adherence and developed specifically for use in a community-based sports medicine rehabilitation clinic. While the SIRAS has been shown to have good psychometric properties (Brewer, Van Raalte, Petitpas et al., 2000), it is arguably difficult to capture human behavior with three items. Because there is no gold-standard measure or agreed upon operational definition of rehabilitation adherence, it is also difficult to be sure that the SIRAS is really measuring adherence. And, as discussed previously, athletes receiving rehabilitation services via their collegiate athletic training

room likely have different factors affecting their rehabilitation than patients receiving rehabilitation services at a community-based sports medicine rehabilitation clinic.

Therefore, a measure of rehabilitation adherence in a community-based sports medicine clinic may not be appropriate for research or clinical use within the collegiate athletic training room.

### Operational Definitions

***Rehabilitation adherence:*** Behaviors an athlete demonstrates by pursuing a course of action that coincides with the recommendations of the athletic trainer.

***Rehabilitation antecedents:*** Biopsychosocial factors (injury characteristics, biological factors, psychological factors, sociodemographic factors, social/contextual factors) that influence rehabilitation behaviors and outcomes (Brewer, Andersen, & Van Raalte, 2002).

***Rehabilitation outcomes:*** Influenced by rehabilitation antecedents and behaviors, rehabilitation outcomes can be both immediate biopsychological outcomes (e.g., strength, range of motion, functional ability) and/or overall sport injury rehabilitation outcomes (e.g., functional performance, quality of life, treatment satisfaction, readiness to return to sport) (Brewer, Andersen et al., 2002)

***Rehabilitation Behavior:*** Outwardly expressed, clinically relevant action that can be easily observed and judged by the athletic trainer (behaviors do not overlap with antecedents or outcomes).

## Statement of the Problem

The current lack of a valid and reliable rehabilitation adherence measurement tool specific to the athletic training setting is a noted hindrance in sport injury rehabilitation adherence research and clinical practice (Levy, Polman, Clough, & McNaughton, 2006). A measure of adherence behaviors for rehabilitation must not only be useful in practice, but must also be conceptually-based and psychometrically-sound. Identifying and measuring the behaviors that comprise sport injury rehabilitation adherence in a collegiate athletic training setting is vital to the further understanding and investigation of the overall rehabilitation process (e.g., biopsychosocial factors that influence rehabilitation adherence, potential interventions to enhance adherence) and successful outcomes (e.g., range of motion, strength, functional ability, future injury, etc.). For a measure of rehabilitation adherence to be valid, the measure must be purposely limited to these athlete behaviors that are easily interpretable and observable by collegiate athletic trainers. For a rehabilitation adherence measure to have clinical use, rehabilitation adherence behaviors must be generally agreed upon by collegiate athletic trainers who will be rating athlete behaviors of adherence.

## Purposes and Objectives

The long-term goal is to develop a survey measure that adequately assesses behaviors of rehabilitation adherence in an athletic training setting. While measure development and evaluation is a lengthy process that requires multiple investigations to

establish reliability and validity, the *purpose of this project* is to develop a preliminary measure of rehabilitation adherence for athletic training that includes indicators of adherence identified by athletic trainers who are currently practicing in the collegiate athletic training setting and that reflects the operational definition of rehabilitation adherence.

***Objective 1:*** Identify indicators (i.e., behaviors) of sport injury rehabilitation adherence that reflect the definition and are relevant to collegiate athletic training.

***Objective 2:*** Develop a preliminary rehabilitation adherence measure for athletic training (RAdMAT) based on these indicators.

***Expected Outcome 1:*** Indicators generated by athletic trainers will be relevant to collegiate athletic training and reflect the operational definition of rehabilitation adherence. These indicators will include, but not be limited to, attendance and exercise completion.

***Expected Outcome 2a:*** The preliminary RAdMAT will reflect the operational definition, have acceptable psychometric properties, and be relevant for using in an athletic training setting.

***Expected Outcome 2b:*** The RAdMAT will be psychometrically as sound as and more relevant to an athletic training setting than the 3-item SIRAS that was developed for the community-based sports medicine setting.

As per the long-term goal, the RAdMAT can be tested further and refined in continuing research, and also serve as a measure in research examining antecedents, outcomes and the process of rehabilitation adherence. Further research on the measure itself may include additional retrospective investigations of rehabilitation adherence and prospective investigations with athletes who are currently prescribed rehabilitation in the collegiate athletic training room. With the current project and follow-up investigations, the RAdMAT will provide researchers and clinicians a measure to use in improving the rehabilitation process and overall rehabilitation outcomes.

## CHAPTER II

### REVIEW OF THE LITERATURE

An estimated 380,000 student-athletes participate in the National Collegiate Athletic Association (NCAA) across 23 sports at more than 1000 institutions nationwide (Jones & Levine, 2006). Many of these athletes with injuries likely required some degree of sport injury rehabilitation in order to return to full function. Rehabilitation adherence is commonly accepted as a critical component for successful sport injury rehabilitation (Arnheim & Prentice, 2000; Bassett, 2003; Bassett & Prapavessis, 2007; Fisher, Mullins et al., 1993; Flint, 1998; Kolt et al., 2007; Taylor & May, 1996; Udry, 1997). This review of literature will begin with an overview of the models and constructs of adherence, then discuss adherence indices and measures. A review of the research on rehabilitation adherence will follow, leading to the limitations of the existing research and the objectives of the current project.

#### Adherence Models

Models serve as frameworks for understanding the rehabilitation process and for guiding sport injury rehabilitation research. Models are useful because they provide a conceptual overview from which the antecedents and outcomes related to rehabilitation adherence can be investigated. A Biopsychosocial Model of Rehabilitation (Brewer, Andersen et al., 2002) and a rehabilitation schematic showing the mediator and moderator role of adherence (Brewer, Van Raalte, Cornelius et al., 2000) are two models

that are useful to both practitioners and researchers for conceptualizing rehabilitation adherence.

### *Biopsychosocial Model of Rehabilitation*

In general medicine and health, as well as in sport injury rehabilitation, physical factors (e.g., type and severity of injury, health status of patient) affect overall recovery following an injury. More recently, psychological and social factors have received attention as contributors to recovery. The Biopsychosocial Model of Sport Injury Rehabilitation can serve as a guide for sport injury rehabilitation research by providing an inclusive framework from which both physical and psychosocial factors can be investigated (Brewer, Andersen et al., 2002).

This Biopsychosocial Model of Rehabilitation (Brewer, Andersen et al., 2002) provides a conceptual framework that ties biological and psychosocial factors to rehabilitation outcomes. This model has Injury Characteristics (e.g., type/severity) and Sociodemographic Factors (e.g., financial issues, gender) contributing to Biological Factors (e.g., nutrition, general health), Psychological Factors (e.g., personality, mood, stress) and Social/contextual Factors (e.g., team status, family situation). Biological, Psychological and Social/contextual factors are interrelated and reciprocally affect Immediate Biopsychological responses (e.g., ROM, pain). Immediate Biopsychological responses directly influence Sport Injury Rehabilitation Outcomes.

While the Biopsychosocial Model does not show adherence, it is logical to situate adherence (e.g., attendance, exercise completion) immediately prior to biopsychological

outcomes because these behaviors may contribute to range of motion, strength, etc. This placement of adherence in the model is alluded to by the authors of this model in describing how social/contextual factors influence outcomes: “For example, disruptive life circumstances may interfere with adherence to a rehabilitation protocol, thereby hampering achievement of favorable intermediate biopsychological outcomes and, ultimately, desired functional performance at the end of rehabilitation” (Brewer, Andersen et al., 2002). This is a nice fit for adherence because these behaviors may also be influenced by injury characteristics, biological factors, sociodemographic factors, and psychological factors. It follows then, that adherence may be a mediator between biopsychosocial factors and rehabilitation outcomes (both immediate and overall).

### *Role of Adherence*

As part of an investigation on the mediation role of adherence, Brewer and colleagues developed a schematic showing rehabilitation adherence (e.g., attendance, practitioner ratings, exercise completion) as a mediator between psychological factors (e.g., self-motivation, psychological distress, efficacy for rehabilitation) and rehabilitation outcomes (e.g., functional ability, physical symptoms) (Brewer, Van Raalte, Cornelius et al., 2000). Rehabilitation outcomes can be influenced by psychological factors both directly or indirectly with rehabilitation adherence as a mediator. This model serves as the conceptual model for the mediation role of rehabilitation adherence.

## Constructs of Adherence

The terms adherence and compliance have been used interchangeably (Bassett & Prapavessis, 2007; Taylor & May, 1996). Generally, adherence describes behavior that is aimed at a particular outcome. Adherence definitions have been provided in general medical and health areas, in the exercise domain and in rehabilitation.

### *Adherence in Medicine and Health*

Adherence is particularly relevant in medical and health areas and most terms and models come out of these areas. A widely accepted definition of adherence is “an active, voluntary collaborative involvement of the patient in a mutually acceptable course of behavior to produce a desired preventative or therapeutic result” (Meichenbaum & Turk, 1987). Adherence in this domain has also been defined as “the degree to which patient behaviors coincide with the recommendations of health-care providers,” (Vitolins et al., 2000). These definitions stress the importance of the patient’s voluntary action in following practitioner recommendations. These are important factors in rehabilitation adherence in an athletic training environment.

### *Exercise Adherence*

Much research has focused on adherence to exercise for health promotion and maintenance. Within the broader area of health psychology and behavioral medicine, “[a]dherence refers to maintaining an exercise regimen for a prolonged period of time...Central to adherence is the assumption that the individual voluntarily and

independently chooses to engage in the activity.” (Lox, Martin Ginis, & Petruzzello, 2006). This exercise adherence definition is in line with the medical and health areas and is also related to rehabilitation adherence in the athletic training context, because behaviors must be maintained for a period of time. However, while exercise adherence behavior may be motivated by long-term health promotion there is arguably an immediate motivating component (i.e., recovery from injury, return to competitive sport, return to play pressures, etc.) with rehabilitation.

Exercise prescribed for a specific medical condition or disability closely relates to rehabilitation adherence in an athletic training environment because recovery from the condition (e.g., heart attack, knee injury) is the driving motivation for rehabilitation. Similar to exercise adherence, rehabilitation adherence relies on an individual choosing to engage in the rehabilitation and to what degree. However, exercise adherence applies to a behavior to be maintained continuously over the lifespan, whereas rehabilitation is a time-limited set of behaviors aimed at returning to normal function.

#### *Adherence in Community-Based Sports Medicine Clinic Rehabilitation*

Community-based sports medicine clinics include physical therapy and physiotherapy clinics. Clinic patients must pay for services, either with medical insurance or out of pocket. Patients must have transportation to the rehabilitation clinic and clinic hours may not meet patient needs. Rehabilitation in a clinic may also consist largely of home exercises which the patient must complete on their own. Similar to the general medical and health definition, sport injury rehabilitation adherence in physiotherapy

research has been defined as “the extent to which the subjects followed the clinic- and home-based components of their physical therapy intervention” (Bassett & Prapavessis, 2007).

### *Adherence in Athletic Training Rehabilitation*

The conceptual definition of rehabilitation adherence in athletic training has been assumed to be the same as in community-based clinic rehabilitation. However, rehabilitation in an athletic training setting is different than rehabilitation in a community-based sports medicine clinic. Further, conceptual models that come out of clinical sports medicine literature are not specific to athletic training. Therefore, rehabilitation adherence in an athletic training room needs to be defined specific to the collegiate athletic training context. Currently there is no rehabilitation adherence definition specific to athletic training.

### Indices and Measures of Adherence

A measure of rehabilitation adherence for use in the athletic training setting has yet to be developed. Indices and measure come out of medicine and health, exercise and clinic rehabilitation. Adherence in these domains is generally related to taking medications, amount of exercise, attendance, and report of rehabilitation exercise completion. These indices may not be adequate to measure rehabilitation in an athletic training setting.

### *Adherence in Medicine and Health*

Adherence to medication prescription is widely used as an operational definition of adherence to medical regimens (i.e., the degree to which a patient took their medication) and is perhaps the most widely investigated adherence behavior. Adherence to medication usage has been measured via self-report in the form of interviews, questionnaires and diaries (Vitolins et al., 2000). Counting pills and prescription refills have also been used as a measure of adherence (Vitolins et al., 2000). More advanced techniques of monitoring such as electronic medication monitoring devices which record the times when bottles are opened and biochemical measures of medication adherence have also been used for some drugs (Vitolins et al., 2000).

The behavior of taking medication is easier to quantify than rehabilitation adherence, either the patient takes their medication or not. Rehabilitation has multiple tasks which make up the adherence behavior. Therefore, more complex behaviors such as adherence to exercise are more similar to rehabilitation and may have more relevance to rehabilitation adherence.

### *Exercise Adherence*

Exercise adherence has been measured by a variety of methods, all which attempt to quantify amount of exercise. Common measurements include: energy expenditure, observation, self-report/recall logs, pedometers, movement sensors and accelerometers (Vitolins et al., 2000). Mutrie (1999) suggests adherence be reported as a percentage of target behavior specified by exercise prescription (e.g., exercise completion, minutes of

activity). In line with the conceptual definition, these measures must be used over a prolonged period of time.

Exercise is commonly prescribed in response to disease and disability. Major categories of disease/disability for which exercise is prescribed are: cardiovascular and pulmonary diseases, metabolic diseases, immunological/hematological disorders, neuromuscular disorders, cognitive/emotions/sensory disorders, and orthopedic diseases/disabilities (Mutrie, 1999). Adherence in these domains has been measured by program completion and attendance (Casey, Hughes, Rosneck, Waechter, & Josephson, 2007; Mutrie, 1999).

It is more difficult to define and measure rehabilitation adherence than exercise adherence. Rather than measuring straightforward quantity of exercise, rehabilitation adherence is comprised of several behaviors (e.g., attending sessions, completing exercises, complying with activity restrictions). This makes rehabilitation adherence more difficult to quantify than exercise adherence.

#### *Adherence in Community-Based Sports Medicine Clinic Rehabilitation*

Sport injury rehabilitation adherence in a community-based clinic has been measured in a variety of ways, including: attendance, exercise completion, compliance with activity restrictions, healing rate and practitioner reports.

Attendance at rehabilitation sessions is perhaps the easiest to obtain and most objective measurement. Many studies have used attendance either on its own or in conjunction with other adherence measures (Bassett & Prapavessis, 2007; Brewer et al.,

2003b; Brewer, Van Raalte, Cornelius et al., 2000; Daly, Brewer, Van Raalte, Petitpas, & Sklar, 1995; Scherzer et al., 2001; Udry, 1997). Home exercise completion has been measured with retrospective self-report questionnaires and daily exercises logs (Bassett & Prapavessis, 2007; Brewer et al., 2003b; Brewer, Van Raalte, Cornelius et al., 2000; Scherzer et al., 2001; Taylor & May, 1996). Completion of home cryotherapy has also been collected in a similar manner (Bassett & Prapavessis, 2007; Brewer et al., 2003b; Brewer, Van Raalte, Cornelius et al., 2000; Scherzer et al., 2001; Taylor & May, 1996). Patient self-report of compliance with activity restrictions has been used in a handful of studies (Bassett & Prapavessis, 2007; Taylor & May, 1996). In addition, compliance with strapping/bracing and compliance with elevation have been used (Bassett & Prapavessis, 2007). Healing rate has also served to evaluate rehabilitation adherence (Brewer, 1998).

Practitioner reports have been used to measure rehabilitation adherence. For example, Taylor & May (1996) had physiotherapists estimate patients' compliance with home-based rehabilitation protocol (e.g., mobility, stretching and strengthening exercises, hot/cold therapy, application of compression). Practitioner ratings of comprised of patient's intensity of rehabilitation completion, frequency of following practitioner instructions and advice, and receptivity to changes in rehabilitation have also been used (Brewer, Avondoglio et al., 2002; Brewer, Van Raalte, Cornelius et al., 2000).

### *Adherence in Athletic Training Rehabilitation*

As discussed previously, the athletic training room provides a distinct rehabilitation environment. Typically free services, convenient hours and location of the

athletic training room allow athletes easy access to rehabilitation services. Further, athletes also often have established rapport with athletic trainers who work and travel with their sports teams. Because of the unique factors associated with the athletic training room, behaviors associated with adherence would be expected to be different from those of a community-based rehabilitation clinic.

Little research of rehabilitation adherence has been done within the context of athletic training. The research that has been done has measured adherence by attendance (Byerly et al., 1994; Cramer Roh, 2001) and practitioner ratings (Albinson & Petrie, 2003; Byerly et al., 1994; Cramer Roh, 2001; Tubilleja, 2003). Due to a lack of research on rehabilitation adherence behaviors in athletic training, behaviors which demonstrate adherence are currently unidentified. These behaviors may include exercise completion, effort, modalities such as icing, and restricting activity.

#### Instruments to Measure Rehabilitation Adherence Behaviors

Two instruments have been developed for practitioner ratings of behaviors in rehabilitation: the Sports Medicine Observation Code (Crossman & Roch, 1991) and the Sport Injury Rehabilitation Adherence Scale (Brewer, Van Raalte, Cornelius et al., 2000). These measures were designed for use in a sports medicine clinic. SMOC is an observation tool to log athlete rehabilitation behaviors, not specifically adherence, and SIRAS is used to rate athlete rehabilitation adherence.

### *Sports Medicine Observation Code (SMOC)*

The SMOC was developed for use in sports medicine rehabilitation clinics to track athlete behaviors during rehabilitation sessions. The SMOC requires recording the frequency and duration of 11 specific behaviors of athletes with injury in a sports medicine rehabilitation environment. These eleven behaviors were compiled by first observing behaviors of athletes in two different sports medicine clinics. These specific behaviors, along with their definitions, were checked for validity by three experts and found to meet face validity criteria.

Behavior categories are: active rehabilitation (e.g., icing, ultrasound), initial treatment (e.g., first aid), attending-related (e.g., athlete listens to clinic personnel, related to injury), attending-unrelated (e.g., athlete listens to clinic personnel, un-related to injury), interaction-related (e.g., athlete interacts verbally with clinic personnel, related to injury), interaction-unrelated (e.g., athlete interacts verbally with clinic personnel, un-related to injury), waiting, initial diagnosis, preventative treatment (e.g., taping), maintenance (e.g., scheduling next appointment), non-activity, unrelated activity (e.g., reading a book), exclusion (e.g., athlete visits restroom).

Behaviors can either be recorded by momentary-time-sampling, in which the observer records the subjects' behavior at the completion of a given time period (e.g., 10 seconds), or by interval recording in which the behavior is recorded in 20-second intervals over a period of time. The observer using the SMOC must memorize the meaning of each behavior and be able to quickly and accurately recognize and record behaviors. To rate adherence for each category, the frequency of each behavior is totaled.

It is then converted to a percentage by dividing the frequency for each behavior by the total number of intervals and multiplying by 100.

A pilot study was conducted with 20 university varsity athletes (10 male, 10 female) receiving rehabilitation at a clinic (Crossman & Roch, 1991). Athletes were observed using the SMOC for an average of 35 minutes (authors do not report number or description of observers). Findings show 45.5% of time was spent in active rehabilitation, 9.6% in unrelated activity, 9.1% in maintenance, 7.5% in preventative treatment, 7.2% in waiting, 6.2% in interaction-unrelated, 5.1% in initial treatment, 3.4% in non-activity, 2.0% in attending-related, 1.8% in interaction-related, 1.7% in attending-unrelated, 0.6% in exclusion and 0% in initial diagnosis. The authors note the SMOC may be useful in assessing time management in rehabilitation, but no reliability or inter-observer agreement data has been reported.

SMOC is a time-intensive measure that requires the practitioner who is completing the SMOC to be trained in accurately observing and recording each of the behaviors. The authors who developed the SMOC report preliminary support for face validity based on three experts' ratings (Crossman & Roch, 1991). Following the initial publication in 1991, however, there have been no published reports utilizing the SMOC. If used correctly and completed accurately, the SMOC provides a summary of behaviors in rehabilitation and could be effective in a clinic's time management. However, the SMOC does not provide a measure of adherence behavior. Adherence is left up to interpretation. For example, if a patient spends time waiting, is this non-adherent behavior, or is their rehabilitation practitioner busy with another patient? Further, the

patient could be following instructions to wait, and thus demonstrating good rehabilitation adherence.

### *Sport Injury Rehabilitation Adherence Scale (SIRAS)*

Similar to the SMOC, the SIRAS was developed for use in a community-based sports medicine / physical therapy clinic. (Brewer, Van Raalte, Petitpas et al., 2000). The SIRAS was developed by the authors from existing literature on adherence. The SIRAS is a brief measure consisting of 3 items that ask the rehabilitation practitioner to rate the patient's intensity of rehabilitation completion, frequency of following practitioner instructions and advice, and receptivity to changes in rehabilitation on a 5-point Likert-type scale (range 3-15, with higher scores indicating greater adherence).

The SIRAS has been reported to have satisfactory psychometric properties. The initial published article introducing the SIRAS summarized three studies (Brewer, Van Raalte, Petitpas et al., 2000). The first study included 145 patients receiving rehabilitation services at a physical therapy clinic (82 males, 62 females, 1 unidentified; mean age 43.95). Each participant's rehabilitation practitioner (i.e., physical therapist, athletic trainer, occupational therapist or physical therapy assistant) completed the SIRAS. Attendance percentage at rehabilitation sessions to date was also recorded. The mean total SIRAS score was 12.55 (SD=2.30) and internal consistency was high (Cronbach's alpha=0.82). Principal components analysis showed a single factor that accounted for 74% of the variance (eigenvalue=2.21). Attendance was significantly related to SIRAS

ratings ( $r=0.21$ ,  $p<.05$ ). Patients' SIRAS scores did not differ by gender, level of sport involvement, age, or type of rehabilitation practitioner.

The second study included 31 patients (19 male, 12 female) who were receiving physical therapy following ACL reconstructive surgery. Rehabilitation practitioners (i.e., physical therapists and athletic trainers) completed the SIRAS for each participant at two consecutive rehabilitation sessions (approximately 1 week apart). The mean total SIRAS rating for the first rehabilitation session was 11.68 (SD=2.43) and 11.81 (SD=2.44) for the second session. Test-retest reliability from one session to the next was found to be moderately high ( $r=0.77$ ).

The third study included 43 patients (33 male, 10 female) who were also receiving physical therapy following ACL reconstructive surgery. Patients' primary rehabilitation practitioners (i.e., individual who supervised the majority of rehabilitation) (i.e., physical therapists, athletic trainers, physical therapy assistants) and secondary rehabilitation practitioners (i.e., those who supervised the most other than the primary practitioner) completed the SIRAS following each patients' rehabilitation session. Interclass correlation between the primary and secondary practitioners was 0.57. The Cronbach's alpha of 0.86 was found for multiple administrations of the SIRAS (for patients who attended all 10 of their sessions) among different rehabilitation practitioners over time, indicating good test-retest reliability.

Later, Brewer and colleagues conducted two studies aimed at validity and inter-rater agreement of the SIRAS (Brewer, Avondoglio et al., 2002). The first study had student rehabilitation practitioners (26 undergraduate athletic training students, 17

undergraduate/graduate physical therapy students) complete the SIRAS while watching three videos demonstrating patients who had high, moderate and low adherence. Mean total SIRAS scores were 14 (SD=1.27), 8.93 (SD=1.76) and 4.79 (SD=1.93) for the high, moderate, and low adherence videos respectively. Inter-rater agreements for the high adherence video, moderate adherence video and low adherence video were 0.90, 0.86 and 0.84, respectively. Viewing carry-over effects from one video to the next were not taken into account. Therefore, the authors note these values may be under-estimates of true inter-rater agreements.

The second study (Brewer et al., 2002) included 12 patients (9 men, 3 women; mean age 29.33, SD=11.44) who were receiving physical therapy following ACL reconstructive surgery. SIRAS ratings were completed for each patient by both their treating certified athletic trainer and an observing certified athletic trainer. SIRAS measures were completed for each patient at 4 consecutive rehabilitation appointments. The rater-agreement index statistic for the 4 appointments was 0.94, indicating high SIRAS rating agreement between the certified athletic trainers.

A recent published report investigating the SIRAS for use with clinical physiotherapy (Kolt et al., 2007) included two studies that replicated those by Brewer et al. (2002). The first study had physiotherapy students in Australia or New Zealand (n=60; 17 were registered physiotherapists) complete the SIRAS while watching the same three videos used in Brewer et al. (2002) with patients who had high, moderate and low adherence. Mean total SIRAS scores (range 5-15 with higher scores indicating greater adherence) were 13.53 (SD=1.51), 8.02 (SD=1.95) and 4.50 (SD=1.57) for the high,

moderate, and low adherence videos respectively. Inter-rater agreements for the high adherence video, moderate adherence video and low adherence video were 0.93, 0.87 and 0.92, respectively. These inter-rater correlations are higher than Brewer et al.'s (2002) investigation with athletic training and physical therapy students. Similar to Brewer et al.'s (2002) study, Kolt et al. (2007) also note these inter-rater values may be underestimates because viewing order was not taken into account.

The second study in Kolt et al. (2007) included 45 patients (18 male, 27 female; over 18 years of age). Patients were receiving physiotherapy treatment for a musculoskeletal condition. SIRAS ratings were completed for each patient by both their treating physiotherapist and an observing physiotherapist. Repeat SIRAS measures were completed one week later for 28 patients. Test-retest reliability for the treating physiotherapist was 0.76 (95% CI 0.61 to 0.90) and 0.63 (95% CI 0.39 to 0.88) for the observing physiotherapist. Inter-rater reliability for the first session was 0.76 (95% CI 0.61 to 0.90) and 0.89 (95% CI 0.82 to 0.97) for the second session. Mean total SIRAS scores for the first session were 12.63 (SD=2.19) for the treating physiotherapist and 12.76 (SD=1.75) for the observing physiotherapist. Mean total SIRAS scores for the second session were 12.39 (SD=1.69) for the treating physiotherapist and 12.46 (SD=1.64) for the observing physiotherapist.

While the SIRAS has been widely used in research with sport injury rehabilitation in community-based sports medicine clinics (i.e., physical therapy, physiotherapy) (Bassett & Prapavessis, 2007; Brewer et al., 2003b; Brewer, Van Raalte, Cornelius et al., 2000; Daly et al., 1995; Kolt et al., 2007; Scherzer et al., 2001) only one published study

has utilized the SIRAS as a measure of adherence in the athletic training environment (Albinson & Petrie, 2003). As part of an investigation on pre- and post-injury factors related to psychological adjustment to sport injury, Albinson and Petrie (2003), had the team athletic trainer complete the SIRAS for football players who sustained a sport related injury during the season (n=19). SIRAS measures were collected at days 1, 4, 7, 14 and 28 post-injury. SIRAS totals were as follows: Day 1 mean 10.33 (SD=2.64, n=18), Day 4 mean 9.60 (SD=3.03, n=10), Day 7 mean 11.50 (SD=1.23, n=6), Day 14 mean 12.00 (SD=0.00, n=5), Day 28 mean 12.00 (SD=0.00, n=5). Unfortunately, statistic analyses related to psychosocial variables measured pre- and post-injury could not be conducted due to small sample size.

The SIRAS has also been used in dissertation research in an athletic training setting (Cramer Roh, 2001; Tubilleja, 2003). However, Tubilleja (2003) did not report SIRAS properties. Cramer Roh (2001) found athlete attendance in 37 injured high school (n=8) and college athletes (n=29) (23 men, 14 women) significantly related to SIRAS scores ( $r=.523$ ,  $p<.01$ ). In this study, internal consistency of the three SIRAS items was  $\alpha=0.86$  and scale totals were 12.69 and 12.63 (SDs = 2.54 and 2.9, ns = 31 and 34) at one week and one month post-injury, respectively.

The author has conducted two studies using SIRAS. The first study investigated Locus of Control in Rehabilitation and adherence in a physical therapy clinic for patients (n=9) following orthopedic surgery (Granquist & Appaneal, unpublished). SIRAS total score and attendance percentage were significantly related ( $p<.01$ ,  $r=.836$ ). SIRAS

measure reliability was ( $\alpha=.930$ ). SIRAS score mean was 13.78 on a 15 point scale (range 9-15, SD=1.98).

The second study investigated hardiness related adherence during rehabilitation in an athletic training room (Granquist & Gill, unpublished). SIRAS were collected from athletes (n=3) and their athletic trainers (n=3) for four consecutive weeks at the beginning of rehabilitation (one athlete/athletic trainer pair only completed three consecutive weeks). SIRAS score mean was 14.36 (range 13-15, SD=.81) for athletes and 14.0 (range 10-15, SD=1.79) for athletic trainers. Athlete and athletic trainer SIRAS were related ( $r=.691$ ,  $p=.019$ ) indicating athletes and athletic trainers had similar ratings of rehabilitation adherence.

The review of literature on the SIRAS demonstrates it has good internal consistency, moderate to high test-retest reliability, high inter-rater reliability and practitioner ratings are related to patient ratings when used in community-based sports medicine settings. However, the SIRAS contains only three items and mean SIRAS scores were all relatively high and have little variability, a common finding when using the SIRAS (Albinson & Petrie, 2003; Cramer Roh, 2001; Granquist & Appaneal, 2006; Kolt et al., 2007). Further, the SIRAS is a single-factor measure that may limit its ability to fully capture rehabilitation adherence behaviors.

### Research on Sport Injury Rehabilitation Adherence

Sport injury rehabilitation adherence research can be summarized in four broad, overlapping areas: antecedents to adherence, the mediating role of adherence,

rehabilitation outcomes, and rehabilitation interventions. Because adherence has been poorly defined in research, study results are often misleading and in some cases measure outcomes rather than adherence. The following is a summary of research in sport injury rehabilitation adherence.

### *Antecedents to Rehabilitation Adherence*

Brewer et al.'s Biopsychosocial Model of Sport Injury Rehabilitation (2002) incorporates both physical and psychosocial factors which may relate to rehabilitation adherence. From the psychosocial factors, a variety of personal and situational factors have been suggested to be related to rehabilitation adherence. Personal factors repeatedly found to be positively related with adherence include: self-motivation, pain tolerance, task involvement and toughmindedness (Brewer, 1998). Personal factors found to be inversely related to rehabilitation adherence include: ego involvement and trait anxiety (Brewer, 1998).

Situational factors related to better adherence seen in more than one study are: belief in treatment efficacy, comfortable clinical environment, rehabilitation scheduling convenience, perceived exertion during rehabilitation, and social support (Brewer, 1998). Situational factors found to be related to adherence in single studies include: academic class status, attribution of recovery to stable and personally controllable factors, ability to cope with the injury, rehabilitation value, injury duration, instrumental coping, emotional adjustment, perceived injury severity, perceived susceptibility to further complications

without rehabilitation, practitioner expectation of adherence, rehabilitation self-efficacy, and self-esteem (Brewer, 1998).

*Community-Based Sports Medicine Clinic Rehabilitation.* Rehabilitation compliance was investigated among 62 university physiotherapy patients (age range 19-32 years) who were involved in recreational and competitive athletics in Britain (Taylor & May, 1996). Using Protection Motivation Theory as a basis for adherence behavior, four cognitive appraisal perceptions were investigated: 1) severity of a potentially harmful situation, 2) perceived susceptibility to further harm without rehabilitation, 3) response/treatment efficacy, or how likely the rehabilitation will reduce or prevent the threat, and 4) self-efficacy that particular rehabilitation actions can be performed. They developed the Sport Injury Rehabilitation Beliefs Scale (SIRBS) to measure these components of Protection Motivation Theory.

Patients completed the SIRBS during their first physiotherapy appointment. Compliance was measured by patient and physiotherapist ratings of prescribed rehabilitation (i.e., mobility, stretching and strengthening, hot/cold therapy, compression and activity restrictions) on a 5-point scale (none to all) with high scores indicating greater compliance. Patients were classified as “non-compliers” if their average compliance ratings were 3 or less, and “complier” if their ratings were greater than 3.

Results show that the physiotherapists’ estimates of non-compliers and compliers were significantly different for all of the Protection Motivation Theory determinants: susceptibility, severity, self-efficacy, treatment efficacy showing initial support for Protection Motivation Theory’s use in predicting rehabilitation compliance. However,

none of these determinants were found to differentiate non-compliers from compliers when analyzed with patient self-report of prescribed modalities compliance. In relation to compliance with modified activity, perceived susceptibility was the only determinant to differentiate non-compliers from compliers based on self-report, such that the greater perceived susceptibility patients reported, the greater compliance they reported.

In a more recent study, Brewer et al. (2003) also investigated SIRBS' relationship with adherence. Participants were patients at a physical therapy clinic receiving treatment following anterior cruciate ligament (ACL) reconstruction (n=85; mean age 27.25 years; SD=8.27). Adherence was measured by attendance, SIRAS, and patient self-report of home exercise completion and home cryotherapy completion. Results show that perceived susceptibility was positively related to SIRAS ( $r=.29$ ,  $p<.01$ ), home exercise completion ( $r=.31$ ,  $p<.01$ ), and home cryotherapy completion ( $r=.33$ ,  $p<.01$ ). Treatment efficacy was related also to SIRAS ( $r=.39$ ,  $p<.01$ ), home exercise completion ( $r=.43$ ,  $p<.01$ ), and home cryotherapy completion ( $r=.37$ ,  $p<.01$ ). Self-efficacy was also related to SIRAS ( $r=.37$ ,  $p<.01$ ), home exercise completion ( $r=.38$ ,  $p<.01$ ), and home cryotherapy completion ( $r=.36$ ,  $p<.01$ ). These findings indicate that the higher a patient's perceived susceptibility to harm, treatment efficacy, and self-efficacy are, the better rehabilitation adherence they demonstrate.

Udry (1997) studied 25 patients who had undergone ACL reconstructive surgery (Mean age 27.9, SD=8.4). Athletic participation was measured in hours per week (mean=9.3, SD=6.2). Predictors included: demographics, coping strategies (measured by the Coping With Health and Injury Problems), mood disturbance (measured by the

shortened Profile of Mood States), social support (measured by the Social Support Inventory). Adherence was measured by physical therapy attendance percentage. Data were collected before surgery, and at 3, 6, 9 and 12 weeks post-surgery.

Multiple regression analysis for coping styles (i.e., instrumental coping, negative coping, distraction coping, palliative coping, and social support) predicting adherence found significant results at 9-weeks ( $R^2=.44$ ,  $p=.03$ ) with instrumental coping (i.e., actively attempting to alleviate stress) positively related and contributing the most ( $\beta=.64$ ) to the prediction of adherence. This indicates coping styles may not be related to rehabilitation adherence, or coping may influence adherence differently at different stages in the rehabilitation process.

While Quinn and Fallon (1999) investigated psychological changes throughout the rehabilitation process, they also collected rehabilitation self-efficacy measures on 136 elite Australian athletes (mean age 24.6 years,  $SD=4.5$ ). Along with other psychological variables, athletes were asked “how confident they were of adherence to the rehabilitation program”. These self-efficacy data were collected during the first three phases of rehabilitation (within one week of the injury, approximately one-third of the estimated recovery time, approximately two-thirds of the estimated recovery time). Results show there were no significant changes in the mean scores for adherence self-efficacy over any of the phases.

A pilot study aimed at investigating the relationship between locus of control (i.e., perception of the control an individual has regarding rehabilitation) and sport injury rehabilitation adherence included 14 post-surgical patients receiving rehabilitation

services (9 male, 5 female; mean age=19, range 13-48) at a community orthopedic office and physical therapy clinic (Granquist & Appaneal, unpublished). All participants were new patients beginning rehabilitation after surgery for an athletic related injury and anticipated rehabilitation durations greater than 4 weeks. At a post-surgical visit to the orthopedic office participants completed a packet consisting of demographic information and the Locus of Control in Rehabilitation Scale. At the completion of 4 weeks of rehabilitation, the participants' rehabilitation practitioner completed the SIRAS and reported participants' attendance. Practitioners completed SIRAS measures for 9 participants. No significant relationships were found between any subscales of the LCRS and SIRAS total scores. The LCRS Internal and External subscales were found to be significantly related ( $r=.731$ ,  $p<.01$ ). Examination of minors ( $n=7$ ) revealed significant relationships between SIRAS ratings and LCRS Internal ( $r=.992$ ,  $p<.01$ ) and External subscales ( $r=.986$ ,  $p=.014$ ). In addition, as age increased among minors, the LCRS Chance subscale decreased ( $r=-.792$ ,  $p=.034$ ).

Due to the challenges in recruiting and collecting data within a clinic, the sample size was small; this in turn limited the findings. The relationship between LCRS Internal and External subscales may indicate that participants assign responsibility for their rehabilitation (either to themselves or others) rather than simply leaving outcomes up to chance. A significant relationship between LOC and rehabilitation adherence was found only for participants under the age of 18 years. Little LOC and adherence data have been collected for minors; therefore additional exploratory analysis was performed with this data. As age increased, the LCRS Chance subscale decreased, indicating younger

participants report rehabilitation outcomes are more likely left to chance. Limited variability of the SIRAS measure (i.e., practitioners rated participants high on all categories) and small sample size could have contributed to the lack of significant relationships between LOC and rehabilitation adherence among the entire sample.

*Athletic Training Room Rehabilitation.* A small handful of published studies have looked at factors related to rehabilitation adherence in a collegiate athletic training setting (Albinson & Petrie, 2003; Byerly et al., 1994; Cramer Roh, 2001; Fisher & Hoisington, 1993; Fisher, Scriber et al., 1993).

Byerly et al. (1994) investigated the relationship between pain, social support, exertion, scheduling, motivation and environment and rehabilitation adherence. Participants were Division II collegiate athletes (n=44, 39 men, 5 women; age range 17-25) who were injured and receiving rehabilitation treatment in the athletic training room. Independent variables were measured by a 40-item questionnaire which asked participants to rate their agreement with statements on a 4-point Likert-scale. Adherence was measured by attendance (one point) and athletic trainer perception of participation (one point). Daily adherence scores were averaged across days. Athletes with scores of 1.75 to 2 were labeled “adherent” (n=27); those below 1.75 were labeled “nonadherent” (n=17). Analyses showed that adherent and non-adherent groups were significantly different on pain and social support. In addition, overall significant relationships with adherence were found between pain ( $r=-.40$ ,  $p<.01$ ) and social support ( $r=.39$ ,  $p<.01$ ). These results indicate that a greater amount of pain may decrease adherence, and a greater amount of social support may enhance adherence.

Albinson and Petrie (2003) investigated psychosocial factors in relation to adjustment to injury with 84 Division I-A university football players (mean age 19.59). Life-event stress was measured using the Life Event Stress for College Athletes (LESCA) survey. Social support was measured with the Social Support Inventory (SSI). Dispositional optimism was measured with the Life Orientation Test (LOT). Mood State was measured with the Incredibly Short Profile of Mood States (ISP). Primary and secondary cognitive appraisals were measured by participants' agreement with two statements: "I am experiencing stress due to my injury" and "My injury is difficult to deal with". Coping methods were measured with Billings and Moos coping-responses inventory. Rehabilitation adherence was measured using the SIRAS completed by the athletic trainer.

During a preseason meeting, participants completed: a demographics form, LESCA, SSI, LOT, and ISP. Participants who were injured as part of sport competition (as defined by the NCAA Injury Surveillance System) completed the ISP and cognitive-appraisal items 1 day post injury. The athletic trainer also completed the SIRAS for the participant 1 day post injury. If the participant was still injured on day 4, they again completed the ISP and cognitive appraisal items as well as the coping-response inventory. These same measures, along with the SIRAS, were administered on days 7, 14, and 28 if the participant was still injured. If a participant was injured longer than 28 days, measures were continued to be collected every 2 weeks until the participant returned to sport participation, or the season ended.

Nineteen participants were injured during the season; one with a career-ending injury who was excluded from the study. Ten participants remained injured on day 4; 6 participants remained injured on day 7, and 5 participants remained injured on days 14 and 28. Five of the participants were excluded from statistical analyses due to incomplete pre-injury data.

Mean SIRAS scores for day 1 were 10.33 (range 0 to 12; SD=2.64) with higher scores indicating greater rehabilitation adherence. Mean SIRAS scores for day 4 were 9.60 (SD=3.03). Mean SIRAS scores for day 7 were 11.5 (SD=1.23). And mean SIRAS scores for days 14 and 28 were 12 (SD=0). Unfortunately, however, no statistical analyses were performed for rehabilitation adherence due to the small sample size. Therefore, Byerly et al. (1994) remains the only published study to date that has reported results for factors related to rehabilitation adherence in the collegiate athletic training setting.

In a pilot study, the investigator attempted to investigate the relationship between psychosocial factors and rehabilitation adherence (measured by the athlete and athletic trainer both completing the SIRAS) in a collegiate athletic training environment (Granquist & Gill, unpublished). She ran into similar difficulty with small subject numbers (n=3) that Albinson and Petrie (2003) did. Correlations with these small numbers showed that athletic identity, measured by the Athletic Identity Measurement Scale (Brewer, Van Raalte, & Linder, 1993) and hardiness (total and subscales), measured by the Hardiness Scale (Bartone, Ursano, Wright, & Igraham, 2000) were not

related to rehabilitation adherence. Lack of significant findings was likely due to small sample size.

#### *Adherence: The Mediating Variable in Rehabilitation*

While adherence has been the accepted mediator between psychosocial factors and rehabilitation outcomes in the clinical practice of physical therapy and athletic training, only one study to date has tested the mediation of adherence between psychological factors and rehabilitation outcomes (Brewer, Van Raalte, Cornelius et al., 2000).

Participants (n=95) were patients receiving physical therapy in a sports medicine clinic following ACL surgery. At a pre-operative appointment, patients completed a series of psychological measures. After surgery, adherence measures were collected for patients at each physical therapy appointment. Outcome measures were collected approximately 6 months post-surgery.

Mediation was not achieved because none of the adherence measures (e.g., rehabilitation attendance, SIRAS ratings, self-report of home exercise and cryotherapy completion) were found to be significantly related to both psychological factors (e.g., self-motivation, social support, athletic identity, psychological distress) and rehabilitation outcomes (e.g., knee joint laxity, one-leg hop, subjective symptoms).

Results for psychological factors were also reported. Significant correlations were found between self-motivation and SIRAS ratings ( $r=.26$ ,  $p<.05$ ) and home exercise completion ( $r=.48$ ,  $p<.005$ ). A significant relationship was found between social support

and home exercise completion ( $r=.22, p<.05$ ). Athletic identity was significantly related to all outcome measures: increased knee joint laxity ( $r=.38, p<.005$ ), one-leg hop ( $r=.26, p<.05$ ), subjective symptoms ( $r=.27, p<.05$ ). Psychological distress was negatively correlated with knee joint laxity ( $r=-.52, p<.005$ ). These findings suggest that antecedents are related to both adherence and outcomes.

Adherence measures were also related to outcome measures. Attendance was significantly related to knee joint laxity ( $r=-.24, p<.05$ ) and one-leg hop ( $r=.25, p<.05$ ). SIRAS ratings were found to be significantly related to one-leg hop ( $r=.27, p<.05$ ). Home exercise completion was not found to be significantly related to any outcome measure. Home cryotherapy completion was significantly negatively related to the one-leg hop ( $r=-.30, p<.05$ ). These findings suggest that behaviors in rehabilitation have a positive relationship with rehabilitation outcomes, while home behaviors have either no relationship or a negative relationship with outcomes.

In this study, it is difficult to determine the effect of psychological distress on the functional outcome of knee joint laxity, the decrease in laxity could be due to increased healing or simply increased muscle tension caused by stress. Further, it is counter-intuitive that home cryotherapy completion was related to a decrease in the functional performance demonstrated by the one-leg hop. These mixed results may be the consequence of inadequate measures of adherence. As is demonstrated by this investigation, the mediating role of adherence between psychological variables and outcome measures has not been adequately examined and the limited research has produced mixed results.

### *Sport Injury Rehabilitation Outcomes*

Brewer et al's Biopsychosocial Model of Sport Injury Rehabilitation (2002) incorporates immediate biopsychological outcomes (e.g., range of motion, strength, joint laxity, pain, endurance, rate of recovery) and overall rehabilitation outcomes (e.g., functional performance, quality of life, treatment satisfaction, readiness to return to sport). It is suggested in this model that adherence precedes these outcomes. However, investigations into rehabilitation outcomes related to rehabilitation adherence have also produced mixed results.

One study included participants (n=108; 72 men, 36 women; age range 14-54, mean age 29.38) who had undergone ACL reconstructive surgery and were receiving accelerated knee rehabilitation services at a physical therapy clinic (Brewer et al., 2004). Adherence measures were collected both at home and in the clinic for the first six weeks of the rehabilitation program. Home exercise program adherence measures included a self-report and hidden counter that recorded the number of times a patient's audiocassette (containing instructions for the home program had been played) that served as an objective report. Clinic-based adherence measures were attendance and SIRAS (completed each visit). Outcome measures were taken before and after surgery. Participants served as their own controls). Outcome measures included: knee laxity (Lachman test), functional ability (one-leg hop for distance), and subjective symptoms (KOS-SAS: Knee Outcomes Survey-Sports Activities Scale).

Results indicate that the SIRAS measure was significantly related to Lachman post-test ( $r=.33$ ,  $p<.005$ ), such that higher SIRAS scores were related to greater knee

laxity. Canonical correlations show that greater attendance and higher SIRAS scores were related to higher levels of Lachman test (greater knee laxity) and KOS-SAS scores. The finding of greater knee laxity is puzzling because it would be expected that rehabilitation would decrease knee joint laxity, and at the very least not increase it. The use of the audiotape at home further compounds the study because the audiotape could be considered an intervention that could influence patients' adherence behaviors.

Sport injury rehabilitation outcomes have been investigated independent of rehabilitation adherence in two studies. In the first study, predictors of recovery time were investigated in elite athletes (n=118; age range 18-44 years; mean age 24.6) who were injured (Quinn & Fallon, 2000). The athlete was considered recovered if they had medical clearance to resume full training and/or competition. Recovery time was estimated by the physician at the beginning of the research. Total recovery range was 4 to 99 weeks.

In addition to demographic information, psychosocial variables were collected at four phases: phase 1 (post-injury evaluation), phase 2 (partial recovery; approximately 1/3 of anticipated recovery time), phase 3 (semirecovery; approximately 2/3 of anticipated recovery time), and phase 4 (full recovery). Psychosocial variables included: injury appraisal (i.e., asking the athlete to estimate how many weeks it would take to reach full recovery), confidence (measured by the State Sport-Confidence Inventory: (Vealey, 1986), emotional response (measured by the Modified Profile of Mood States: (Grove & Prapavessis, 1992), self-efficacy (scale from 0 – 100 on recovery confidence and rehabilitation adherence confidence), self-esteem (measured by the Rosenberg Self-

Esteem Scale: (Rosenberg, 1989), daily hassles (measured by the Daily Hassles Scale: (De Longis, Folkman, & Lazarus, 1988), social support (measured by The Social Support Behaviors Scale, not cited by authors), coping skills (measured by the COPE Inventory: (Carver, Scheier, & Weintraub, 1989), motivation (measured by questions regarding intensity of effort and self-motivation), and cognitive evaluation (measured by answering yes/no if they had worries about returning to their sport, and if so what).

Step-wise multiple regression was conducted with the psychosocial variables thought to be most important predictors of recovery time entered first. Being a team athlete was a significant predictor of recovery time at all four phases. Active coping was a significant predictor of partial recovery. Other predictors of partial recovery were: recovery confidence, not completing rehabilitation, and less social support. Vigor and denial were significant predictors of quicker semirecovery. Previous injury/illness, vigor, confidence and intensity of effort in rehabilitation were significant predictors of faster recovery. These results suggest that psychosocial factors (social support, coping strategy, personality) relate to injury recovery outcomes.

A second study of retrospective design included participants who were at least minimally active and having received physiotherapy (n=32; 14 females, 18 males; age range 14-48, mean age 29.8) (Ievleva & Orlick, 1991). Recovery time for participants ranged from 4 to 20 weeks, with the average recovery time of 9.75 weeks. Participants were ranked by their recovery time (i.e., fastest to slowest), and then divided into three groups based on their ranking: fast (5 weeks or less), average (5 to 12 weeks), and slow (longer than 12 weeks).

Dependent variables were measured by the Sports Injury Survey (developed by the authors) and included the following psychosocial variables: goal setting, positive self-talk, healing imagery, outlook, stress, support, and attitude. Open-ended questions on the survey related to: what helped most, mind over body, level of stress, social support, self-talk, fear of reinjury, goal setting, imagery, and lessons and/or benefits.

Quantitative variables significantly associated with the fastest recovery time were goal setting ( $r = -.864$ ,  $p < .01$ ), and positive self-talk ( $r = -.668$ ,  $p < .01$ ). Fast and Slow-healers also differed significantly on both goal setting and positive self-talk. Qualitative responses indicated that fast healers were likely to take personal responsibility and have control of their healing, have a strong belief in the mind-body connection, have positive self-talk, have less fear of reinjury, have greater use of goal setting, have greater utilization of healing imagery, and have found greater benefits and lessons learned from the injury.

### *Rehabilitation Adherence Interventions*

A handful of studies have implemented psychosocial interventions aimed at enhancing rehabilitation (Bassett & Petrie, 1999; Durso-Cupal, 1998; Scherzer et al., 2001). Cupal's (1998) review provides a nice overview of the research investigating psychosocial interventions and rehabilitation. Thirteen studies were reviewed (sample size range: 1-60, sample size mean: 19.6). Interventions included biofeedback, systematic desensitization, imagery, hypnosis, counseling, relaxation, goal setting, guided imagery, and stress-inoculation training. Seven of the thirteen reviewed studies had control groups.

Eight studies were a quantitative design, three were qualitative, and two were mixed-methods. All studies indicated favorable intervention effects with either objective results (i.e., increased strength, increased ROM) and/or subjective results (e.g., reduced pain, enhanced mood, reduced anxiety).

Since the publication of Cupal's review, several more recent investigations have implemented interventions to enhance rehabilitation adherence and/or outcomes. A goal setting intervention was implemented with 66 physiotherapy patients (Bassett & Petrie, 1999). Participants were divided into three groups: collaborative goal setting with physiotherapist-participant, mandatory physiotherapist goal setting, and no formal goal setting. Results indicate there were no significant differences between groups on overall compliance.

Mental skills have been investigated in relation to rehabilitation adherence (Scherzer et al., 2001). For patients participating in physical therapy following ACL surgery (n=54), the reported use of goal setting was found to be a significant predictor of home exercise completion (beta = .51,  $p < .005$ ) and SIRAS ratings (beta=.35,  $p < .05$ ), but goal setting was not significantly related to home cryotherapy completion or physical therapy attendance. Cryotherapy and attendance was also not predicted by imagery. Positive self-talk was significantly related to completion of prescribed home exercises ( $r = .52$ ,  $p < .05$ ). However, positive self-talk was not significantly related to home cryotherapy completion, SIRAS ratings or attendance. These results suggest goal setting and positive self-talk may be effective interventions to increase home exercise

completion. Increasing home modality completion and attendance at rehabilitation sessions, however, needs further investigation to identify effective interventions.

### Limitations of Existing Research

Adherence has been measured in a variety of ways; however, there are inherent limitations with each of these assessments. How adherence is measured will arguably affect the results. For example, psychosocial variables related to adherence measured by attendance may be different from adherence measured by exercise completion. While attendance is an objective measure, it has been reported to not truly be indicative of adherence because of the tendency for patients to attend the majority of their scheduled rehabilitation sessions (Brewer, 1998). Therefore, attendance does not differentiate levels of adherence. Also, self-report measures have limitations due to inaccuracies of patient recall and patients' tendency to report desired behaviors. In addition, self-reports in the form of a daily log or diary may be considered an intervention in itself (Brewer, 1998); that is, a self-report may be a determinant or influence on adherence.

A measure of adherence should be distinct from both determinants and outcomes. For example, healing rate should be used as an outcome, not as an adherence behavior. The obvious problem with healing as a measure of adherence is that patients may vary in biological issues, psychosocial factors, in injury type, surgery and rehabilitation protocols, all which affect healing rate even if patients have similar adherence. Further, adherence related to outcomes has produced mixed results. Perhaps this finding is due to poor measures of adherence. Adherence measures often overlap with antecedents and

outcomes. Current adherence measures are either not based in concepts and models/definitions of adherence and/or are not designed for clinical relevance in athletic training.

### Summary

While researchers and clinicians agree rehabilitation adherence is required to achieve successful recovery from a sport related injury, this review demonstrates that many questions remain to be answered surrounding the role of rehabilitation adherence and overall recovery outcomes. Indeed, research on the mediation role of adherence between psychological factors and rehabilitation outcomes has produced mixed findings that do not support the mediating role of adherence. Adherence remains to be demonstrated as an integral part of rehabilitation, yet it is likely due to the fact that previous research has not adequately measured adherence. Further, it has yet to be determined if successful rehabilitation outcomes require complete or 100% adherence. One reason for inconsistent results is lack of an adequate measure of rehabilitation adherence. Current measures are varied, and none were developed for use in an athletic training environment.

The current lack of a valid and reliable rehabilitation adherence measurement tool is a noted hindrance in sport injury rehabilitation adherence research and clinical practice in the athletic training setting (Levy et al., 2006). A measure of adherence behaviors for rehabilitation must not only be useful in practice, but must also be conceptually-based and psychometrically-sound. Identifying and measuring the behaviors that comprise sport

injury rehabilitation adherence in a collegiate athletic training setting is vital to the further understanding and investigation of the overall rehabilitation process and successful outcomes.

The most widely used measure, SIRAS, has demonstrated strong psychometric and research validity in community-based sports medicine rehabilitation clinics. However, there are several important differences between community-based clinic rehabilitation and an athletic training room. First, athletes typically have free access to medical care within a collegiate athletic training setting. Second, the athletic training room is generally located on campus, which facilitates athletes' access and ease of use. Because collegiate athletics generally requires a certified athletic trainer to provide medical coverage for practices and/or competitions, the athlete with injury will generally have a pre-existing relationship with the athletic trainer. Student-athletes' experiences are unique from that of a community-based rehabilitation population in several ways: they are concurrently a student, they are part of a team, if there is scholarship money involved they may view their sport as a job, and they may highly identify as an athlete. Development of the SIRAS was based upon previous literature, rather than athlete observation or athletic trainer identification; and, as a result, it may not completely and adequately capture rehabilitation adherence behaviors occurring within a collegiate athletic training environment.

Therefore, the objectives of this project are to: 1) identify indicators of sport injury rehabilitation adherence that reflect the definition and are relevant for collegiate athletic training and 2) develop a preliminary rehabilitation adherence measure for

athletic training (RAdMAT) based on these indicators. Based on the existing literature, it is expected that the major indices of adherence will include attendance, exercise completion and effort. It is also expected that the preliminary measure will be useful for research and relevant for use in an athletic training room.

## CHAPTER III

### METHODS

As stated in the introduction, the long-term goal is to develop a survey measure that adequately assesses behaviors of rehabilitation adherence in a collegiate athletic training setting. While measure development and evaluation is a lengthy process that requires multiple investigations to establish reliability and validity, the objectives of the current investigation are to 1) identify indicators (i.e., behaviors) of sport injury rehabilitation adherence that reflect the definition and are relevant to collegiate athletic training and 2) develop a preliminary rehabilitation adherence measure for athletic training (RAdMAT) based on these indicators. Future investigations will be needed to further establish the measure's psychometric properties and usefulness in research and practice.

The current study included three steps in the development of the rehabilitation adherence in athletic training measure. First, an initial survey of certified athletic trainers provided data to generate items. This first step satisfies the first objective. Second, an expert panel reviewed the preliminary items and provided feedback pertaining to content and clarity of items. Finally in step three, the preliminary measure was administered to a larger sample of certified athletic trainers to provide data for initial reliability and validity analyses. Steps two and three satisfy the second objective.

### Step 1: Item Generation

For the initial step of item generation, certified athletic trainers who were active in clinical practice completed an open-ended online survey to generate a list of rehabilitation adherence behaviors. These rehabilitation behaviors were used to generate the preliminary survey items.

#### *Participants*

As well as using her own contacts, the investigator asked faculty members of the University of North Carolina at Greensboro (UNCG) Exercise and Sport Science Department, who are also active in the athletic training community, for participant recommendations who meet the inclusion criteria. It was important to have practicing athletic trainers identify rehabilitation behaviors in step 1 because the survey is intended for use by practitioners and clinical relevance is of primary importance. Thus, all participants were certified athletic trainers employed full time to work with collegiate athletes and were directly involved in conducting and/or supervising rehabilitation for collegiate athletes in the United States. After compiling a list of potential participants, the investigator intentionally chose contacts in an attempt to include participants who were representative of collegiate certified athletic trainers (i.e., Division I, II, III, NAIA; male/female; sports coverage; area of the country) (Mason, 2002).

### *Measure*

The step 1 survey (see Appendix A) included basic demographic information and provided participants with the definition of rehabilitation adherence used in this investigation (i.e., *The behaviors an athlete demonstrates by pursuing a course of action that coincides with the recommendations of the athletic trainer*). The main items (items 1-7) that were used in step 1 asked participants to define rehabilitation adherence, to list behaviors that indicate rehabilitation adherence and non-adherence, and to list anything else they use to determine if an athlete is adherent or non-adherent. Participants were also asked to think about athletes they have worked with who had good and poor adherence and to list behaviors that indicated their good/poor adherence. The survey also asked participants to list factors (personal, environmental, etc.) that contribute to and detract from rehabilitation adherence; these questions were not intended to generate adherence behaviors, but to help separate antecedents and outcomes from adherence behaviors. Questions were open-ended and room was provided for participant comments. See Figure 1 for Rehabilitation Adherence Questions.

To help determine the degree to which rehabilitation adherence is a problem in athletic training, additional items asked participants if they think poor rehabilitation adherence is a problem, if they have athletes that have poor adherence, and if they have athletes that are over-adherent (do too much, do not comply with activity restrictions, etc.). Responses for these items were on 4-point Likert-type scales with space for participant comments.

**Figure 1.** Rehabilitation Adherence Questions

1. How do you define rehabilitation adherence?
2. List specific behaviors that indicate an athlete is adherent to rehabilitation.
3. List anything else that you use to determine that an athlete is adherent.
4. List specific behaviors that indicate an athlete is non-adherent to rehabilitation.
5. List anything else that you use to determine if an athlete is non-adherent.
6. Think about an athlete that you worked with who had good adherence in rehabilitation. List specific behaviors that indicated good adherence.
7. Think about an athlete you worked with who had poor adherence in rehabilitation. List specific behaviors that indicated poor adherence.

*Procedures*

Following IRB approval, the investigator contacted potential participants via e-mail with a letter explaining the purpose of the study and asking for their participation. (See Appendix B.) The seven athletic trainers who agreed to participate clicked on the online survey link embedded in the recruitment e-mail.

Survey Monkey, an internet-based survey tool, was used to administer surveys and collect responses. In Survey Monkey, participants were again provided with information on the purpose of the study and informed consent was obtained prior to beginning the survey. Participants were asked to complete the survey within one week. After the seven responses were analyzed it was determined that saturation (i.e., the same responses continually appeared and no new responses were given) had been reached and

further responses would likely yield no new information. Therefore, additional participants were not recruited for item generation.

### *Analysis*

Collected responses were independently analyzed by the investigator and a second coder. Following methods for qualitative data analysis described by Mason (2002), the investigator conducted a literal reading of the data to extract content. The investigator identified all key words and phrases to compile a list of adherence behaviors (see Figure 2 in the results section). Items that were clearly not relevant were ignored (e.g., if the item was an antecedent or outcome rather than an adherence behavior). Items that were the same (e.g., “attendance”, “comes to rehabilitation”) were combined. From that list of behaviors, items that were similar or related were grouped into categories. The second coder (a sport psychology doctoral student who is also a certified athletic trainer) independently followed the same procedures. The investigator and second coder then reviewed the results to verify agreement on combined and ignored items and on categories. Discrepancies (e.g., wording such as “timeliness” vs. “punctuality”, “home regimens” vs. “home exercises”, “instructions” vs. “compliance”) were resolved through discussion.

To ensure the list of compiled behaviors reflected what participants had intended, the list was then distributed back to participants via e-mail (see Appendix C). Participants were asked to check for accuracy and provide any further additions within one week. No further additions or revisions were made, and the draft version of the rehabilitation

adherence measure for athletic training was created for Expert Review in Step 2 from these behaviors (see Appendix D). For most of the measure items, participants' wording was directly used. In items where the direct wording was not used, the investigator corrected for grammar and/or clarity.

### Step 2: Expert Review

The compiled behaviors identified from Step 1 were organized into a survey format and sent via e-mail to a different set of experts in the field (i.e., sport injury/rehabilitation researchers, athletic training educators/faculty/staff) for input on item content, clarity and format. Expert ratings were used to revise the draft measure and provide an initial assessment of content validity.

### *Participants*

Similar to step 1, expert reviewers were intentionally recruited to ensure a representative sample. As in step 1, as well as using her own contacts, the investigator asked faculty members of the UNCG Exercise and Sport Science Department, who are also active in the athletic training, sport psychology and/or rehabilitation research communities, for recommendations of whom they considered to be experts in their respective fields. These experts included practicing certified athletic trainers working with collegiate athletes, similar to step 1, because of their clinical expertise. Experts also included non-practicing experts who had expertise in athletic training education, sport psychology and/or rehabilitation research because of their educational and/or research

experience. Collegiate athletic trainers were purposely limited to those in the United States; but due to the narrow specialization of psychology of sport injury, rehabilitation researchers were recruited internationally.

### *Measure*

Experts' basic demographic information (e.g., gender, position, location) was collected (see Appendix D for complete step 2 survey). The instructions included the definition of rehabilitation adherence, and a list of the 49 preliminary items (behaviors of adherence). The experts rated the content (does the behavior accurately measure rehabilitation adherence?) and clarity (is the item clear and understandable?) of each item on a three-point scale (*Yes, Maybe, No*), and were allowed the opportunity to re-word items or make additions and/or clarifications so items better represented adherence.

### *Procedures*

Experts are commonly used as a means of survey review and can provide valuable insight into potential problems with survey items (Van der Zouwen & Smit, 2004). As in step 1, the investigator asked colleagues for names and contact information of experts in the fields of athletic training, sport psychology and/or rehabilitation research. The investigator then contacted experts via e-mail to explain the project and asked them to review the preliminary measure. (See Appendix E.)

Experts were provided with information on the purpose of the study and informed consent was obtained prior to beginning the survey. Experts completed demographic

information, rated items for content and clarity, and were also asked for formatting suggestions. Experts were asked to review the measure within one week. As in step 1, the survey was distributed and data were collected via Survey Monkey.

### *Analysis*

Expert ratings and comments were compiled by the investigator. Items that were not rated as having appropriate content or being clear (e.g., not an observable behavior or confusing wording) by all experts were reviewed by the investigator. Items were revised or deleted based on the ratings and comments of the expert panel. The investigator reviewed the results and revisions with a second reviewer (her advisor, a senior faculty member with experience in development of psychological measures). After agreement on all revisions, the 26 revised items were sent back to the experts, who were asked if items needed further revision (yes, no) to verify accuracy and for additional comments (see Appendix F). The 25-item preliminary Rehabilitation Adherence Measure for Athletic Training (RAdMAT) was created from these final expert revisions.

### Step 3: Athletic Trainer Survey

The 25-item preliminary RAdMAT was sent via e-mail to certified athletic trainers who practiced in the collegiate setting. Certified athletic trainers completed the measure based on athletes they have worked with in rehabilitation over the past year. Specifically, participants were asked to rate the most adherent, least adherent, and a typical athlete they had worked with.

### *Participants*

Eligible participants included 1000 Certified Athletic Trainers who were members of the National Athletic Trainers' Association (NATA) and had given NATA permission to be contacted via e-mail by the NATA National Office. This number was the maximum number of members the National Office would contact. Participants' member type was either 'Regular Certified' or 'Student Certified,' and they were self-identified as working in a "College" or "Junior College" setting in the United States.

### *Measures*

The survey first asked the athletic trainer to provide their own basic demographic information: gender, years as a certified athletic trainer, highest degree obtained, job title, college/university location and NCAA division, and sports coverage responsibility. The participants then completed the preliminary 25-item Rehabilitation Adherence Measure for Athletic Training (RAdMAT) that was developed through steps 1 and 2. Instructions included the definition of rehabilitation adherence, and then participants were asked to consider three athletes (most adherent, least adherent, average) with whom they have worked and who completed rehabilitation in the past year. Respondents were then asked to rate each of those three athletes using the preliminary RAdMAT; each item was on a 4-point scale (1 = never, 4 = always). Possible scores ranged between 25 and 100 with higher scores indicating greater adherence. (See Appendix G.)

In addition to the RAdMAT, the Sport Injury Rehabilitation Adherence Scale (Brewer, Van Raalte, Petitpas et al., 2000) was also administered. Although not a primary

objective of this study, the SIRAS was included in order to provide initial comparisons between the athletic training derived scale (RAdMAT) and one developed for community-based clinics. The SIRAS consists of 3 items that ask the athletic trainer to rate athletes on their 1) intensity of rehabilitation completion, 2) frequency of following practitioner instructions and advice, and 3) receptivity to changes in rehabilitation on a 5-point scale. The three items are summed to obtain a total SIRAS score that ranges between 3 and 15 with higher scores indicating greater adherence.

Similar to step 1, participants were also asked if they think poor rehabilitation adherence is a problem (no problem to major problem), if they have athletes that have poor adherence (never to always), and if they have athletes that are over-adherent (i.e., do too much, do not comply with activity restrictions, etc.) (never to always). Responses for these items (#13-15) were on a 4-point Likert-type scale with space for participant comments.

### *Procedures*

The investigator contacted the NATA and received permission to use the Member Contact service to collect data. NATA members were contacted through this NATA service and were provided a cover letter (as per NATA contact list use agreement) providing a brief overview of the purpose of the study and link to the survey (See Appendix H). E-mails were sent by the NATA National Office to a random sample of 1000 participants who met the participation criteria (Certified, collegiate setting, etc.). Participants were provided with information on the purpose of the study and informed

consent was obtained prior to beginning the survey. On the survey, participants were asked to complete the RAdMAT and the SIRAS three times; that is, they were asked to rate three different athletes' rehabilitation adherence (most adherent athlete, least adherent athlete, average adherent athlete that had completed rehabilitation in the last year) using both measures. (See Appendix I for rehabilitation adherence questions). Athlete order (most adherent and least adherent) was counter-balanced so that half of the participants rated their most adherent first and the other half rated their least adherent first. Survey Monkey was used to distribute surveys and collect responses. A follow-up message was sent two weeks after the initial e-mail from the National Office in an attempt to get additional responses.

### *Analyses*

SPSS v. 16 was the statistical package used for analysis. Means and standard deviations were calculated for all items on both the RAdMAT and SIRAS for each of the three athlete types ("Most adherent", "Least adherent" and "Average adherent"). Internal consistency reliability analyses were run for all initial scale items, and again on items that remained after factor analyses to examine the degree to which items on the scale are alike (Messick, 1989). A within-subjects MANOVA was conducted to compare the three athlete groups (i.e., most adherent, least adherent, average) on the RAdMAT and SIRAS total scores and also on the individual items to determine whether the scale and individual items adequately discriminate among adherence levels. Comparisons and correlations (Pearson's and Spearman's) of RAdMAT scores across the three athletes provides initial

evidence for the measure's construct validity, and concurrent validity was examined through a comparison and correlations of scores on the RAdMAT, RAdMAT subscales and SIRAS. Principal component factor analyses with varimax rotation were used to explore the factor structure of the 25-item RAdMAT and to reduce the number of items for the final RAdMAT. Descriptives, internal consistency reliability analyses and factor analyses were run for the resulting final RAdMAT. Additional principal component factor analyses with varimax rotation were used to explore the factor structure of the final RAdMAT.

## CHAPTER IV

### RESULTS

The objectives of this project were to: 1) identify indicators of sport injury rehabilitation adherence that fit the operational definition of rehabilitation adherence (behaviors an athlete demonstrates by pursuing a course of action that coincides with the recommendations of the athletic trainer) and that are relevant to collegiate athletic training, and 2) develop a preliminary rehabilitation adherence measure for athletic training (RAdMAT) based on these indicators. The current study included three steps involved in developing the preliminary RAdMAT. First, an initial survey of certified athletic trainers provided data to generate items. Second, an expert panel reviewed the preliminary items and provided feedback pertaining to the content and clarity of the items. Finally, in step three, the preliminary RAdMAT and SIRAS were administered to a larger sample of certified athletic trainers to examine psychometric properties and relevance for the athletic training setting. Also, while not a primary objective, general comparisons were made between the RAdMAT and SIRAS. This chapter discusses the results from each step, leading to the RAdMAT.

#### Step 1: Item Generation

Sixteen certified athletic trainers were contacted and seven completed the step 1 survey. After the responses were analyzed it was determined that saturation had been reached and further responses would likely yield no new information. The seven

participants (3 males, 4 females) who completed the step 1 initial survey came from across the country (i.e., CA, FL, MS, TX, WI, WA) and represented all NCAA Divisions as well as NJCAA Division I. All participants were Certified Athletic Trainers, had Master's degrees and had practiced athletic training in the collegiate setting for an average of 11.3 years (range 4-30 years). Two participants were Head Athletic Trainers, four were Assistant Athletic Trainers and one was the Sports Medicine Director. Participants collectively had athletic training coverage responsibilities for nearly all sports and were directly involved in conducting and/or supervising rehabilitation for collegiate athletes.

When the investigator independently analyzed the responses (see Appendix J for Item Generation Responses) from the first step of item generation, responses were classified into three general categories: presence (attendance, etc.), active participation (follows instructions, etc.) and positive attitude (gives 100% effort, etc.). When the second coder independently analyzed the results, responses were classified into eight categories: attendance, timeliness (punctual, etc.), home regimens (home exercises, etc.; the second coder noted this category could be combined with "restrictions/instruction"), effort (trying hard, etc.), attitude (positive attitude, etc.), personal attributes/motivation (enthusiasm, etc.), communication (asked questions, etc.) and restrictions/instructions (follows prescribed plan, etc.). The investigator and second coder then reviewed the results to verify agreement on combined and ignored items, which resulted in three broad categories. Within those three categories include ten subcategories, and these are reflected by the heading and subheadings, respectively, in Figure 2. In regards to item

clarity and appropriateness, the investigator and second coder were in agreement on nearly all item results. Any discrepancies (e.g., wording such as “timeliness” vs. “punctuality”, “home regimens” vs. “home exercises”, “instructions” vs. “compliance”) were resolved through discussion. A list of adherence behaviors, including all categories identified and agreed upon by both coders, was compiled. (See Figure 2.)

Participants made no further modifications when the list of complied behaviors was redistributed for the accuracy check. The 49-item draft version of the rehabilitation adherence measure for athletic training (RAdMAT) was created from these behaviors (see Figure 2). For most items, the participants’ original wording was used, and for items where the actual words were not used, the investigator corrected for grammar and/or clarity.

**Figure 2.** Draft version of the rehabilitation adherence measure for athletic training

The athlete:

PRESENCE

a. Attendance

1. attends rehabilitation regularly
2. attends all rehabilitation sessions

b. Timeliness

3. is punctual to rehabilitation sessions
4. is timely to rehabilitation sessions
5. shows up to rehabilitation on time
6. allows enough time to complete rehabilitation program

ACTIVE PARTICIPATION

a. Follows instructions

7. obeys instructions
  8. follows the athletic trainer's recommendations
  9. follows the prescribed rehabilitation plan
- b. Complies with activity restriction
10. complies with restrictions
  11. limits things they're not supposed to do
- c. Completes exercises in athletic training room
12. completes all tasks assigned by the athletic trainer
  13. completes exercises
  14. completes entire rehabilitation protocol
  15. completes all tasks
  16. correctly performs exercises
  17. consistently performs exercises
  18. complies with directed exercises
- d. Complies with home regimens
19. completes assigned home exercises
  20. completes any "homework" that is assigned
  21. completes home rehabilitation program
  22. completes home modalities
- e. Communicates with athletic trainer
23. has good communication
  24. asks questions
  25. gives suggestions
  26. communicates with the athletic trainer
  27. communicates if there is a problem with the exercises
  28. communicates effectiveness of rehabilitation prescription
  29. provides feedback
  30. knows when to report pain or discomfort

#### POSITIVE ATTITUDE

- a. Positive Attitude

- 31. has a positive outlook
  - 32. has a positive attitude toward rehabilitation
  - 33. has a positive attitude toward the athletic trainer
  - 34. good attitude toward the rehabilitation process
  - 35. is enthusiastic
  - 36. is energetic
  - 37. has positive self-talk
  - 38. is pleasant to work with
- b. Effort
- 39. gives 100% effort
  - 40. demonstrates effort
  - 41. has a strong work ethic
  - 42. takes initiative to help him/herself
  - 43. is an active participant in the rehabilitation process
  - 44. concentrates on exercises
- c. Motivation
- 45. is motivated
  - 46. is prepared for rehabilitation sessions
  - 47. works well on their own
  - 48. is independent
  - 49. shows interest in rehabilitation process

Participant definitions of rehabilitation adherence generally reflect the operational definition of adherence (see Appendix J), as well as provided information on how practicing athletic trainers define adherence. These responses were examined to see if they included any additional behaviors that might be added to the measure. Generally, the definitions referred to similar behaviors, and review of the definitions resulted in no new items.

When asked, “Do you think poor rehabilitation adherence is a problem in sport injury rehabilitation?” (anchors: no problem, minor problem, problem, major problem), one participant reported it was a minor problem (14.3%), four reported it was a problem (57.1%), one reported it was a major problem (14%) and one left the question unanswered. When asked “Do you have athletes that have poor rehabilitation adherence?” (anchors: never, occasionally, often, always), six participants reported occasionally (85.7%) and one left the question unanswered. When asked “Do you have athletes that are over-adherent (e.g., do too much, do not comply with activity restrictions, etc.)?” (anchors: never, occasionally, often, always), six participants reported occasionally (85.7%) and one left the question unanswered. One participant also commented: “I wouldn't classify this as 'over-adherent'. Rather, they just don't adhere to the rehabilitation tasks/program. I consider activity restrictions a part of the whole rehabilitation process.”

## Step 2: Expert Review

Out of 18 potential participants contacted, 12 (6 male, 6 female) reviewed the draft measure. Three participants were faculty/researchers in sport psychology, 3 had dual appointments (i.e., faculty and athletic training), and 6 were practicing athletic trainers. Ten participants were from the United States (GA, MA, MS, NC, OH, OR, UT, WA), one was from the United Kingdom and one was from Australia. Participants in the United States represented all NCAA Divisions. (See Appendix K for expert ratings and comments.)

The investigator and her advisor reviewed expert ratings and revised the measure based on experts' ratings and comments. Based on the ratings and review of the 49 items, 23 items were deleted because they were not consistently rated as clear and accurate or were repetitious of better items. From the remaining items, 14 items were revised based on experts' comments, which resulted in 26 items. (See Figure 3 for measure revisions.)

**Figure 3.** Measure revisions

The athlete:

- ~~1. attends rehabilitation regularly~~
2. attends scheduled ~~all~~ rehabilitation sessions (1)
- ~~3. is punctual to rehabilitation sessions~~
- ~~4. is timely to rehabilitation sessions~~
5. shows up to rehabilitation on time (2)
- ~~6. allows enough time to complete rehabilitation program~~
- ~~7. obeys instructions~~
8. follows the athletic trainer's instructions ~~recommendations~~ (3)
9. follows the prescribed rehabilitation plan (4)
10. complies with restrictions (5)
- ~~11. limits things they're not supposed to do~~
12. completes all tasks assigned by the athletic trainer (6)
13. completes exercises correctly (7)
- ~~14. completes entire rehabilitation protocol~~
- ~~15. completes all tasks~~
- ~~16. correctly performs exercises~~
- ~~17. consistently performs exercises~~
- ~~18. complies with directed exercises~~
19. completes assigned home exercises (8)
- ~~20. completes any "homework" that is assigned~~
21. completes home rehabilitation program (9)
- ~~22. completes home modalities~~
23. has good communication with the athletic trainer (10)
24. asks questions about his/her rehabilitation (11)

- ~~25. gives suggestions~~
- ~~26. communicates with the athletic trainer~~
- 27. communicates if there is a problem with the exercises (12)
- ~~28. communicates effectiveness of rehabilitation prescription~~
- 29. provides feedback about the rehabilitation program (13)
- 30. ~~knows when to~~ reports pain or discomfort when appropriate (14)
- 31. has a positive outlook (15)
- 32. has a positive attitude ~~toward rehabilitation~~ during rehabilitation sessions (16)
- ~~33. has a positive attitude toward the athletic trainer~~
- 34. has a positive ~~good~~ attitude toward the rehabilitation process (17)
- ~~35. is enthusiastic~~
- ~~36. is energetic~~
- ~~37. has positive self talk~~
- 38. is ~~pleasant~~ easy to work with in rehabilitation (18)
- 39. gives 100% effort in rehabilitation sessions (19)
- ~~40. demonstrates effort~~
- ~~41. has a strong work ethic~~
- 42. takes initiative ~~to help him/herself~~ in rehabilitation (20)
- 43. is an active participant in the rehabilitation process (21)
- 44. ~~concentrates on~~ stays focused while doing rehabilitation exercises (22)
- 45. is motivated to complete rehabilitation (23)
- 46. is prepared for rehabilitation sessions (24)
- 47. works well on ~~their~~ his/her own during rehabilitation sessions (25)
- ~~48. is independent~~
- 49. shows interest in the rehabilitation process (26)

Note. Deleted items are lined out; wording revisions are underlined; and new item numbers are indicated in parentheses.

From the 26 items, three additional revisions were made based on the second expert review of the modified items (question 2 was changed from “shows up” to “arrives”, question 12 added communicates “with athletic trainer”, question 15 “has a positive outlook” was deleted). This resulted in the 25-item preliminary RAdMAT (See

Figure 4). The Preliminary RAdMAT consisted of three categories and 10 subcategories as described in step 1, and among the 25 items, two items related to attendance (items 1 and 2), 12 items related to active participation (items 3-14) and 11 items related to positive attitude/effort (items 15-25).

**Figure 4.** Preliminary RAdMAT – 25 item

The following is a measure of athlete rehabilitation adherence. Rehabilitation adherence is defined as *the behaviors an athlete demonstrates by pursuing a course of action that coincides with the recommendations of the athletic trainer.*

Please rate the athlete on each item using the scale: 1=never, 2=occasionally, 3=often, 4=always.

The athlete:

1. attends scheduled rehabilitation sessions.
2. arrives at rehabilitation on time.
3. follows the athletic trainer's instructions during rehabilitation sessions.
4. follows the prescribed rehabilitation plan.
5. complies with physical activity restrictions.
6. completes all tasks assigned by the athletic trainer.
7. completes exercises correctly in rehabilitation sessions.
8. completes assigned home exercises.
9. completes home rehabilitation modalities (i.e., ice, heat, etc.).
10. communicates well with the athletic trainer.
11. asks questions about his/her rehabilitation.
12. communicates with the athletic trainer if there is a problem with the exercises.
13. provides the athletic trainer feedback about the rehabilitation program.
14. reports pain or discomfort when appropriate.
15. has a positive attitude during rehabilitation sessions.
16. has a positive attitude toward the rehabilitation process.
17. is easy to work with in rehabilitation.
18. gives 100% effort in rehabilitation sessions.
19. is self-motivated in rehabilitation sessions.

20. is an active participant in the rehabilitation process.
21. stays focused while doing rehabilitation exercises.
22. is motivated to complete rehabilitation.
23. is prepared for rehabilitation sessions.
24. works well on his/her own during rehabilitation sessions.
25. shows interest in the rehabilitation process.

### Step 3: Athletic Trainer Survey

Of the 1000 e-mails that were sent from the NATA National Office, 46 e-mails were not delivered because of members' invalid e-mail address or problem with their server. Of the remaining 954 valid emails, 198 potential participants started the online survey and 164 of those participants completed the survey for the "most adherent athlete". Among the 164 participants (79 male, 85 female), 45 were Head Athletic Trainers, 81 were Assistant Athletic Trainers, 18 were Athletic Trainers, 5 were ATEP Directors, 1 was an ATEP Clinical Coordinator, 13 were Faculty and 1 did not report job title. Twenty participants reported their highest academic degree as a Bachelor's, 134 reported a Master's and 10 reported a Doctoral degree. Participants had been certified for an average of 10.4 years (range 1 to 38 years) and had worked in the collegiate setting for an average of 9.3 years (range 1 to 41 years). All NCAA Athletics Divisions as well as NJCAA and Club Sports were represented. All NCAA sports were represented as well as rugby, crew, cheerleading, dance, equestrian, rodeo, squash, judo, badminton, synchronized swimming and skating.

### *Data Reduction*

RAdMAT item descriptives, scales' internal consistencies and factor analyses were calculated from the raw data. For the RAdMAT scale totals, missing items for the RAdMAT were replaced with the series mean if no more than two items were missing on a scale, therefore scale totals were calculated on 164 participants for the Most adherent athlete data, 159 participants for the Least adherent athlete data, and 145 participants for the Average adherent athlete data.

Specifically, of the 164 participants, 23 participants had one missing item for the RAdMAT (Most adherent), 4 participants had 2 missing items for the RAdMAT (Most adherent) and one participant was missing one item for the SIRAS (Most adherent). Of the 164 participants, 26 participants had one missing item for the RAdMAT (Least adherent), 9 participants had 2 missing items for the RAdMAT (Least adherent), 2 participants had 3 items missing from the RAdMAT (Least adherent), 3 participants had missing data for all items of the RAdMAT (Least adherent) and one participant was missing one item for the SIRAS (Least adherent). Of the 164 participants, 15 participants had one missing item for the RAdMAT (Average adherent), 2 participants were missing 2 items for the RAdMAT (Average adherent), 19 participants had missing data for all items of the RAdMAT (Average adherent) and 2 participants were missing one item for the SIRAS (Average adherent).

*Item and Scale Descriptives*

Descriptives for the RAdMAT (25 item) and SIRAS were calculated for the “Most adherent”, “Least adherent” and “Average adherent” athlete with the raw data for items (see Table 1) and again with the series mean replaced data for the totals (see Table 2). Means for all scale items and totals fall as expected; the most adherent athlete data have the highest means, the least adherent athlete data have the lowest means and the average adherent athlete data falls between the most and least adherent athlete data.

**Table 1.** Item descriptives for the RAdMAT and SIRAS Items

	<b>Most Adherent</b>		<b>Average Adherent</b>		<b>Least Adherent</b>	
	Mean	SD	Mean	SD	Mean	SD
<b>RAdMAT 1</b>	3.83	.377	2.98	.546	2.07	.503
<b>RAdMAT 2</b>	3.59	.506	2.85	.593	2.02	.702
<b>RAdMAT 3</b>	3.84	.366	3.25	.607	2.60	.801
<b>RAdMAT 4</b>	3.76	.428	3.17	.658	2.27	.680
<b>RAdMAT 5</b>	3.41	.598	2.91	.676	2.16	.836
<b>RAdMAT 6</b>	3.77	.425	3.14	.573	2.21	.732
<b>RAdMAT 7</b>	3.67	.472	3.18	.597	2.66	.767
<b>RAdMAT 8</b>	3.23	.654	2.48	.648	1.55	.614
<b>RAdMAT 9</b>	3.24	.659	2.56	.657	1.70	.612
<b>RAdMAT 10</b>	3.71	.481	3.01	.618	1.97	.674
<b>RAdMAT 11</b>	3.44	.703	2.81	.720	2.06	.847
<b>RAdMAT 12</b>	3.58	.565	3.00	.729	2.15	.876
<b>RAdMAT 13</b>	3.45	.640	2.84	.663	2.01	.740
<b>RAdMAT 14</b>	3.45	.640	3.00	.679	2.47	.913
<b>RAdMAT 15</b>	3.53	.570	2.89	.593	1.99	.698
<b>RAdMAT 16</b>	3.48	.570	2.83	.607	1.84	.603
<b>RAdMAT 17</b>	3.73	.471	3.10	.632	2.07	.763
<b>RAdMAT 18</b>	3.63	.532	2.97	.654	2.01	.779
<b>RAdMAT 19</b>	3.63	.599	2.83	.701	1.71	.619
<b>RAdMAT 20</b>	3.71	.480	2.94	.684	1.91	.605

<b>RAdMAT 21</b>	3.45	.547	2.76	.640	1.97	.629
<b>RAdMAT 22</b>	3.71	.494	2.96	.718	1.95	.646
<b>RAdMAT 23</b>	3.63	.522	2.94	.617	2.06	.696
<b>RAdMAT 24</b>	3.65	.540	2.83	.690	1.83	.757
<b>RAdMAT 25</b>	3.60	.550	2.84	.613	1.86	.615
<b>SIRAS 1</b>	4.48	.570	3.66	.689	2.58	.919
<b>SIRAS 2</b>	4.65	.540	3.85	.715	2.63	.842
<b>SIRAS 3</b>	4.68	.606	3.99	.754	2.86	1.00

**Table 2.** Scale descriptives for the RAdMAT (25 items) and SIRAS totals

	<b>Mean</b>	<b>Minimum</b>	<b>Maximum</b>	<b>Std. Deviation</b>
<b>RAdMAT - Most Adherent</b>	89.72	60	100	8.04
<b>RAdMAT - Average Adherent</b>	73.03	49	96	10.35
<b>RAdMAT - Least Adherent</b>	51.10	25	81	10.83
<b>SIRAS - Most Adherent</b>	13.80	9	15	1.28
<b>SIRAS - Average Adherent</b>	11.48	6	15	1.84
<b>SIRAS - Least Adherent</b>	8.08	3	13	2.30

Note: The RAdMAT range is 25-100; the SIRAS range is 3-15.

Internal consistency analyses were run for the RAdMAT and SIRAS for the Most, Least and Average adherent data using the raw data. The 25-item RAdMAT demonstrated high internal consistency for the most, average and least adherent athlete data (Cronbach's  $\alpha = .927, .944$  and  $.926$ , respectively). The 3-item SIRAS demonstrated moderate internal consistency for the most, average and least adherent athlete data (Cronbach's  $\alpha = .591, .861, .771$ , respectively).

The relationship between adherence level (most, average, least) and the 25-item RAdMAT total was positive, significant and of moderately high strength (Pearson's

$r=.853$ ,  $p<.01$ ; Spearman's  $r_s=.860$ ,  $p<.01$ ,  $n=468$ ). The relationship between adherence level and the SIRAS total was also positive, significant and of moderately high strength (Pearson's  $r=.790$ ,  $p<.01$ ; Spearman's  $r_s=.812$ ,  $p<.01$ ,  $n=492$ ). Correlations between the RAdMAT total and SIRAS total for the most, least and average adherent athlete data were all significant, positive and of moderately high strength. The strongest correlation was found between the scales for the least adherent athlete data (Pearson's  $r=.748$ ,  $p<.01$ ). The correlations between the average and most adherent athlete scales were 0.669 and 0.624, respectively. The relationship between the RAdMAT totals for all athlete data and SIRAS totals for all athlete data was significant, positive and of high strength (Pearson's  $r=.904$ ,  $p<.01$ ; Spearman's  $r_s=.904$ ,  $p<.01$ ,  $n=468$ ).

#### *Comparisons of Most, Least and Average Adherent Athlete Data*

All RAdMAT items clearly differentiate the 3 adherence levels; the univariate F-value for the adherence effect was statistically significant ( $p<.001$ ) for all 25 items with all F-values over 87; follow-up simple contrasts were also all significant ( $p<.001$ ) with all F-values over 55 (See Appendix L). The univariate F-value for the adherence effect was also statistically significant ( $p<.001$ ) for the SIRAS: Item 1  $F(2, 326) = 322.89$ ,  $\eta^2 = .570$ ; Item 2  $F(2, 326) = 461.25$ ,  $\eta^2 = .540$ ; Item 3  $F(2, 326) = 282.57$ ,  $\eta^2 = .606$ .

Within-subjects MANOVAs were conducted to compare the three athlete groups (i.e., most adherent, least adherent, average) on the RAdMAT total scores, RAdMAT items and SIRAS total scores to determine whether the scale and individual items adequately discriminate among adherence levels. First, the within-subjects MANOVA

comparing the RAdMAT total scores for the most, least and average athlete revealed strong adherence level differences,  $F(2, 328) = 766.89, p < .001, \eta^2 = .824$ . Follow up simple contrasts showed that all 3 levels differed significantly from each other. Contrasts comparing level 1 (most) v 3 (average) and 2 (least) v 3 (average) revealed strong effects:  $F(1, 164) = 1264.80, p < .001, \eta^2 = .885$  and  $F(1, 164) = 489.75, p < .001, \eta^2 = .749$ , respectively. MANOVA comparing the three SIRAS scores also revealed significant differences across adherence levels,  $F(2, 328) = 23.10, p < .001, \eta^2 = .124$ , and the contrasts comparing levels 1 v 3,  $F(1, 164) = 45.32, p < .001, \eta^2 = .217$ , and 2 v 3,  $F(1, 164) = 9.09, p < .003, \eta^2 = .053$ , were statistically significant. However, as the eta-square values indicate, differences on the SIRAS scores were not as strong as differences on the RAdMAT scores. Separate within-subjects ANOVAs were conducted for each of the RAdMAT items to examine item discrimination. As the resulting F values listed in Appendix L indicate, all RAdMAT items significantly discriminated among the three adherence levels. Also, follow-up simple contrasts revealed that all three levels differed significantly for each item.

#### *Factor Structure of the RAdMAT*

Principal component factor analyses with varimax rotation was used to explore the factor structure of the “Most adherent” athlete raw data. First, the factor analysis was allowed to run with unlimited factors, which yielded a 6-factor solution. (See Table 3 for rotated component matrices, and Figure 5 for scree plot.) Additional exploratory factor

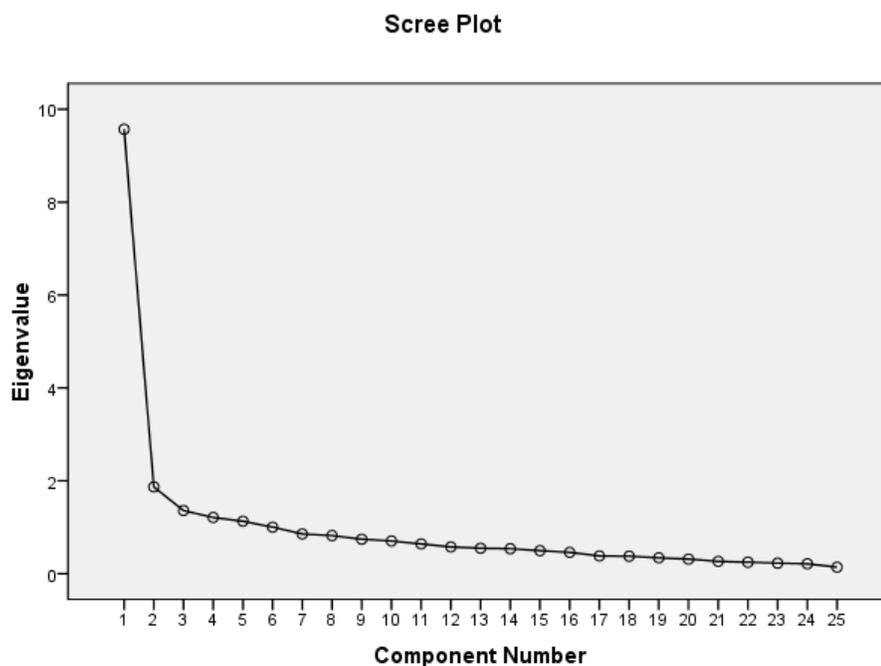
analyses were also run for the “Least adherent” and “Average adherent” athlete data and are similar to the “Most adherent” factor structure (see Appendix M).

**Table 3.** Rotated component matrix – unlimited factors

Items	Components					
	1	2	3	4	5	6
1. attends scheduled rehabilitation sessions.	.433	<u>.622</u>	.044	.111	-.030	-.066
2. arrives at rehabilitation on time.	<u>.537</u>	.360	.172	-.218	.120	.166
3. follows the athletic trainer’s instructions during rehabilitation sessions.	.337	<u>.593</u>	.060	.094	.267	.013
4. follows the prescribed rehabilitation plan.	-.044	<u>.815</u>	.074	.125	.199	.155
5. complies with physical activity restrictions.	.116	.367	.308	-.095	.477	.242
6. completes all tasks assigned by the athletic trainer.	.197	<u>.677</u>	.139	.092	.047	.284
7. completes exercises correctly in rehabilitation sessions.	.280	.286	.097	.145	<u>.650</u>	-.050
8. completes assigned home exercises.	.265	.124	.183	.126	.199	<u>.779</u>
9. completes home rehabilitation modalities (i.e., ice, heat, etc.).	.147	.268	.180	.107	.062	<u>.788</u>
10. communicates well with the athletic trainer.	.382	.186	.485	.388	-.103	.086
11. asks questions about his/her rehabilitation.	.231	-.087	-.024	<u>.768</u>	.106	-.018
12. communicates with the athletic trainer if there is a problem with the exercises.	.105	.162	.264	<u>.733</u>	.276	.068
13. provides the athletic trainer feedback about the rehabilitation program.	-.013	.299	.200	<u>.695</u>	.036	.252
14. reports pain or discomfort when appropriate.	-.044	-.068	.242	.350	<u>.655</u>	.202
15. has a positive attitude during rehabilitation sessions.	.277	.096	<u>.788</u>	.149	.248	.146
16. has a positive attitude toward the rehabilitation process.	.118	.098	<u>.834</u>	.151	.284	.115
17. is easy to work with in rehabilitation.	.363	.361	.395	.111	.212	.218
18. gives 100% effort in rehabilitation sessions.	<u>.622</u>	.159	.294	.163	.380	.069

19. is self-motivated in rehabilitation sessions.	<u>.615</u>	.250	.187	.143	.217	.236
20. is an active participant in the rehabilitation process.	<u>.504</u>	.278	.291	.358	.130	.188
21. stays focused while doing rehabilitation exercises.	<u>.562</u>	-.061	-.126	.106	.296	.477
22. is motivated to complete rehabilitation.	<u>.584</u>	.260	.290	.373	-.056	.194
23. is prepared for rehabilitation sessions.	.334	.473	.286	.041	.300	.171
24. works well on his/her own during rehabilitation sessions.	.270	.248	.171	.048	<u>.581</u>	.209
25. shows interest in the rehabilitation process.	<u>.545</u>	.191	.413	.270	.151	.177
<b>Initial Eigenvalues</b>	9.57	1.87	1.36	1.21	1.13	1.00
<b>% of Variance</b>	38.28	7.47	5.43	4.83	4.52	4.00
<b>Cumulative % Variance</b>	38.28	45.75	51.18	56.02	60.54	64.54

**Figure 5.** Scree plot



Based on the scree plot and percentage of variance explained, it is likely that a 2-factor or 3-factor solution will fit the data, and also fit with the conceptual model of steps 1 and 2. Factor 1 in the 6-factor solution includes attendance and several of the attitude/effort items, while factor 2 includes attendance and several participation items. Factors 3 and 4 include a few items related to attitude and communication. The three items loading on factor 5 (completes exercises correctly, reports pain, works well on own) do not reflect a particular category, do not load on any other stronger factors, and, as a result, may not be necessary. The two items related to home-based exercise loaded on factor 6, which accounted for little variance. Also, home-based exercise is not easily observed or evaluated by athletic trainers, and these items have limited clinical use. Thus, items loading on only factors 5 (#7, #14, #24) and 6 (# 8, #9) can be dropped from the RADMAT. Also, items that did not load over .50 on any factor (# 5, 10, 23) do not seem to add any useful information and can also be dropped.

To further explore the factor structure additional principal component factor analyses were used with the “Most adherent” athlete data and forced into 3-factor, 2-factor and 1-factor solutions (see Appendix N for all factor loadings and results with these analyses). Generally, the structure results were similar to the 6-factor solution, suggesting three factors, with items suggested as being dropped with the 6-factor solution still not providing additional information. Thus, those items (5, 7, 8, 9, 10, 14, 17, 23, 24) were dropped and the remaining 16 items run in a factor analysis (resulting in a 3-factor solution), and also forced into 2-factor and 1-factor solutions (see Appendix O for all factor loadings and results for the 2-factor).

A 3-factor solution for the 16 items, that explains 57.93% of the variance, seems to be the best fit with factor 1 containing attitude/effort items (15, 16, 18-22, 25), factor 2 containing attendance/participation items (1-4, 6) and factor 3 containing communication items (11-13) (see table 4). A forced 1-factor solution (see table 5) shows that all items strongly load on a single factor. The suggested 3-factor and 1-factor solutions also fit well for the least and average athlete data (see Appendix P).

**Table 4.** Rotated component matrix – Unlimited-factor for 16 items

Items	Components		
	1	2	3
1. attends scheduled rehabilitation sessions.	.140	<u>.708</u>	.104
2. arrives at rehabilitation on time.	.452	<u>.494</u>	-.129
3. follows the athletic trainer's instructions during rehabilitation sessions.	.325	<u>.649</u>	.019
4. follows the prescribed rehabilitation plan.	.070	<u>.729</u>	.178
6. completes all tasks assigned by the athletic trainer.	.181	<u>.747</u>	.127
11. asks questions about his/her rehabilitation.	.136	-.020	<u>.747</u>
12. communicates with the athletic trainer if there is a problem with the exercises.	.308	.127	<u>.792</u>
13. provides the athletic trainer feedback about the rehabilitation program.	.131	.221	<u>.786</u>
15. has a positive attitude during rehabilitation sessions.	<u>.792</u>	.077	.266
16. has a positive attitude toward the rehabilitation process.	<u>.692</u>	.011	.336
18. gives 100% effort in rehabilitation sessions.	<u>.712</u>	.323	.100

19. is self-motivated in rehabilitation sessions.	<u>.640</u>	.400	.095
20. is an active participant in the rehabilitation process.	<u>.580</u>	.378	.315
21. stays focused while doing rehabilitation exercises.	<u>.604</u>	.106	.030
22. is motivated to complete rehabilitation.	<u>.575</u>	.353	.313
25. shows interest in the rehabilitation process.	<u>.586</u>	.291	.376
<b>Initial Eigenvalues</b>	6.36	1.71	1.20
<b>% of Variance</b>	39.72	10.71	7.50
<b>Cumulative % Variance</b>	39.72	50.44	57.93

**Table 5.** Component matrix – Forced 1-factor for 16 items

Items	Component
	1
1. attends scheduled rehabilitation sessions.	.529
2. arrives at rehabilitation on time.	.539
3. follows the athletic trainer's instructions during rehabilitation sessions.	.595
4. follows the prescribed rehabilitation plan.	.523
6. completes all tasks assigned by the athletic trainer.	.590
11. asks questions about his/her rehabilitation.	.407
12. communicates with the athletic trainer if there is a problem with the exercises.	.630
13. provides the athletic trainer feedback about the rehabilitation program.	.551
15. has a positive attitude during rehabilitation sessions.	.728
16. has a positive attitude toward the rehabilitation process.	.650
18. gives 100% effort in rehabilitation sessions.	.733

19. is self-motivated in rehabilitation sessions.	.720
20. is an active participant in the rehabilitation process.	.760
21. stays focused while doing rehabilitation exercises.	.507
22. is motivated to complete rehabilitation.	.741
25. shows interest in the rehabilitation process.	.742
<b>Initial Eigenvalue</b>	6.356
<b>% of Variance</b>	39.72

### *Suggested Structure and Items for RAdMAT*

Based on initial evidence from the current study, the investigator suggests 16-items for the final RAdMAT (shown in Figure 6). The scale has three subscales and could also be used as a single factor representative of adherence. The Attendance/Participation subscale items are #1-5. The Communication subscale items are #6-8. The Attitude/Effort subscale items are #9-16. Subscale and total scale totals and internal consistencies for the most, average and least adherent athlete data are acceptable for the suggested 16-item measure. (see table 6 for scale descriptives).

Within-subjects MANOVAs comparing the total scores for the most, least and average athlete data discriminate among adherence levels:  $F(2, 163) = 614.77, p < .001, \eta^2 = .790$ . Follow-up simple contrasts comparing level 1 (most) v 3 (average) and 2 (least) v 3 (average) showed that all 3 levels differed significantly from each other:  $F(1, 163) = 173.72, p < .001, \eta^2 = .516$  and  $F(1, 163) = 392.18, p < .001, \eta^2 = .755$ , respectively.

Further, within-subjects MANOVA comparing the subscale scores for the most, least and average athlete data also discriminate among adherence levels: Multivariate  $F(6, 158) = 211.19, p < .001, \eta^2 = .889$ . Univariate tests were significant for all three

subscales; Attendance,  $F(2,326) = 645.73, p < .001, \eta^2 = .798$ ; Communication,  $F(2,326) = 299.07, p < .001, \eta^2 = .647$ ; Attitude,  $F(2,326) = 395.22, p < .001, \eta^2 = .708$ . Follow-up simple contrasts also showed that all 3 levels differed significantly from each other. For the attendance/participation subscale, contrasts comparing level 1 (most) v 3 (average) and 2 (least) v 3 (average) revealed strong effects:  $F(1, 163) = 370.75, p < .001, \eta^2 = .695$  and  $F(1, 163) = 392.18, p < .001, \eta^2 = .706$ , respectively. For the communication subscale, contrasts comparing level 1 v 3 and 2 v 3 revealed moderate effects:  $F(1, 163) = 139.91, p < .001, \eta^2 = .462$  and  $F(1, 163) = 194.18, p < .001, \eta^2 = .544$ , respectively. For the attitude/effort subscale, contrasts comparing level 1 v 3 and 2 v 3 revealed weak and strong effects:  $F(1, 163) = 36.82, p < .001, \eta^2 = .184$  and  $F(1, 163) = 400.24, p < .001, \eta^2 = .711$ , respectively.

Relationships between adherence level (most, average, least) and the 16-item RAdMAT total and subscales were all positive, significant and of moderately high strength. The relationship between the 16-item RAdMAT total and SIRAS total was significant, positive and of high strength. Relationships between the RAdMAT subscales and SIRAS total were also all significant, positive and of moderately high strength. (See Appendix Q.)

**Figure 6.** Suggested changes on the 25-item scale to produce a final 16-item RAdMAT

The athlete:

1. attends scheduled rehabilitation sessions. (1)
2. arrives at rehabilitation on time. (2)
3. follows the athletic trainer's instructions during rehabilitation sessions. (3)
4. follows the prescribed rehabilitation plan. (4)

- ~~5. complies with physical activity restrictions.~~
6. completes all tasks assigned by the athletic trainer. (5)
- ~~7. completes exercises correctly in rehabilitation sessions.~~
- ~~8. completes assigned home exercises.~~
- ~~9. completes home rehabilitation modalities (i.e., ice, heat, etc.).~~
- ~~10. communicates well with the athletic trainer.~~
11. asks questions about his/her rehabilitation. (6)
12. communicates with the athletic trainer if there is a problem with the exercises. (7)
13. provides the athletic trainer feedback about the rehabilitation program. (8)
- ~~14. reports pain or discomfort when appropriate.~~
15. has a positive attitude during rehabilitation sessions. (9)
16. has a positive attitude toward the rehabilitation process. (10)
- ~~17. is easy to work with in rehabilitation.~~
18. gives 100% effort in rehabilitation sessions. (11)
19. is self-motivated in rehabilitation sessions. (12)
20. is an active participant in the rehabilitation process. (13)
21. stays focused while doing rehabilitation exercises. (14)
22. is motivated to complete rehabilitation. (15)
- ~~23. is prepared for rehabilitation sessions.~~
- ~~24. works well on his/her own during rehabilitation sessions.~~
25. shows interest in the rehabilitation process. (16)

Note. Suggested items to be deleted are lined out; new item numbers are indicated in parentheses.

**Table 6.** Scale and subscale descriptives for the RAdMAT (16 items)

	Mean	Min	Max	SD	Cronbach's Alpha
<b>Attendance – Most Adherent</b>	18.79	14	20	1.52	.767
<b>Attendance – Average Adherent</b>	15.38	9	20	2.01	.764
<b>Attendance – Least Adherent</b>	11.17	5	18	2.61	.824
<b>Communication – Most Adherent</b>	10.47	6	12	1.57	.759
<b>Communication – Average Adherent</b>	8.65	4	12	1.67	.796

<b>Communication – Least Adherent</b>	6.22	3	11	1.97	.748
<b>Attitude – Most Adherent</b>	25.03	15	28	2.80	.872
<b>Attitude – Average Adherent</b>	22.99	14	32	3.80	.910
<b>Attitude – Least Adherent</b>	15.24	8	27	3.80	.884
<b>Total – Most Adherent</b>	54.28	37	60	4.85	.890
<b>Total – Average Adherent</b>	47.03	32	63	6.45	.919
<b>Total – Least Adherent</b>	32.63	16	50	7.00	.901

Note: The Attendance/Participation subscale range is 4-20. The Communication subscale range is 3-12. The Attitude/Effort subscale range is 8-32. The total scale range is 16-64.

### *Additional Results*

In addition to completing the RAdMAT and SIRAS based on their athletes, participants were also asked “Do you think poor rehabilitation adherence is a problem in sport injury rehabilitation?” (no problem to major problem). Participants reported it was: no problem (n=1, 0.7%) minor problem (n=44, 29.1%), problem (n=74, 49%), major problem (n=32, 21.2%), unanswered (n=14). When asked “Do you have athletes that have poor rehabilitation adherence?” (never to always), participants reported: never (n=2, 1.3%), occasionally (n=106, 70.2%), often (n=37, 24.5%), always (n=6, 4%), unanswered (n=14). When asked “Do you have athletes that are over-adherent (do too much, do not comply with activity restrictions, etc.)?” (never to always), participants reported: never (n=2, 1.3%), occasionally (n=108, 72%), often (n=38, 25.3%), always (n=2, 1.3%) unanswered (n=15). (See Appendix R for participant comments to these three questions.) These results, like those with the small sample in step 1, suggest that adherence is indeed an issue for athletic trainers. Nearly all reported that poor adherence was at least occasionally an issue, with about 25% reporting often encountering poor adherence.

## Results Summary

Most athletic trainers endorse rehabilitation adherence as a problem in sport injury rehabilitation adherence and have poor rehabilitation adherence. The initial item generation in step 1 yielded a list of 49 behaviors reflecting athlete rehabilitation adherence. Expert panel review in step 2 resulted in some revisions and reduced the preliminary RAdMAT to 25 items, and these items fall under the general categories of attendance, active participation/communication, and positive attitude/effort. The athletic trainer survey in step 3 demonstrated the preliminary 25-item RAdMAT had good internal consistency but further factor analyses reduced the measure to 16 items and suggested three sub-scales (attendance/participation, communication, attitude/effort). The resulting RAdMAT subscales and total all have good internal consistency and clearly discriminate among adherence levels. All individual items have good item-total correlations and contribute to internal consistency of their respective subscales and the total and all items discriminate among adherence levels. Furthermore, the internal consistency and discrimination results for the RAdMAT are at least equivalent to those obtained with the SIRAS.

## CHAPTER V

### DISCUSSION

Poor rehabilitation adherence is recognized as a problem in the athletic training setting. Nearly all athletic trainers in the current investigation reported that poor rehabilitation adherence was an issue at least occasionally and about 25% reported they often encounter poor rehabilitation adherence. The current lack of a valid and reliable rehabilitation adherence measurement tool specific to athletic training is a noted hindrance in sport injury rehabilitation adherence research and clinical practice in the athletic training setting (Levy, Polman, Clough, & McNaughton, 2006). A measure of adherence behaviors for rehabilitation must not only be useful in practice, but must also be conceptually-based and psychometrically-sound. Identifying and measuring the behaviors that comprise sport injury rehabilitation adherence in a collegiate athletic training setting is vital to the further understanding and investigation of the overall rehabilitation process and successful outcomes in this setting.

Therefore, the objectives of this project were to: 1) to identify indicators of sport injury rehabilitation adherence that reflect the operational definition of rehabilitation adherence (behaviors an athlete demonstrates by pursuing a course of action that coincides with the recommendations of the athletic trainer) and are relevant to a collegiate athletic training setting, and 2) to develop a preliminary rehabilitation adherence measure for athletic training (RAdMAT) based on these indicators. Findings relative to each of these objectives as well as a general interpretation will be discussed.

## Objective 1

To identify indicators (i.e., behaviors) of sport injury rehabilitation adherence in the athletic training setting, certified athletic trainers who were currently practicing in the collegiate athletic training setting provided data to generate items in step one. Based on the participating athletic trainers' open-ended responses, the investigator and second coder identified 49 adherence behaviors that served as the base for the preliminary RAdMAT measure.

### *Expected Outcome 1.*

The first expected outcome of this investigation was that rehabilitation adherence indicators generated by athletic trainers would be relevant to the athletic training setting and reflect the operational definition of rehabilitation adherence. Further, these indicators would include, but not be limited to, attendance and exercise completion. As demonstrated with the results of step one, the first expectation was met. Responses were generally consistent with previous literature on rehabilitation adherence with items relating to attendance, following instructions and completing exercises (Bassett & Prapavessis, 2007; Brewer et al., 2003; Brewer et al., 2000; Scherzer et al, 2001; Taylor & May, 1996). The current investigation is unique, however, because previous literature has not captured these behaviors in an athletic training setting. Because of this, several responses were novel and add to our understanding of rehabilitation adherence behaviors in the athletic training setting.

Novel responses include timeliness (i.e., punctual to rehabilitation sessions) and communication. Previous literature has used attendance as a measure of rehabilitation adherence (Bassett & Prapavessis, 2007; Byerly et al., 1994; Brewer et al., 2003; Brewer et al., 2000, Scherzer et al., 2001; Udry, 1997), but has not included timeliness. As is demonstrated with the athletic trainers' responses, timeliness is an important behavior in judging rehabilitation adherence and is clearly different from attendance. Two previous studies have addressed communication in the athletic training room as an important factor for rehabilitation adherence (Fisher & Hoisington, 1993; Fisher et al., 1993), but previous literature has not identified communication as a rehabilitation adherence behavior. As discussed later, it is yet to be determined if communication is an adherence behavior that can be easily rated by athletic trainers. Further, communication is an exchange between two or more people (in this case the athletic trainer and athlete) and may be highly dependent on the communication skills of each party involved in that exchange.

While most of the responses were behaviors and were clearly indicative of athlete adherence (e.g., attends rehabilitation sessions, completes rehabilitation exercises), there were several responses that were also behaviors, but may not necessarily reflect adherence behavior. For example, when asked, *“Think about an athlete that you worked with who had good adherence in rehabilitation. List specific behaviors that indicated good adherence.”*, one athletic trainer responded “was supportive of their teammates on the field”. The intention of this response was likely to demonstrate a particular athlete's behavior, but supporting teammates on the field is not a rehabilitation adherence behavior. Another example, when asked to *“List specific behaviors that indicate an*

*athlete is non-adherent to rehabilitation*”, one athletic trainer responded “Lack of understanding goals.” Unlike following rehabilitation goals, understanding goals is not a rehabilitation adherence behavior; rather understanding of goals is an antecedent of rehabilitation adherence. It could also be argued that the athletes’ lack of understanding could be due to poor explanation from the athletic trainer. Finally, when asked, “*Think about an athlete you worked with you had poor adherence in rehabilitation. List specific behaviors that indicated poor adherence*”, one athletic trainer responded “family concerns” and another athletic trainer responded “failed to progress over a period of time”. Family concerns may be an antecedent to adherence and progression is a rehabilitation outcome; however, antecedents and outcomes should not be confused with behaviors of rehabilitation adherence.

From these sample responses, it is clear that athletic trainers likely use other cues (e.g., athlete personality, behaviors occurring outside of the athletic training room, etc.) to judge adherence. This is also reflective of the unique relationship that athletic trainers may have with their athletes, compared to rehabilitation professionals working in a community-based clinic. It is important to keep this in mind when interpreting the scores of the RAdMAT or any measure of adherence. To address this, a measure of adherence, should include rehabilitation adherence behaviors that are easily observable in the athletic training setting; the RAdMAT meets this standard.

## Objective 2

To develop the preliminary RAdMAT, in step 2 an expert panel reviewed the rehabilitation adherence items that were generated from the practicing athletic trainers and provided feedback pertaining to the content and clarity of the items. The twelve experts who completed the item review had solid national and international reputations in athletic training, rehabilitation adherence and/or sport psychology.

Experts provided insight into the content and clarity of items and measure instructions. The overall content of the items (attendance, timeliness, exercise completion, etc.) was not greatly altered due to expert comments; most experts rated most items as having acceptable content. Most items that were dropped from the preliminary 25-item RAdMAT were dropped due to lack of clarity. Some dropped items were similar to other items that had clearer wording. For example, the choice to keep the timeliness item (*shows up to rehabilitation on time*) was based on experts' ratings on clarity of this item compared to other timeliness items (*punctual to rehabilitation sessions, timely to rehabilitation sessions*).

One expert also provided much assistance in making items conform to a Likert-type scale. For example, the original wording of one item was *attends all rehabilitation sessions*. The expert noted that this item would result in “a dichotomous ‘all or nothing’ distribution of responses”; because of this comment, along with the other experts' comments, the resultant item reads *attends scheduled rehabilitation sessions*.

The preliminary 25-item RAdMAT was created based on the experts' ratings and comments. In step three, this preliminary measure and the Sport Injury Rehabilitation

Adherence Measure (SIRAS: Brewer et al., 1995) were administered to a larger sample of certified athletic trainers to examine psychometric properties of the RAdMAT and its relevance for the athletic training setting.

### *Expected Outcome 2*

The second expectation was that the RAdMAT would reflect the operational definition, have acceptable psychometric properties, and be relevant to and easily used in an athletic training setting. Care was taken by the investigator, and checked by a second coder and the investigator's advisor, that each item was reflective of the operational definition: *behaviors an athlete demonstrates by pursuing a course of action that coincides with the recommendations of the athletic trainer.*

The preliminary 25-item RAdMAT totals (range 25-100) for the most (mean = 89.72), average (mean = 73.03) and least (mean = 51.10) adherent athlete data fall as expected with the highest scores for the most adherent, the lower scores for the least adherent, which provides evidence for construct validity. The internal consistencies for the most, average and least adherent athlete data are high ( $\alpha = 0.927, 0.944$  and  $0.926$ , respectively). This is not surprising because high alpha values are common with a large number of items even if some items are not highly related to others. Initial evidence for concurrent validity is demonstrated with the positive and significant relationships between the totals for the preliminary 25-item RAdMAT and the SIRAS with the most, average and least adherent athlete data.

Given the descriptive and correlational results, the 25-item preliminary RAdMAT fits the conceptual model and reflects the behaviors identified in steps 1 and 2. It also demonstrates good internal consistency and discriminates among varying levels of adherence. However, several items appear redundant, and a shorter version may be adequate. Also, given that steps 1 and 2 suggested possible sub-scales within the RAdMAT, factor analyses were used to examine the factor structure and modify the measure.

Based on factor analyses and conceptual appropriateness, several items were removed, resulting in a 16-item RAdMAT. Items were selected for the RAdMAT for two major reasons: 1) items strongly loaded on one of the first components of the exploratory factor analyses and, 2) the items are ones that can be easily judged by the athletic trainer. Items relating to regimens outside of the athletic training room (i.e., items 5, 7-9) were removed from the final measure because the athletic trainer cannot observe these behaviors and thus cannot rate them on the measure. Home regimen items might be appropriate to include on an athlete self-report measure of adherence. Additionally, one of the communication items (i.e., item 10) was dropped from the final measure because this item did not strongly load on the factor analyses. Further, this item suggests an interaction between the athletic trainer and the athlete and the athletic trainer, therefore may have difficulty rating this behavior. The other communication items (i.e., items 11-13) were kept because they are more specific behaviors than item 10, which only refers to communication rather than asking questions and providing feedback. These items also strongly loaded on the factor analyses. Item 14 (the athlete reports pain or discomfort

when appropriate) was dropped because it did not load strongly on the first factors would also likely be difficult for the athletic trainer to judge the athlete's pain, thus making it difficult to rate appropriate reporting. Item 17 (the athlete is easy to work with) was dropped because *easy* is not specific and the item did not load strongly on any factor. Item 24 (the athlete is prepared for rehabilitation sessions) was dropped because *prepared* is not specific. The attendance and timeliness items (i.e., items 1-2) are more appropriate than rating preparedness. Additionally, based on different rehabilitation protocols, athletes may need to prepare for rehabilitation in different ways (e.g., bringing goal statements or running shoes to rehabilitation). Finally, item 24 (the athlete works we on his/her own during rehabilitation sessions) did not load strongly on the first factors and this independence behavior is captured with items 18-22 that refer to effort, focus and motivation.

Both a 3-factor solution and 1-factor solution fit the final items for the most, average and least adherent athlete data, suggesting that the RAdMAT may be used with three sub-scales (attendance/participation, communication, attitude/effort) as well as with a total score. The attendance/participation subscale includes items 1-5 on the final 16-item RAdMAT. The communication subscale includes items 6-8. The attitude/effort subscale includes items 9-16. Internal consistencies for these subscales and the totals for the most, average and least adherent athlete data are all high (Cronbach's  $\alpha > 0.748$ ), indicating items contribute to the subscale and the total. Demonstrated with MANOVA and follow-up contrasts, each subscale clearly differentiates between data for the most, average and least adherent athlete, indicating both the subscales and totals may be used in

future research to differentiate adherence levels. Although further analyses may refine the items and measure, internal consistencies and item discrimination are acceptable for the 16-item RAdMAT.

The final expectation was that the RAdMAT would be as psychometrically sound as and more relevant to an athletic training setting than the 3-item SIRAS that was developed for use in the community-based sports medicine setting. The SIRAS totals (range 3-15) for the most (mean = 13.8), average (mean = 11.48) and least (mean = 8.08) adherent athlete data fall as expected with the highest scores for the best adherence and lowest scores for the worst adherence. However, the RAdMAT has greater variability in the totals which may pick up more subtle differences between the adherence groups than can be determined with the SIRAS.

Internal consistencies for the SIRAS for most and least adherent athlete data ( $\alpha = 0.591$ , and  $0.771$ , respectively) are lower than reported in previous literature of alpha at  $0.82$  and  $0.86$  (Brewer et al., 2000). Internal consistency for average athlete data ( $\alpha = 0.861$ ), however, was similar to previous literature. Fewer items generally result in lower internal consistencies. However, these internal consistencies may indicate the SIRAS demonstrates different psychometric properties when used with a collegiate athlete population who demonstrate high or low adherence rates. The RAdMAT with higher internal consistency may be a more appropriate measure for a collegiate athlete population.

The results from this investigation suggest the RAdMAT is at least as psychometrically sound as the SIRAS, and may be a more appropriate measure of

rehabilitation adherence in an athletic training setting than the SIRAS. As demonstrated with MANOVA, both the RAdMAT and SIRAS total scores significantly differentiate adherence groups. The RAdMAT appears to have some a slight advantage over the SIRAS in detecting between-group differences in adherence levels. In further support of the RAdMAT, as shown with exploratory factor analyses, the RAdMAT items fall into subscales. This is a major improvement upon the SIRAS because the RAdMAT, which is able to differentiate factors of rehabilitation adherence (attendance/participation, communication, attitude/effort), can be used to examine relationships of these three factors to rehabilitation adherence antecedents and outcomes. While previous literature has endorsed the SIRAS as valid and reliable in the community-based sports medicine setting, results from the current investigation suggest the RAdMAT may be just as good and even perhaps more appropriate for measuring rehabilitation adherence in the athletic training setting.

### Strengths and Limitations

In step 1, the use of certified athletic trainers who were currently practicing in the collegiate setting is a strength because the measure is intended for use by practitioners and clinical usefulness is of primary importance. This development method sets the RAdMAT apart from the SIRAS, which was created from a review of the literature. This current method helps to ensure the RAdMAT is reflective of adherence behaviors specific to the athletic training setting and is relevant to athletic trainers.

While every attempt was made to ensure that the sample used in step one was representative (university division, area of the country, etc.), this selective sample may limit the generalizability of the measure items. Collected responses were independently analyzed by the investigator and a second coder. The investigator and second coder were in agreement on nearly all results, and discrepancies were resolved through discussion. The compiled behaviors were then distributed back to participants via e-mail to check for accuracy and provide further additions. The use of a second coder and participant check confirms the accuracy of the compiled adherence behaviors and supports the content validity of the items on the rehabilitation adherence for athletic training measure. Compared to the SIRAS, the RAdMAT covers a broader array of adherence behaviors.

The expert panel in step two included certified athletic trainers, who worked with collegiate athletes, and non-practicing experts. The inclusion of clinical and research experts further supports the content validity of the measure items. Similar to step 1, while every attempt was made to ensure this step was representative (e.g., expertise area, geographical area, etc.), this selective sample may limit the generalizability of the measure items. Expert ratings and comments were compiled by the investigator and reviewed by her advisor as well as the expert panel. Every effort was made to ensure measure items reflected the ratings and comments of the experts. However, the investigator had to use her knowledge of athletic training and rehabilitation adherence to resolve inconsistencies, possibly biasing the resulting 25 preliminary items.

In step three, data from the sample of athletic trainers provided good support for the internal consistency of the measure and its ability to discriminate among adherence

levels. However, knowing the outcome of rehabilitation in this retrospective study design may have altered the athletic trainer's perception of rehabilitation behaviors. The use of recall cases is a limitation, but the measure discriminated among these recalled cases providing initial validity evidence that can be further tested with actual cases in prospective designs.

The RAdMAT factor structure may not be very stable as only 164 participants' data were included in the statistical analyses. Therefore, future investigations with a greater number of participants are needed to explore the factor structure and subscales of the RAdMAT. Future research will also help to determine the usefulness of the RAdMAT subscales for predicting rehabilitation adherence.

#### Future Research with the RAdMAT

Follow-up investigations should continue to examine the psychometric properties of RAdMAT. First, a follow-up investigation similar to step three might be conducted with a larger sample to further examine the psychometric properties of the RAdMAT. Although the current sample was sufficient for development of the preliminary measure, larger samples are needed to confirm the factor structure and internal consistency of the scale and sub-scales, as well as correlations with SIRAS and ability to discriminate among adherence levels. To improve upon the retrospective design, athletic trainers could complete the RAdMAT, SIRAS and a separate overall adherence rating for athletes during their rehabilitation using a prospective design. Adherence might be measured repeatedly (i.e., weekly) during rehabilitation until the athlete is fully cleared to return to

play. Correlations could be used to examine relationships between RAdMAT and SIRAS scores with the overall adherence rating.

While the measure was developed specifically for use within an athletic training setting, the individual items on the measure are not context-specific. If for example, items on the RAdMAT were athlete-specific, such as the coach's role in adherence, the measure would be limited to athletic training. However, items are specific to rehabilitation behavior, regardless whether or not it occurs within an athletic training setting. Therefore, the RAdMAT may also be a useful clinical and research tool in a variety of rehabilitation settings beyond athletic training. Future research may investigate the viability of using the RAdMAT in other sport injury rehabilitation settings beyond athletic training.

Currently, there is no empirical evidence that supports the mediation role of adherence between rehabilitation antecedents and outcomes. Based on the results of this study, the RAdMAT has sufficient reliability and validity to justify its use in research examining these predictors and outcomes of rehabilitation adherence. While the SIRAS may be a valid measure of rehabilitation adherence, the subscales of the RAdMAT provide more specific information regarding adherence behaviors. For example, the RAdMAT may be useful in examining relationships in the Brewer et al. (2000) model that are widely assumed, but seldom tested. Using the RAdMAT, ratings for adherence totals as well as subscales can be obtained. This allows the research to be more specific when exploring antecedents of rehabilitation adherence. Further studies will likely move

beyond examining relationships to investigate strategies and interventions aimed at improving outcomes (e.g., functional ability, quality of life, etc.).

### Summary and Practical Implications

Previous literature shows that adherence is a problem, which was supported by the current findings; and poor adherence affects rehabilitation in the athletic training setting (Byerly, et al., 1994; Fisher, et al., 1993). The current lack of a valid and reliable rehabilitation adherence measurement tool specific to the athletic training setting is a noted hindrance in sport injury rehabilitation adherence research and clinical practice (Levy, Polman, Clough, & McNaughton, 2006). Identifying and measuring the behaviors that comprise sport injury rehabilitation adherence in a collegiate athletic training setting is vital to the further understanding and investigation of the overall rehabilitation process (e.g., biopsychosocial factors that influence rehabilitation adherence, potential interventions to enhance adherence) and successful outcomes (e.g., range of motion, strength, functional ability, future injury, etc.).

While there is no ‘gold’ standard for adherence measures by which to compare the RAdMAT and SIRAS, the RAdMAT is at least as good as the SIRAS for measuring rehabilitation adherence behaviors in the athletic training setting. The RAdMAT has the advantage of including subscales that assess more than simply attending rehabilitation and completing the recommended exercises. These subscales may be useful for guiding practice and interventions to enhance sport injury rehabilitation adherence. Low ratings on any one of the three subscales might inform intervention efforts during rehabilitation.

For example, if an athlete receives particularly low ratings on the communication subscale, athletic trainers and sport psychology consultants working with the athlete might introduce skills to enhance communication.

The RAdMAT differentiates between the most, least and average adherent athlete, providing evidence for its validity. Furthermore, total scores and subscales for the most, least and average adherent athletes were significantly related to the SIRAS, which has been found to be a reliable measure of adherence in the community-based sports medicine setting. Both the SIRAS and RAdMAT discriminated among the most, least and average adherent athlete cases, but the RAdMAT was slightly better at group discrimination, as indicated by larger eta-square values. Additional testing of both measures is needed to know if one measure is more appropriate than the other for the athletic training setting,

In conclusion, the RAdMAT was based on a clear definition and focused on behaviors. Unlike the SIRAS, the RAdMAT underwent multiple revisions and reviews by coders as well as field experts. The development steps involved practicing athletic trainers in identifying and confirming relevant adherence behaviors. Thus, the RAdMAT has both a conceptual base and a base in clinical athletic training practice that make it particularly relevant to and appropriate for athletic training settings. With only 16 items in a simple format, the RAdMAT is also relatively easy to use, whether by athletic trainers in clinical practice or for research purposes.

## REFERENCES

- Albinson, C. B., & Petrie, T. A. (2003). Cognitive appraisals, stress, and coping: preinjury and postinjury factors influencing psychological adjustment to sport injury. *Journal of Sport Rehabilitation, 12*, 306-322.
- Arnheim, D. D., & Prentice, W. E. (2000). *Principles of Athletic Training* (10th ed.). Boston: McGraw Hill.
- Bartone, P., Ursano, R., Wright, K., & Igraham, L. (2000). Hardiness scale. In K. Corcoran & J. Fisher (Eds.), *Measures for clinical practice: A sourcebook* (3rd ed., Vol. 2, pp. 322-326). New York: Free Press.
- Bassett, S. F. (2003). The assessment of patient adherence to physiotherapy rehabilitation. *New Zealand Journal of Physiotherapy, 31*(2), 60-66.
- Bassett, S. F., & Petrie, K. J. (1999). The Effect of Treatment Goals on Patient Compliance with Physiotherapy Exercise Programmes. *Physiotherapy, 85*(3), 130-137.
- Bassett, S. F., & Prapavessis, H. (2007). Home-based physical therapy intervention with adherence-enhancing strategies versus clinic-based management for patients with ankle sprains. *Physical Therapy, 87*, 1132-1143.
- Brewer, B. W. (1998). Adherence to sport injury rehabilitation programs. *Journal of Applied Sport Psychology, 10*, 78-82.
- Brewer, B. W., Andersen, M. B., & Van Raalte, J. L. (2002). Psychological aspects of sport injury rehabilitation: Toward a biopsychosocial approach. In Mostofsky & Zaichkowsky (Eds.), *Medical and Psychological Aspects of Exercise* (pp. 41-54). Morgantown, WV: Fitness Information Technology.
- Brewer, B. W., Avondoglio, J. B., Cornelius, A. E., Van Raalte, J. L., Brickner, J. C., Petitpas, A. J., et al. (2002). Construct Validity and Interrater Agreement of the Sport Injury Rehabilitation Adherence Scale. *Journal of Sport Rehabilitation, 11*(3), 170-179.
- Brewer, B. W., Cornelius, A. E., Van Raalte, J. L., Brickner, J. C., Sklar, J. H., Corsetti, J. R., et al. (2004). Rehabilitation adherence and anterior cruciate ligament reconstruction outcome. *Psychology, Health & Medicine, 9*(2), 163-175.

- Brewer, B. W., Cornelius, A. E., Van Raalte, J. L., Petitpas, A. J., Sklar, J. H., Pohlman, M. H., et al. (2003). Protection Motivation Theory and Adherence to Sport Injury Rehabilitation Revisited. *The Sport Psychologist, 17*, 95-103.
- Brewer, B. W., Van Raalte, J. L., Cornelius, A. E., Petitpas, A. J., Sklar, J. H., Pohlman, M. H., et al. (2000). Psychological factors, rehabilitation adherence, and rehabilitation outcome after anterior cruciate ligament reconstruction. *Rehabilitation Psychology, 45*(1), 20-37.
- Brewer, B. W., Van Raalte, J. L., & Linder, D. E. (1993). Athletic identity: hercules' muscles or achilles' heel? *International Journal of Sport Psychology, 24*, 237-254.
- Brewer, B. W., Van Raalte, J. L., Petitpas, A. J., Pohlman, M. H., Krushell, R. J., Ditmar, T. D., et al. (2000). Preliminary psychometric evaluation of a measure of adherence to clinic-based sport injury rehabilitation. *Physical Therapy in Sport, 1*(3), 68-74.
- Byerly, P., Worrell, T., Gahimer, J., & Domholdt, E. (1994). Rehabilitation compliance in an athletic training environment. *Journal of Athletic Training, 29*(4), 352-355.
- Carver, C. S., Scheier, M. F., & Weintraub, J. K. (1989). Assessing coping strategies: A theoretically based approach. *Journal of Personality and Social Psychology, 56*(2), 267-283.
- Casey, E., Hughes, J. W., Rosneck, J., Waechter, D., & Josephson, R. (2007). Depressive symptoms and age, but not exercise capacity and gender, predict cardiac rehabilitation adherence, *Association for Applied Sport Psychology*. Louisville, KY.
- Cramer Roh, J. (2001). Patient satisfaction among injured high school and college athletes and its association with rehabilitation adherence and compliance: West Virginia University, unpublished dissertation.
- Crossman, J., & Roch, J. (1991). An observation instrument for use in sports medicine clinics. *The Journal of the Canadian Athletic Therapists Association*(April), 10-13.
- Daly, J. M., Brewer, B. W., Van Raalte, J. L., Petitpas, A. J., & Sklar, J. H. (1995). Cognitive appraisal, emotional adjustment, and adherence to rehabilitation following knee surgery. *Journal of Sport Rehabilitation, 4*, 23-30.

- De Longis, A., Folkman, S., & Lazarus, R. S. (1988). The impact of daily stress on health and mood: psychological and social resources as mediators. *Journal of Personality and Social Psychology*, 54(3), 486-495.
- Durso-Cupal, D. (1998). Psychological interventions in sport injury prevention and rehabilitation. *Journal of Applied Sport Psychology*, 10, 103-123.
- Fisher, A., & Hoisington, L. (1993). Injured athletes' attitudes and judgments toward rehabilitation adherence. *Journal of Athletic Training*, 28(1), 48-50.
- Fisher, A., Mullins, S. A., & Frye, P. A. (1993). Athletic trainers' attitudes and judgments of injured athletes' rehabilitation adherence. *Journal of Athletic Training*, 28(1), 43-47.
- Fisher, A., Scriber, K., Matheny, M., Alderman, M., & Bitting, L. (1993). Enhancing athletic injury rehabilitation adherence. *Journal of Athletic Training*, 28(4), 312-318.
- Flint, F. (1998). *Psychology of Sport Injury: A Professional Achievement Self-Study Program Course*. Champaign, IL: Human Kinetics.
- Granquist, M., & Appaneal, R. (unpublished). Pilot study: Psychological aspects of adherence to an athletic injury rehabilitation program: University of North Carolina at Greensboro, unpublished report.
- Granquist, M., & Gill, D. L. (unpublished). Psychological Aspects of Adherence to an Athletic Injury Rehabilitation Program: Instrument Evaluation and Pilot Study: University of North Carolina at Greensboro, unpublished report.
- Grove, J. R., & Prapavessis, H. (1992). Preliminary evidence for the reliability and validity of abbreviated profile of mood states. *International Journal of Sport Psychology*, 23, 93-109.
- Ievleva, L., & Orlick, T. (1991). Mental links to enhanced healing: An exploratory study. *The Sport Psychologist*, 5, 25-40.
- Jones, S., & Levine, S. (2006). *2006-07 Guide for the College-Bound Student-Athlete*. Iowa City, IA: National Collegiate Athletic Association.
- Kolt, G. S., Brewer, B. W., Pizzari, T., Schoo, A. M. M., & Garrett, N. (2007). The sport injury rehabilitation adherence scale: a reliable scale for use in clinical physiotherapy. *Physiotherapy*, 93, 17-22.

- Lox, C. L., Martin Ginis, K. A., & Petruzzello, S. J. (2006). *The Psychology of Exercise: Integrating Theory and Practice* (2nd ed.). Scottsdale, AZ: Holcomb Hathaway Publishers.
- Meichenbaum, D., & Turk, D. C. (1987). *Facilitating Treatment Adherence: A Practitioner's Guidebook*. New York: Plenum Publishing.
- Mutrie, N. (1999). Exercise adherence and clinical populations. In S. J. Bull (Ed.), *Adherence Issues in Sport and Exercise* (pp. 75-109). Chichester, England: John Wiley & Sons, LTD.
- Quinn, A. M., & Fallon, B. J. (2000). Predictors of recovery time. *Journal of Sport Rehabilitation*, 9(1), 62-77.
- Rosenberg, M. (1989). *Society and the Adolescent Self-Image* (Revised edition ed.). Middletown, CT: Wesleyan University Press.
- Scherzer, C. B., Brewer, B. W., Cornelius, A. E., Van Raalte, J. L., Petitpas, A. J., Sklar, J. H., et al. (2001). Psychological skills and adherence to rehabilitation after reconstruction of the anterior cruciate ligament. *Journal of Sport Rehabilitation*, 10, 165-172.
- Taylor, A. H., & May, S. (1996). Threat and coping appraisal as determinants of compliance to sports injury rehabilitation: an application of protection motivation theory. *Journal of Sports Sciences*, 14, 471-482.
- Tubilleja, K. (2003). Sport psychology strategies, types of social support, and adherence to injury rehabilitation among university student-athletes: West Virginia University, unpublished dissertation.
- Udry, E. (1997). Coping and social support among injured athletes following surgery. *Journal of Sport & Exercise Psychology*, 19, 71-90.
- Vealey, R. S. (1986). Conceptualization of sport-confidence and competitive orientation: preliminary investigation and instrument development. *Journal of Sport Psychology*, 8, 221-246.
- Vitolins, M. Z., Rand, C. S., Rapp, S. R., Ribisl, P. M., & Sevick, M. A. (2000). Measuring adherence to behavioral and medical interventions. *Controlled Clinical Trials*, 21, 188S-194S.

## APPENDIX A

### INITIAL SURVEY FOR REHABILITATION ADHERENCE BEHAVIORS

**Demographic Information:**

- Male
- Female

What year did you become a Certified Athletic Trainer? \_\_\_\_\_

What is your highest academic degree?

- Bachelor's degree
- Master's degree
- Doctoral degree

How many years have you worked in the collegiate athletic training setting? \_\_\_\_\_

What is your current job title?

- Head athletic trainer
- Assistant/associate athletic trainer
- Athletic trainer
- Other: \_\_\_\_\_

Are you directly involved in conducting and/or supervising rehabilitation for collegiate athletes?

- Yes
- No

In what state is your college/university located?

(List of US States)

What Athletics Division is your college/university?

- Division I
- Division II
- Division III
- NAIA
- Other: \_\_\_\_\_

What sports do you have primary responsibility for?

(List of sports from NCAA)

What other sports do you work with?

(List of sports from NCAA)

***Rehabilitation Adherence is defined as the behaviors an athlete demonstrates by pursuing a course of action that coincides with the recommendations of the athletic trainer.***

**Rehabilitation Adherence Questions:**

8. How do you define rehabilitation adherence?

9. List specific behaviors that indicate an athlete is adherent to rehabilitation.
10. List anything else that you use to determine that an athlete is adherent.
11. List specific behaviors that indicate an athlete is non-adherent to rehabilitation.
12. List anything else that you use to determine if an athlete is non-adherent.
13. Think about an athlete that you worked with who had good adherence in rehabilitation. List specific behaviors that indicated good adherence.
14. Think about an athlete you worked with who had poor adherence in rehabilitation. List specific behaviors that indicated poor adherence.
15. What factors (personal, environmental, etc.) contribute to rehabilitation adherence?
16. What factors detract from rehabilitation adherence?
17. Do you think poor rehabilitation adherence a problem in sport injury rehabilitation?

No problem / minor problem / Problem / Major problem

Comments:

18. Do you have athletes that have poor rehabilitation adherence?

Never / occasionally / often / always

Comments:

19. Do you have athletes that are over-adherent (e.g. do too much, do not comply with activity restrictions, etc.)?

Never / occasionally / often / always

Comments:

## APPENDIX B

### E-MAIL TO PARTICIPANTS FOR ITEM GENERATION

Dear \_\_\_\_\_,

I am developing a scale to assess sport injury rehabilitation adherence in an athletic training room for my dissertation research at The University of North Carolina in Greensboro. I received your name from - - as a person who may be willing to contribute to this research. In order to develop a valid and reliable scale, I need your assistance.

Specifically, I would like you to respond to several questions related to your experience with athletes in rehabilitation. Below is the overall purpose of the study and a link to the online questionnaire. This study has been approved by the UNCG Institutional Review Board (IRB# 078251).

***Rehabilitation Adherence is defined as the behaviors an athlete demonstrates by pursuing a course of action that coincides with the recommendations of the athletic trainer.*** Many factors may influence adherence and adherence may result in different outcomes. Identifying and measuring the behaviors that comprise sport injury rehabilitation adherence in a collegiate athletic training setting is vital to the further understanding and investigation of the overall rehabilitation process and successful outcomes.

***Therefore, the purpose of this questionnaire is to identify behaviors that represent adherence to rehabilitation in a collegiate athletic training room.***

**Please complete the questionnaire you will find by clicking on the link by Wednesday, March 5<sup>th</sup>. Completing the survey will take about 15 minutes of your time and your responses are confidential and anonymous.**

[http://www.surveymonkey.com/s.aspx?sm=B4QUxN6opkIx9znALAFrAA\\_3d\\_3d](http://www.surveymonkey.com/s.aspx?sm=B4QUxN6opkIx9znALAFrAA_3d_3d)

Your responses will be used to help develop the initial version of the rehabilitation adherence questionnaire. I will send you a summary of the responses to this survey in a few weeks, and upon completion of the study I will be glad to send you the rehabilitation adherence questionnaire.

Thank you for your time.

Sincerely,  
Megan Granquist, MS, ATC, LAT

Attachment: IRB consent form for your records.

[mdgranqu@uncg.edu](mailto:mdgranqu@uncg.edu)  
Department of Exercise and Sport Science  
The University of North Carolina at Greensboro  
PO Box 26170  
Greensboro, NC 27407-6170

APPENDIX C

COMPILED ADHERENCE BEHAVIORS FOR  
PARTICIPANT ACCURACY CHECK

Thank you very much for your participation in my research project and help in identifying behaviors that represent adherence to rehabilitation in a collegiate athletic training room. Based on the responses collected, rehabilitation adherence behaviors have been grouped into three categories of behavior that athletes demonstrate: presence, active participation, positive attitude. Below are the categories and subcategories of adherence behaviors.

Please check the listed adherence behaviors and 1) note any behaviors that should be deleted or revised, and 2) add behaviors that should be included on the list in the space provided. Responses are confidential and anonymous.

1. Athlete demonstrates PRESENCE:

- a. Attendance (e.g., present/absent)
- b. Timeliness (e.g., punctual, allows enough time to complete exercise program, etc.)

2. Athlete demonstrates ACTIVE PARTICIPATION:

- a. Follows instructions (e.g., follows prescribed plan/rehab protocol, etc.)
- b. Complies with activity restriction (e.g., limits things they're not supposed to do, etc.)
- c. Completes exercises in athletic training room (e.g., finishes directed rehab exercises, etc.)
- d. Complies with home regimens (e.g., completes home exercises/modalities, etc.)
- e. Communicates with athletic trainer (e.g., provides feedback, asks questions, etc.)

3. Athlete demonstrates POSITIVE ATTITUDE:

- a. Attitude (e.g., positive, enthusiastic, etc.)
- b. Effort (e.g., gives 100%, etc.)
- c. Motivation (e.g., desire to improve condition, athlete takes initiative to help themselves, etc.)

APPENDIX D

REHABILITATION ADHERENCE MEASURE FOR ATHLETIC TRAINING:

DRAFT VERSION FOR REVIEW

**Reviewer Demographic Information:**

- Male
- Female

What is your highest academic degree?

- Bachelor's degree
- Master's degree
- Doctoral degree

What is your current position of employment?

- Athletic Training Staff
  - Head athletic trainer
  - Assistant/associate athletic trainer
  - Athletic trainer
  - Other: \_\_\_\_\_
- Academic Faculty
  - Specialty area: \_\_\_\_\_
  - Professor
  - Associate professor
  - Assistant professor
  - Lecturer
  - Other: \_\_\_\_\_

Are you a Certified Athletic Trainer?  Yes  No

If yes, what year did you become a Certified Athletic Trainer? \_\_\_\_\_

Are you directly involved in conducting and/or supervising rehabilitation for collegiate athletes?

- Yes
- No

In what state is your college/university located?  
(List of US States)

What Athletics Division is your university?

- Division I
- Division II
- Division III
- NAIA
- Other: \_\_\_\_\_

## Rehabilitation Adherence Measure for Athletic Training (draft version for review)

*Rehabilitation Adherence is defined as the behaviors an athlete demonstrates by pursuing a course of action that coincides with the recommendations of the athletic trainer.* Many factors may influence adherence, and may be results of adherence. Identifying and measuring the behaviors that comprise sport injury rehabilitation adherence in a collegiate athletic training setting is vital to the further understanding and investigation of the overall rehabilitation process and successful outcomes.

**Reviewers:** Following are the items in the initial version of the Rehabilitation Adherence in Athletic Training Survey. The survey items were generated by practicing certified athletic trainers and put into survey form by the investigator. In this draft version of the survey, you are asked to rate the items for **content** (does this item measure rehabilitation adherence) and for **clarity** (is the item clear and understandable). Any comments or suggestions for revising items would also be appreciated. Use the columns for your ratings (*Yes, Maybe, No*), and write comments on items in the space below the item. General comments and formatting suggestions will be welcomed at the end of the survey.

---

A. Following are the instructions for the Rehabilitation Adherence Measure for Athletic Training:

*Please rate the athlete's behavior for the following items:*

Are these instructions clear? YES    MAYBE    NO

Please add any suggestions.

B. Following are the survey items for the Rehabilitation Adherence in Athletic Training Scale. For each item, please rate the item **Content** (is it appropriate for rating rehabilitation adherence in athletic training) and **Clarity** of the item by selecting **Yes**, **Maybe**, or **No**.

The athlete:

1. attends rehabilitation regularly
2. attends all rehabilitation sessions
3. is punctual to rehabilitation sessions
4. is timely to rehabilitation sessions
5. shows up to rehabilitation on time
6. allows enough time to complete rehabilitation program
7. obeys instructions

8. follows the athletic trainer's recommendations
9. follows the prescribed rehabilitation plan
10. complies with restrictions
11. limits things they're not supposed to do
12. completes all tasks assigned by the athletic trainer
13. completes exercises
14. completes entire rehabilitation protocol
15. completes all tasks
16. correctly performs exercises
17. consistently performs exercises
18. complies with directed exercises
19. completes assigned home exercises
20. completes any "homework" that is assigned
21. completes home rehabilitation program
22. completes home modalities
23. has good communication
24. asks questions
25. gives suggestions
26. communicates with the athletic trainer
27. communicates if there is a problem with the exercises
28. communicates effectiveness of rehabilitation prescription
29. provides feedback
30. knows when to report pain or discomfort
31. has a positive outlook
32. has a positive attitude toward rehabilitation
33. has a positive attitude toward the athletic trainer
34. good attitude toward the rehabilitation process
35. is enthusiastic
36. is energetic
37. has positive self-talk
38. is pleasant to work with
39. gives 100% effort
40. demonstrates effort
41. has a strong work ethic
42. takes initiative to help him/herself

- 43. is an active participant in the rehabilitation process
- 44. concentrates on exercises
- 45. is motivated
- 46. is prepared for rehabilitation sessions
- 47. works well on their own
- 48. is independent
- 49. shows interest in rehabilitation process

General comments:

Formatting suggestions:

APPENDIX E

E-MAIL TO EXPERTS FOR REVIEW

Dear \_\_\_\_\_,

I am developing a scale to assess sport injury rehabilitation adherence in an athletic training environment for my dissertation research at The University of North Carolina in Greensboro. You have been identified by - - as an expert in the field of sport injury rehabilitation who may be willing to contribute to this research. In order to develop a valid and reliable scale, I need your assistance.

Below is the overall purpose of the study and a link to the online questionnaire. This study has been approved by the UNCG Institutional Review Board (IRB #078251).

***Rehabilitation Adherence is defined as the behaviors an athlete demonstrates by pursuing a course of action that coincides with the recommendations of the athletic trainer.*** Many factors may influence adherence, and may be results of adherence. Identifying and measuring the behaviors that comprise sport injury rehabilitation adherence in a collegiate athletic training setting is vital to the further understanding and investigation of the overall rehabilitation process and successful outcomes. ***Therefore, the purpose of this project is to develop a preliminary measure of rehabilitation adherence based on adherence behaviors identified by practicing certified athletic trainers.***

Specifically, I would like you to respond to the following questions and rate preliminary survey items for **content** and **clarity** based on your expert knowledge of rehabilitation.

**Please complete the questionnaire you will find by clicking on the link by Friday, April 25<sup>th</sup>. Completing the survey will take about 15-30 minutes of your time and your responses are confidential and anonymous.**

[http://www.surveymonkey.com/s.aspx?sm=ItnqO294FUtAljYVxQWbPw\\_3d\\_3d](http://www.surveymonkey.com/s.aspx?sm=ItnqO294FUtAljYVxQWbPw_3d_3d)

Your responses will be used to help develop the preliminary version of the rehabilitation adherence questionnaire. Upon completion of the study I will be glad to send you the rehabilitation adherence questionnaire.

Thank you for your time.

Sincerely,  
Megan Granquist, MS, ATC, LAT

APPENDIX F

REHABILITATION ADHERENCE MEASURE FOR ATHLETIC TRAINING:

REVISED DRAFT VERSION FOR REVIEW

The following is a measure of athlete rehabilitation adherence. Rehabilitation adherence is defined as *the behaviors an athlete demonstrates by pursuing a course of action that coincides with the recommendations of the athletic trainer.*

Please rate the athlete on each item using the scale: 1=never, 2=occasionally, 3=often, 4=always.

The athlete:

1. attends scheduled rehabilitation sessions.
2. shows up to rehabilitation on time.
3. follows the athletic trainer's instructions.
4. follows the prescribed rehabilitation plan.
5. complies with activity restrictions.
6. completes all tasks assigned by the athletic trainer.
7. completes exercises correctly.
8. completes assigned home exercises.
9. completes the home rehabilitation program.
10. has good communication with the athletic trainer.
11. asks questions about his/her rehabilitation.
12. communicates if there is a problem with the exercises.
13. provides feedback about the rehabilitation program.
14. reports pain or discomfort when appropriate.
15. has a positive outlook.
16. has a positive attitude during rehabilitation sessions.
17. has a positive attitude toward the rehabilitation process.
18. is easy to work with in rehabilitation.
19. gives 100% effort in rehabilitation sessions.
20. takes initiative in rehabilitation.
21. is an active participant in the rehabilitation process.
22. stays focused while doing rehabilitation exercises.
23. is motivated to complete rehabilitation.
24. is prepared for rehabilitation sessions.
25. works well on his/her own during rehabilitation sessions.
26. shows interest in the rehabilitation process.

APPENDIX G

PRELIMINARY REHABILITATION ADHERENCE MEASURE  
FOR ATHLETIC TRAINING

The following is a measure of athlete rehabilitation adherence. Rehabilitation adherence is defined as *the behaviors an athlete demonstrates by pursuing a course of action that coincides with the recommendations of the athletic trainer.*

Please rate the athlete on each item using the scale: 1=never, 2=occasionally, 3=often, 4=always.

The athlete:

1. attends scheduled rehabilitation sessions.
2. arrives at rehabilitation on time.
3. follows the athletic trainer's instructions during rehabilitation sessions.
4. follows the prescribed rehabilitation plan.
5. complies with physical activity restrictions.
6. completes all tasks assigned by the athletic trainer.
7. completes exercises correctly in rehabilitation sessions.
8. completes assigned home exercises.
9. completes home rehabilitation modalities (i.e., ice, heat, etc.).
10. communicates well with the athletic trainer.
11. asks questions about his/her rehabilitation.
12. communicates with the athletic trainer if there is a problem with the exercises.
13. provides the athletic trainer feedback about the rehabilitation program.
14. reports pain or discomfort when appropriate.
15. has a positive attitude during rehabilitation sessions.
16. has a positive attitude toward the rehabilitation process.
17. is easy to work with in rehabilitation.
18. gives 100% effort in rehabilitation sessions.
19. is self-motivated in rehabilitation sessions.
20. is an active participant in the rehabilitation process.
21. stays focused while doing rehabilitation exercises.
22. is motivated to complete rehabilitation.
23. is prepared for rehabilitation sessions.
24. works well on his/her own during rehabilitation sessions.
25. shows interest in the rehabilitation process.

APPENDIX H

E-MAIL TO PARTICIPANTS:  
PRELIMINARY REHABILITATION ADHERENCE MEASURE  
FOR ATHLETIC TRAINING

Dear Fellow Certified Athletic Trainer:

I am a PhD candidate at The University of North Carolina at Greensboro, requesting your help with my research. Please follow the link at the end of this letter to an online survey titled: **Rehabilitation Adherence in Athletic Training**. As a certified athletic trainer, I value your knowledge and opinions regarding this topic and feel your input is invaluable.

*Adherence is the degree to which athlete behaviors coincide with the recommendations of the athletic trainer.* Many factors may influence adherence and may be results of adherence. Identifying and measuring the behaviors that comprise sport injury rehabilitation adherence in a collegiate athletic training setting is vital to the further understanding and investigation of the overall rehabilitation process and successful outcomes. *Therefore, the purpose of this project is to develop a preliminary measure of rehabilitation adherence based on adherence behaviors identified by practicing certified athletic trainers.*

The questionnaire consists of ten participant demographic questions and questions for three athletes: eight athlete demographic questions with two adherence surveys. Participation will take about 15-30 minutes.

Selected certified NATA members in the United States with a listed e-mail address are being asked to complete this questionnaire, but you have the right to choose not to participate. The University of North Carolina at Greensboro Institutional Review Board has approved this study for the Protection of Human Subjects (IRB #078251). This is a completely anonymous questionnaire and upon submission, neither your name nor e-mail address will be attached to your answers. Your information will be kept strictly confidential.

**Please complete the anonymous questionnaire you will find by clicking on the link by Monday, June 23<sup>rd</sup>:**

[http://www.surveymonkey.com/s.aspx?sm=hJUNk\\_2fuUswRqgZgx9yXcug\\_3d\\_3d](http://www.surveymonkey.com/s.aspx?sm=hJUNk_2fuUswRqgZgx9yXcug_3d_3d)

Upon completion of the study I will be glad to send you the rehabilitation adherence questionnaire upon request.

Thank you for your time and consideration.

Sincerely,  
Megan Granquist, MS, ATC, LAT

Department of Exercise and Sport Science  
The University of North Carolina at Greensboro  
PO Box 26170  
Greensboro, NC 27407-6170  
E-mail: [mdgranqu@uncg.edu](mailto:mdgranqu@uncg.edu)

*Participants for this survey were selected at random from the NATA membership database according to the selection criteria provided by the student doing the survey. This student survey is not approved or endorsed by NATA. It is being sent to you because of NATA's commitment to athletic training education and research.*

## APPENDIX I

### REHABILITATION ADHERENCE QUESTIONS

Please use the following athlete descriptions to guide your ratings of rehabilitation adherence:

- 1) From all the athletes that you have worked with and that have completed rehabilitation over the past year, think about the most adherent athlete.
    - a. Athlete: male/female
    - b. Sport: (list of sports)
    - c. Year of eligibility: (list of years)
    - d. Injury type: (list per NCAA ISS)
    - e. Body part: (list per NCAA ISS)
    - f. Severity: (mild/moderate/severe)
    - g. Approximate length of rehabilitation: (month range)
    - h. RAdMAT and SIRAS
    - i. Overall rehabilitation outcomes were: (unsuccessful / successful)
  
  - 2) From all the athletes that you have worked with and that have completed rehabilitation over the past year, think about the least adherent athlete.
    - a. Athlete: male/female
    - b. Sport: (list of sports)
    - c. Year of eligibility: (list of years)
    - d. Injury type: (list per NCAA ISS)
    - e. Body part: (list per NCAA ISS)
    - f. Severity: (mild/moderate/severe)
    - g. Approximate length of rehabilitation: (month range)
    - h. RAdMAT and SIRAS
    - i. Overall rehabilitation outcomes were: (unsuccessful / successful)
  
  - 3) From all the athletes that you have worked with and that have completed rehabilitation over the past year, think about the average/typical athlete.
    - a. Athlete: male/female
    - b. Sport: (list of sports)
    - c. Year of eligibility: (list of years)
    - d. Injury type: (list per NCAA ISS)
    - e. Body part: (list per NCAA ISS)
    - f. Severity: (mild/moderate/severe)
    - g. Approximate length of rehabilitation: (month range)
    - h. RAdMAT and SIRAS
    - i. Overall rehabilitation outcomes were: (unsuccessful / successful)
20. Do you think poor rehabilitation adherence a problem in sport injury rehabilitation?

No problem / minor problem / Problem / Major problem

Comments:

21. Do you have athletes that have poor rehabilitation adherence?

Never / occasionally / often / always

Comments:

22. Do you have athletes that are over-adherent in rehabilitation (e.g. do too much, do not comply with activity restrictions, etc.)?

Never / occasionally / often / always

Comments:

APPENDIX J

STEP 1: ITEM GENERATION RESPONSES

### **How do you define rehabilitation adherence?**

1. How well an athlete complies with the rehab program that is designed for them.
2. Taking part in a prescribed exercise program until one is capable to return back to competition.
3. In my opinion, rehabilitation adherence can be defined as following the doctor's and athletic trainer's recommendations and rehabilitation protocols as closely as possible.
4. The athletes compliance and work ethic in relation to the advise given by the athletic trainer in an effort to return to participation following injury in a timely manner.
5. following the prescribed plan in terms of frequency, intensity etc
6. The athlete completes all tasks assigned by the athletic trainer. All tasks are created with the goal of a safe and fast/efficient return to previous activities.
7. When an athlete is complying with the guidelines set for them by the physician and the athletic trainer-such as exercises, appts, and doing the exercise.

### **List specific behaviors that indicate an athlete is adherent to rehabilitation.**

1. Communicating with their athletic trainer, showing up for appointments, completing exercises or communicating if their is a problem with the exercises, completing any "home work" that is assigned, a general good attitude toward the process
2. Shows up to perform the prescribed rehabilitation regimen, communicates effectiveness of prescription, completes entire rehab protocol
3. Showing up on time and prepared for rehab sessions. Positive attitude towards rehab and myself. Correctly and consistently performing exercises after instruction on one or two occasions.
4. attitude, motivation
5. on time, effort, understanding of the program and goals
6. Completes a home rehabilitation program. Complies with any restrictions. Attends all rehabilitation sessions. Completes all tasks with 100% effort.
7. Comply with exercises directed to do. Shows up as required-daily, weekly, etc. with enough time to do complete exercise program. Obeys instructions for activities outside of athletics.

**List anything else that you use to determine that an athlete is adherent.**

1. Progress towards return to play
2. Positive attitude towards setting goals throughout rehabilitation to monitor progress.
3. verbal and visual feedback
4. Is an active participant in the rehabilitation process.
5. positive attitude and outlook

**List specific behaviors that indicate an athlete is non-adherent to rehabilitation.**

1. Bad attitude, missing appointments, won't communicate, trying to get out of exercises
2. no show, indifferent, late, half assess the exercises
3. Not showing up for rehab or repetitive tardiness. Not following doctor's instructions. Repeatedly not performing exercises correctly after instruction on one or more occasions. Doing outside activities that put the athlete in harm of re-injury or further injury.
4. tardiness, loss of concentration, may forget instructions
5. lack of effort, missed sessions, lack of understanding of goals, do things not supposed to do it.
6. Does not attend rehabilitation sessions. Does not comply with restrictions. (Ie. walking on an ankle that was supposed to be NWB). Does not complete a home rehabilitation program.
7. Doesn't follow instructions. Misses appt. with doctors or with athletic trainers for rehabilitation. Doesn't give 100%

**List anything else that you use to determine if an athlete is non-adherent.**

1. Failure to progress
2. does the athlete take an initiative to help themselves
3. Apathetic attitude towards rehabilitation.
4. Bad/negative attitude. Unpleasant to work with.

**Think about an athlete that you worked with who had good adherence in rehabilitation. List specific behaviors that indicated good adherence.**

---

1. Good communication; overall progressed well even though there will be increases, decreases, and plateaus; always came to appointments or called if there was an issue; always looking to do more; worked on their own very well; independent
2. timely, motivated, energetic
3. Good work ethic, prepared, always looking for a challenge, knows when to report pain or discomfort with certain exercises, does exercises at home or more than once a day.
4. Enthusiasm, punctual, asked questions, wanted to know what else they could do to help, demonstrated a desire to return to play
5. Regular attendance. Showed interest in the rehabilitation process, down to each individual exercise. Gave suggestions. Did research on their injury & rehabilitation. Complied with any restrictions. Completed home exercises. Put forth 100% effort. Positive attitude.
6. Positive attitude always excited to come in and do rehab. Positive self-talk "I'm getting better" "I did better than last week". Showed up on time every single day. Wanted to know if there was more the athlete could do to return quicker. Was supportive of their teammates on the field.

**Think about an athlete you worked with you had poor adherence in rehabilitation. List specific behaviors that indicated poor adherence.**

---

1. Had to be watched very closely; failed to progress over a period of time; bad communication; negative attitude for a prolonged period; late for appointments or just wouldn't show up
2. disinterested, apathetic, late or no show
3. Bad attitude, doesn't like to be corrected when doing exercises incorrect, missing rehab sessions and/or showing up late with excuses to leave early, not following doctor's instructions (example: not using crutches following surgery, not using brace), shows no self motivation or doesn't respond to athletic trainer's motivation techniques, constant complaining of exercises being too hard, hurting, etc.
4. poor effort, family concerns, lack of motivation
5. Poor attendance. Poor attitude. Apathetic. Excuses for not completing tasks. Cheating on exercises/not completing the task. Felt that a full recovery should 'just come'.
6. Didn't give 100% in exercises. Negative attitude. Missed several rehab appointments in a row. Negative self-talk "I'm never going to get stronger" "this hasn't worked before so it won't this time"

**What factors (personal, environmental, etc.) contribute to rehabilitation adherence?**

---

1. An athlete who is very independent and motivated in general, an athlete who has a strong desire to return to their sport; a good rapport between the athletic trainer and the athlete; a good environment in the athletic training room; good communication of the goals of rehab
2. desire to improve ones condition
3. quality of rehab equipment/facility, quality of time in rehab session (example: one-on-one time vs. having several athletes doing rehab at once), convenience of rehab session timing, duration of rehab session, attitude
4. time, they have busy schedules, psychological factors, fear
5. Short duration of rehabilitation. Fits easily into their schedule. Positive personal experience with the injury/rehabilitation process. Good personal relationship with the athletic trainer. Medical facility with a variety of equipment. Rehabilitation area should be a little isolated, not out in the open. Coach/teammate involvement.
6. Supportive network--family, friends, coaches. Positive outlook/perspective. Low number of significant injuries. Skill in sport/role in team dynamic. Rehab is enjoyable-interesting. Some control over it--able to pick some exercises, etc. Attainable goals

**What factors detract from rehabilitation adherence?**

---

1. A poorly motivated athlete; an athlete with other underlying issues that aren't addressed (depression, etc.); feeling too separated from their team; not being motivated to return to their sport (low desire to play to begin with?); low pain tolerance
2. apathetic, immature
3. having multiple athletes doing rehab with only one athletic trainer in the facility monitoring all rehabs, lack of equipment, inconvenient times, long extended rehab sessions
4. previous failure with rehab, time of year (summer, vacation), lack of playing time, personal priorities
5. Long duration of rehabilitation. Bad time of day / no time for rehabilitation in their schedule. Lack of confidence in the athletic trainer. Poor relationship with the athletic trainer. Uncomfortable environment/rehab facility. No involvement/concern from coach/teammates.
6. Low motivation to return lack of positive support High number of significant injury (re-tear of the same ACL can be frustrating) poor outcome from previous injury feeling of lack of control rehab is boring, frustrating

**Do you have athletes that have poor rehabilitation adherence? Comment:**

---

1. I wouldn't classify this as 'over-adherent'. Rather, they just don't adhere to the rehabilitation tasks/program. I consider activity restrictions a part of the whole rehabilitation process.

## APPENDIX K

### STEP 2: EXPERT REVIEW RATINGS & COMMENTS

Item	Content			Clarity		
	Yes	Maybe	No	Yes	Maybe	No
<b>Instruct.</b>	n/a	n/a	n/a	9	3	0
<b>1.</b>	9	1	1	5	4	2
<b>2.</b>	10	0	1	7	3	1
<b>3.</b>	10	0	1	5	5	1
<b>4.</b>	5	3	3	2	4	5
<b>5.</b>	9	2	0	8	3	0
<b>6.</b>	6	4	1	6	2	3
<b>7.</b>	8	2	1	5	4	2
<b>8.</b>	8	2	1	6	3	2
<b>9.</b>	9	2	0	6	3	2
<b>10.</b>	9	1	1	6	4	1
<b>11.</b>	4	5	2	3	4	4
<b>12.</b>	10	0	1	9	1	1
<b>13.</b>	9	1	1	6	2	3
<b>14.</b>	8	2	1	6	1	4
<b>15.</b>	8	2	1	5	4	2
<b>16.</b>	8	3	0	7	3	1
<b>17.</b>	4	6	1	4	4	3
<b>18.</b>	8	2	1	5	4	2
<b>19.</b>	8	2	1	9	2	0
<b>20.</b>	6	4	1	6	2	3
<b>21.</b>	9	2	0	6	4	1
<b>22.</b>	6	3	2	3	4	4
<b>23.</b>	6	3	2	5	4	2
<b>24.</b>	7	3	1	5	5	1
<b>25.</b>	6	3	2	4	6	1
<b>26.</b>	7	3	1	6	5	0
<b>27.</b>	10	1	0	10	1	0
<b>28.</b>	8	3	0	7	2	2
<b>29.</b>	8	2	1	5	5	1
<b>30.</b>	8	2	1	8	2	1
<b>31.</b>	8	2	1	8	2	1
<b>32.</b>	8	2	1	10	1	0
<b>33.</b>	7	3	1	7	4	0
<b>34.</b>	9	1	1	9	2	0
<b>35.</b>	4	6	1	5	4	2
<b>36.</b>	3	7	1	5	5	1
<b>37.</b>	6	3	2	7	4	0
<b>38.</b>	4	4	3	8	2	1

<b>39.</b>	7	4	0	8	3	0
<b>40.</b>	6	4	1	5	3	3
<b>41.</b>	9	1	1	8	3	0
<b>42.</b>	8	3	0	7	4	0
<b>43.</b>	10	1	0	9	2	0
<b>44.</b>	7	4	0	4	5	2
<b>45.</b>	9	2	0	6	3	2
<b>46.</b>	9	1	1	8	2	1
<b>47.</b>	7	4	0	8	2	1
<b>48.</b>	6	3	2	6	3	2
<b>49.</b>	9	2	0	10	1	0

Note. One participant commented they stopped after item 18, and responded “maybe” to the remaining items.

***Instructions for Athletic Trainer: Please rate the athlete's behavior for the following items:***

1. I think misspelled word in first sentence pursuing to pursuing.
2. Not clear if you are including rehabilitation behaviours away from the clinic environment
3. Probably should have an example of ratings and a clear explanation of the scale
4. This could be omitted, or connected to prior sentence, "Many factors may influence adherence, and may be results of adherence." And this could be stated more clearly, "...by pursuing a course of action that coincides with the recommendations of the athletic trainer." Something more simply stated would be better; think straight forward and write it that way. :) PS: Check Brewer's 1998 Adherence article for a straight forward adherence definition. I think he does it quite well.
5. I would change one part above to: Many factors may influence adherence, and many factors may be the result of adherence.

***The athlete:***  
4=always)

(1=never, 2=occasionally, 3=often,

**1. attends rehabilitation regularly**

1. Regularly is rather subjective.
2. add caveat regarding whether the rehab is scheduled for them or they just are expected to show up each day in the training room
3. How is "regularly" defined?
4. What is meant by regularity is a little ambiguous - i.e., how do you define 'regularly'. It seems to me what is the most relevant is attends rehabilitation as suggested / recommended - which may be 3 times a week for one athlete and only once every 2 weeks for another.
5. probably should read "the athletes attends scheduled rehabilitation appointments regularly
6. Can you state it as "when scheduled"; regularly may imply often enough to consider okay attendance...can you see what I'm saying here?
7. I would use #1 or #2 - think they overlap with Likert scale

## **2. attends all rehabilitation sessions**

1. Possibly add all "scheduled" rehabilitation sessions
2. same concern as above
3. This item results in a dichotomous "all or nothing" distribution of responses.
4. This is closer to my previous comment - although if you replaced all with required it might prevent potential contamination where for genuine reasons an athlete has to cancel or rearrange a rehabilitation session, but actually attends through rearranged sessions what is 'required'
5. should maybe read "attends all scheduled rehabilitations" but there is a problem with this item in that "absolute" language (e.g., "all). Absolute language often makes items false. And in this case the item becomes nonsensical because the ratings don't fit with absolute language. What would it mean to "attend all sessions" "occasionally"?
6. attends all scheduled rehabilitation sessions

## **3. is punctual to rehabilitation sessions**

1. Fair question, is there a better term than "punctual"?
2. what is the expectation?
3. need to define punctual - to the minute, within 5 minutes, etc.
4. "arrives on time to scheduled rehabilitations"
5. "The athlete attends rehab sessions on time."

## **4. is timely to rehabilitation sessions**

1. I think this question is too similar to the one prior and may be confusing to define the difference.
2. I'm not sure that the word "timely" is appropriate in this context.
3. I'm not sure what you mean by timely and how it differs from punctual
4. define timely
5. "timely" does not mean "on time". It means opportunely or well timed. Also very redundant with item 3

### **5. shows up to rehabilitation on time**

1. I like this question best of the last 3
2. Again, same comment as above. timely, on time, and punctual could be interpreted the same
3. This means the same as question 3. to me - but I prefer the way this is worded
4. redundant
5. #3,4 and 5 seem to be the same but 5 works best with Likert

### **6. allows enough time to complete rehabilitation program**

1. The availability of time to complete rehabilitation may be outside of the athlete's control..
2. Not clear if this refers to rehabilitation as a whole or a specific session at the clinic or even away from the clinic
3. what does this mean? Enough time to complete the rehab sessions? Doesn't leave sessions early? Allows enough time to complete all of the rehab process before returning to sport? This item is unclear
4. Is the athlete really in charge of this? I'm not really sure what your getting at here; is it our time budgeting, or the athlete being late that has now caused US not to have enough time to get them through it?
5. Excellent Question

### **7. obeys instructions**

1. Not a fan of the term "obeys". Prefer 8 or 9 versions
2. May think about adding additional specifics to question. For example, obeys instructions regarding home instructions, medications, follow-ups
3. be more specific regarding what type of instruction
4. Although may need to include clinic in this question because it would be difficult to respond to this for activities that could not be observed away from the clinic
5. "obeys" is a poor choice of words "follows athletic trainer instructions well" might be better

6. "Obeys" is a strong word; possibly change to "follows"
7. Whose instructions

**8. follows the athletic trainer's recommendations**

1. Recommendations for what? Rehab specific? Home care? Etc...
2. again, more specificity is needed
3. In totality or during clinic based appointments?
4. recommendations for what? home exercise? rest? Unclear
5. (reading my mind!)

**9. follows the prescribed rehabilitation plan**

1. Straight forward question, I like it.
2. more info - each day? overall?
3. as above (9)
4. #8 asks this better

**10. complies with restrictions**

1. May be able to specify what type of restrictions you mean.  
Activity/participation restrictions vs. restrictions to non-weight bearing.  
Also time of season likely to be a critical factor.
2. May need to add...which may impede process or something to that nature.
3. more info regarding type of restriction
4. as (9)
5. what restrictions? physical activity restrictions?
6. Word more simply; "the athlete follows restrictive guidance." Maybe not more clear here.

**11. limits things they're not supposed to do**

1. Prefer 9
2. I think this may not imply that the athletic trainer discussed limits

3. There is singular/plural disagreement in the item.
4. as (9)
5. sounds odd "does not engage in activities they are not supposed to do"
6. Much better!
7. #10 is way better

### **12. completes all tasks assigned by the athletic trainer**

1. add time frame - daily
2. again, absolute language problem. Delete "all". You will get "all" when the item is scored "always" so don't put "all" in the item
3. Very good.

### **13. completes exercises**

1. Prefer wording in 12
2. having read this I'm not sure of the difference between this and the previous one
3. what exercises? unclear
4. Too vague; needs some, all, none. Leaving it open to, "well, they do most of them"....
5. complete all exercises properly.

### **14. completes entire rehabilitation protocol**

1. Duration of the protocol is going to be important in responding to this question. Also wondering where you draw the line regarding maintenance programs.
2. There is always factors which any change for any given rehab protocol
3. time frame needed
4. Grammatically, there should be a "the" after "completes." This item also produces a false "all or nothing" dichotomy. A time period for protocol completion is not specified.
5. as above
6. When? during sessions? home rehab? Unclear

7. add (the) to this sentence.

### **15. completes all tasks**

1. Prefer wording in 12
2. I think as clinicians, we use exercises over tasks.
3. too vague
4. what tasks? Unclear
5. I don't think tasks is enough; need to say rehab exercises/rehab tasks
6. Worded better in 13, 14,16

### **16. correctly performs exercises**

1. this is dependent on good instruction
2. add prescribed
3. in session? at home?
4. need "all exercises"
5. correctly performs all exercises

### **17. consistently performs exercises**

1. Does this link better with the frequency of attendance questions?
2. consistently kind of throws me off a bit.
3. have they been told to do so?
4. during 1 session, multiple sessions - bit ambiguous
5. in session? at home?
6. Really a no value-add question.
7. Not sure what you are looking for here - consistently shows up to do exercise or does exercise consistently/correctly

### **18. complies with directed exercises**

1. Prefer wording in 12
2. doesn't differentiate between just doing and doing correctly

3. "complies with performing directed exercises during scheduled rehab sessions? Is this what you mean?"
4. No clear and not really sure what all we're referring to.
5. exercises as instructed

#### **19. completes assigned home exercises**

1. The respondents are unlikely to know exactly what the athlete does at home.
2. Good! Very clear.

#### **20. completes any "homework" that is assigned**

1. I think 19 and 20 are able to be interpreted in the same way.
2. physical or written?
3. The respondents are unlikely to know exactly what the athlete does at home.
4. although I'm not sure what type of homework you are referring to
5. homework is not a great descriptive term compared to the above wording.
6. 19/21 are worded better

#### **21. completes home rehabilitation program**

1. This makes me think they are doing it all on their own - rather than doing some in the ATR. I like the use of "homework" or home exercises instead.
2. needs time frame
3. The respondents are unlikely to know exactly what the athlete does at home.
4. (the complete)

#### **22. completes home modalities**

1. Home "treatments" instead of home "modalities"?
2. The term modalities seems a bit misleading.

3. give examples
4. The respondents are unlikely to know exactly what the athlete does at home.
5. modalities?
6. Which ones? Are they doing ALL of them, or just some? More directive question is needed.

### **23. has good communication**

1. Specify who this communication occurs with. In college setting, may have more than 1 AT overseeing their care.
2. too vague
3. Is communication an aspect of adherence? What constitutes good communication?
4. I don't think communication (which may be a lot to do with their communication skills) can be an index of adherence
5. regarding what in particular?
6. "displays" instead of has (skills).
7. is a good communicator

### **24. asks questions**

1. Of whom?
2. Questions about what? Is asking questions an aspect of adherence?
3. needs to be contextualized to be meaningful
4. regarding their rehabilitation.
5. asks appropriate

### **25. gives suggestions**

1. Regarding what? Specific exercises? Things they've seen on TV? Based on what their friends say? What they've done in the past? Not sure what you are trying to get at.
2. For some ATC's this question may appear that athletes are trying to guide their own rehab instead of being an active part in the process.

3. regarding...
4. Suggestions about what? Is giving suggestions an aspect of adherence?
5. needs to be contextualized to be meaningful
6. suggestions may be misunderstood here. Possibly has input inot the rehabilitation program?
7. appropriate suggestions

**26. communicates with the athletic trainer**

1. what type of communication
2. Is communication an aspect of adherence? Communicates about what?
3. Much better than just the athlete has comm. skills, presented earlier.
4. communicates well with

**27. communicates if there is a problem with the exercises**

NO COMMENTS

**28. communicates effectiveness of rehabilitation prescription**

1. "perceived" effectiveness of the rehab program?
2. the athlete is not the expert
3. Wording could be better. (effectiveness is vague for some)

**29. provides feedback**

1. Provides "regular" feedback regarding the effectiveness of the rehabilitation program.
2. needs to be more specific
3. Feedback about what? Is providing feedback an aspect of adherence?
4. Needs to be a bit more specific e.g., on progress, effectiveness of exercises etc
5. "gives" feedback to the athletic trainer.
6. I like this better than 23-25/26

### **30. knows when to report pain or discomfort**

1. Knows when, but are they willing to report? Is there a difference between knowing when and doing it then?
2. it's more difficult to evaluate if they know when than just to eval that they did
3. Is such knowledge a form of adherence?
4. although this may be confounded by the effectiveness of the treatment - it requires the trainer to have communicated this information

### **31. has a positive outlook**

1. Outlook on what? Such an attitude might predict or result from adherence, but it's not adherence per se.
2. Good!

### **32. has a positive attitude toward rehabilitation**

1. Such an attitude might predict or result from adherence, but it's not adherence per se.
2. Dependent on a lot of things including effectiveness of trainer and treatment
3. Good!
4. toward the rehabilitation process

### **33. has a positive attitude toward the athletic trainer**

1. Such an attitude might predict or result from adherence, but it's not adherence per se.
2. This one is tricky; might be better stated as "athlete has confidence in the treatment given by the ATC", as this is part of the placebo effect/correlates.
3. has confidence in the athletic trainer

### **34. good attitude toward the rehabilitation process**

1. I like having a question about good attitude toward rehab (seen as short-

term and within sessions) and toward the rehabilitation process (long term). Addressing both is important in a 6 month rehab

2. what is good?
3. Such an attitude might predict or result from adherence, but it's not adherence per se.
4. same as #32

### **35. is enthusiastic**

1. Prefer good attitude or positive attitude
2. about what?
3. Enthusiastic about what? Such enthusiasm might predict or result from adherence, but it's not adherence per se.
4. I do not like the word enthusiastic; are we looking for an injured athlete to be "jumping with joy" when they are in the ATR? I don't know if this question would be judged fairly using that word. So, possibly think about "determined/motivated"?

### **36. is energetic**

1. Prefer good attitude or positive attitude
2. Energetic in what way(s)? Such an energy might predict or result from adherence, but it's not adherence per se.
3. Again, same here; possibly "motivated"

### **37. has positive self-talk**

1. Not sure if you will always see this with the athletes
2. if they AT has heard it
3. Such self-talk might predict or result from adherence, but it's not adherence per se.
4. Too dependent on the skill set of the person making the judgement and the athletes knowledge and use of mental skills
5. "uses" instead of has

**38. is pleasant to work with**

1. Is addressing their "attitude" better to address than our attitude toward the athlete?
2. Such pleasantness might predict or result from adherence, but it's not adherence per se.
3. Doesn't necessarily indicate the athlete's adherence.
4. very important question

**39. gives 100% effort**

1. Attitudes within sessions and overall attendance have already been addressed
2. Effort at what?
3. in what context?

**40. demonstrates effort**

1. Does not quantify the amount of effort exhibited.
2. too vague
3. Effort at what?
4. Context - how do you measure effort?
5. "consistent effort"
6. 39 seems to work better with likert

**41. has a strong work ethic**

1. Work ethic at what?
2. Context - measure?

**42. takes initiative to help him/herself**

1. Help himself or herself at what?
2. But need to contextualize

**43. is an active participant in the rehabilitation process**

1. I like this question.
2. This is similar to an early question if it is re-worded.

**44. concentrates on exercises**

1. Does this line up with the question about performing the exercises properly?
2. What kind of exercises and what constitutes concentration?
3. A little ambiguous
4. "while doing exercises"
5. the athlete has shows an appropriate concentration level during rehabilitation

**45. is motivated**

1. Motivated for what? How do you measure motivation?
2. to do what?
3. Motivated to do what?
4. include a context?

**46. is prepared for rehabilitation sessions**

1. mentally or physically?

**47. works well on their own**

1. Is this more like the work ethic question?
2. Works at what? There is singular/plural disagreement in the item.
3. But what will you base a judgment on?
4. Good example of not suing Intrinsically/self-motivated and putting it much simpler.

**48. is independent**

1. Rather have them as an "active participant" than necessarily

"independent".

2. Independent at what?
3. I like 48 over 47

#### **49. shows interest in rehabilitation process**

1. But not easy to assess
2. Could be a take it or leave it question; much value add?

#### **GENERAL COMMENTS**

1. Overall, it seems to be important to clarify which components of the process you are looking at and also consider the length of process you think you want to examine. 1 month is a much different process than a 6 month process. Although it all involves our perceptions of what the athlete is doing, the more objective you can make it the better - attendance, proper performance of exercises, etc, rather than the subjective efforts, etc.
2. Towards the end, the survey becomes a little tedious. I feel that many of the questions are very similar to others.
3. Overall, many of the items lack sufficient specificity to rehabilitation. The Positive Attitude items are potential predictors of adherence, but do not constitute adherence.
4. I stopped after item 18. There are lots of problems with the items, and this started to take a lot more time than I thought it would. After item 18 I just put in "maybe" for all the responses. Please take my suggestions on the first 18 items and see if they are useful in looking at the rest of the items
5. Good overall evaluation. I will look it over again and see if I think there is anything missing. Great draft!
6. I would pay a lot more attention to a survey that didn't overlap questions that are similar but not knowing anything about research you may have to repeat questions for reliability or whatever

#### **FORMATTING SUGGESTIONS**

1. Contain all necessary information within each question as opposed to grouping questions for the different areas. Identify which component

you are talking about - who the athlete is to be communicating with, etc.

2. Easy to navigate.
3. I think your format is good.
4. I assume you would ask questions and have the columns for 1-4 for me to circle by category. Keeping me focused on each area that you have created seems better than jumping between categories unless you need to as noted in general comments

## APPENDIX L

### UNIVARIATE F TESTS & CONTRASTS

	<b>F (2, 326)</b>	<b><math>\eta^2</math></b>
<b>RAdMAT 1</b>	598.30*	.786
<b>RAdMAT 2</b>	319.68*	.662
<b>RAdMAT 3</b>	195.12*	.545
<b>RAdMAT 4</b>	322.47*	.664
<b>RAdMAT 5</b>	150.49*	.480
<b>RAdMAT 6</b>	360.16*	.688
<b>RAdMAT 7</b>	138.57*	.459
<b>RAdMAT 8</b>	394.22*	.707
<b>RAdMAT 9</b>	334.78*	.673
<b>RAdMAT 10</b>	401.54*	.711
<b>RAdMAT 11</b>	164.81*	.503
<b>RAdMAT 12</b>	197.63*	.548
<b>RAdMAT 13</b>	224.55*	.579
<b>RAdMAT 14</b>	87.20*	.349
<b>RAdMAT 15</b>	270.40*	.624
<b>RAdMAT 16</b>	378.33*	.699
<b>RAdMAT 17</b>	310.60*	.656
<b>RAdMAT 18</b>	280.59*	.633
<b>RAdMAT 19</b>	433.17*	.727
<b>RAdMAT 20</b>	476.72*	.745
<b>RAdMAT 21</b>	273.06*	.626
<b>RAdMAT 22</b>	381.29*	.701
<b>RAdMAT 23</b>	345.03*	.679
<b>RAdMAT 24</b>	352.13*	.684
<b>RAdMAT 25</b>	415.21*	.718

\* p<0.001

	<b>Level</b>	<b>F (1, 163)</b>	<b><math>\eta^2</math></b>
<b>RAdMAT 1</b>	1 v 3	279.44*	.632
	2 v 3	313.63*	.658
<b>RAdMAT 2</b>	1 v 3	192.90*	.542
	2 v 3	161.96*	.498
<b>RAdMAT 3</b>	1 v 3	133.40*	.450
	2 v 3	96.69*	.372
<b>RAdMAT 4</b>	1 v 3	123.72*	.431
	2 v 3	226.23*	.581
<b>RAdMAT 5</b>	1 v 3	65.11*	.285
	2 v 3	103.12*	.387
<b>RAdMAT 6</b>	1 v 3	172.29*	.514

	2 v 3	222.92*	.578
<b>RAdMAT 7</b>	1 v 3	84.12*	.340
	2 v 3	66.39*	.289
<b>RAdMAT 8</b>	1 v 3	160.58*	.496
	2 v 3	272.92*	.626
<b>RAdMAT 9</b>	1 v 3	137.16*	.457
	2 v 3	226.56*	.582
<b>RAdMAT 10</b>	1 v 3	166.24*	.505
	2 v 3	248.21*	.604
<b>RAdMAT 11</b>	1 v 3	82.98*	.337
	2 v 3	102.66*	.386
<b>RAdMAT 12</b>	1 v 3	90.09*	.356
	2 v 3	126.51*	.437
<b>RAdMAT 13</b>	1 v 3	101.32*	.383
	2 v 3	141.62*	.465
<b>RAdMAT 14</b>	1 v 3	55.99*	.256
	2 v 3	46.74*	.223
<b>RAdMAT 15</b>	1 v 3	126.87*	.438
	2 v 3	173.24*	.515
<b>RAdMAT 16</b>	1 v 3	130.23*	.444
	2 v 3	293.16*	.643
<b>RAdMAT 17</b>	1 v 3	128.37*	.441
	2 v 3	190.95*	.539
<b>RAdMAT 18</b>	1 v 3	126.92*	.438
	2 v 3	163.10*	.500
<b>RAdMAT 19</b>	1 v 3	159.89*	.495
	2 v 3	290.98*	.641
<b>RAdMAT 20</b>	1 v 3	190.12*	.538
	2 v 3	304.11*	.651
<b>RAdMAT 21</b>	1 v 3	142.34*	.466
	2 v 3	150.69*	.480
<b>RAdMAT 22</b>	1 v 3	155.25*	.488
	2 v 3	234.35*	.590
<b>RAdMAT 23</b>	1 v 3	164.32*	.502
	2 v 3	207.86*	.560
<b>RAdMAT 24</b>	1 v 3	195.27*	.545
	2 v 3	205.63*	.558

<b>RAdMAT 25</b>	1 v 3	169.25*	.509
	2 v 3	277.96*	.630

Level 1: Most Adherent  
Level 2: Least Adherent  
Level 3: Average Adherent  
\* p<0.001

APPENDIX M

FACTOR STRUCTURE FOR “LEAST ADHERENT” AND  
“AVERAGE” ADHERENT ATHLETE DATA

### Least Adherent Athlete Data

Items	Components					
	1	2	3	4	5	6
1. attends scheduled rehabilitation sessions.	.021	.077	.766	.213	-.112	.069
2. arrives at rehabilitation on time.	.139	.138	.697	.023	.459	-.157
3. follows the athletic trainer's instructions during rehabilitation sessions.	.605	.175	.558	.054	.126	.047
4. follows the prescribed rehabilitation plan.	.293	.264	.582	.056	.072	.279
5. complies with physical activity restrictions.	.116	.102	.173	.219	.206	.773
6. completes all tasks assigned by the athletic trainer.	.324	.246	.582	.104	.084	.389
7. completes exercises correctly in rehabilitation sessions.	.653	.134	.334	.202	.161	-.100
8. completes assigned home exercises.	.359	.333	.082	.087	.569	-.018
9. completes home rehabilitation modalities (i.e., ice, heat, etc.).	.001	.150	.093	.032	.835	.215
10. communicates well with the athletic trainer.	.359	.116	.382	.282	.127	.168
11. asks questions about his/her rehabilitation.	.064	.131	.067	.657	.371	-.175
12. communicates with the athletic trainer if there is a problem with the exercises.	.253	.104	.071	.799	-.072	.051
13. provides the athletic trainer feedback about the rehabilitation program.	.156	.149	.160	.753	.101	.164
14. reports pain or discomfort when appropriate.	-.120	.110	.134	.675	-.183	.402
15. has a positive attitude during rehabilitation sessions.	.806	.258	.101	.131	-.005	7E-6
16. has a positive attitude toward the rehabilitation process.	.697	.370	.002	.106	.077	.314
17. is easy to work with in rehabilitation.	.593	.129	.375	.072	.236	.315
18. gives 100% effort in rehabilitation sessions.	.552	.584	.154	-.011	.252	-.113
19. is self-motivated in rehabilitation sessions.	.264	.662	-.001	.112	.439	.001
20. is an active participant in the rehabilitation process.	.133	.802	.137	.177	.060	.141
21. stays focused while doing rehabilitation exercises.	.355	.531	.279	.151	.220	.043

22. is motivated to complete rehabilitation.	.176	.763	.202	.182	.046	.075
23. is prepared for rehabilitation sessions.	.173	.598	.496	.041	.286	.083
24. works well on his/her own during rehabilitation sessions.	.358	.429	.163	.016	.505	.223
25. shows interest in the rehabilitation process.	.437	.449	.049	.368	.220	.216
<b>Initial Eigenvalues</b>	9.65	2.15	1.66	1.35	1.04	1.01
<b>% of Variance</b>	38.61	8.61	6.62	5.38	4.17	4.02
<b>Cumulative % Variance</b>	38.61	47.22	53.84	59.22	63.39	67.42

#### Average Adherent Athlete Data

Items	Components				
	1	2	3	4	5
1. attends scheduled rehabilitation sessions.	.018	.083	.257	.779	.114
2. arrives at rehabilitation on time.	.266	.234	-.013	.704	.266
3. follows the athletic trainer's instructions during rehabilitation sessions.	.358	.590	.161	.381	-.017
4. follows the prescribed rehabilitation plan.	.334	.584	.289	.323	-.068
5. complies with physical activity restrictions.	.049	.755	.205	.001	.183
6. completes all tasks assigned by the athletic trainer.	.435	.624	.036	.044	.120
7. completes exercises correctly in rehabilitation sessions.	.245	.641	.132	.375	.148
8. completes assigned home exercises.	.331	.181	.066	.257	.673
9. completes home rehabilitation modalities (i.e., ice, heat, etc.).	.141	.076	.168	.169	.850
10. communicates well with the athletic trainer.	.399	.206	.499	.419	.125
11. asks questions about his/her rehabilitation.	.285	.164	.792	.079	-.013
12. communicates with the athletic trainer if there is a problem with the exercises.	.318	.137	.639	.339	.022
13. provides the athletic trainer feedback about the rehabilitation program.	.285	.060	.704	.108	.178
14. reports pain or discomfort when appropriate.	-.003	.333	.689	.001	.198

15. has a positive attitude during rehabilitation sessions.	.649	.244	.045	.243	.066
16. has a positive attitude toward the rehabilitation process.	.722	.328	.075	.048	.126
17. is easy to work with in rehabilitation.	.689	.308	.093	.299	-.058
18. gives 100% effort in rehabilitation sessions.	.667	.424	.264	.189	.165
19. is self-motivated in rehabilitation sessions.	.696	.133	.300	.081	.317
20. is an active participant in the rehabilitation process.	.650	.141	.434	.046	.215
21. stays focused while doing rehabilitation exercises.	.365	.458	.215	-.103	.462
22. is motivated to complete rehabilitation.	.725	.166	.228	.117	.150
23. is prepared for rehabilitation sessions.	.491	.507	.256	.164	.096
24. works well on his/her own during rehabilitation sessions.	.658	.101	.213	.027	.302
25. shows interest in the rehabilitation process.	.690	.085	.412	.087	.099
<b>Initial Eigenvalues</b>	10.91	1.59	1.51	1.30	1.13
<b>% of Variance</b>	43.62	6.35	6.05	5.18	4.51
<b>Cumulative % Variance</b>	43.62	49.97	56.02	61.20	65.72

APPENDIX N

FORCED FACTOR ANALYSES: 25 ITEMS

**Rotated component matrix – Forced 3 factors**

Items	Components		
	1	2	3
1. attends scheduled rehabilitation sessions.	.433	<u>.622</u>	.044
2. arrives at rehabilitation on time.	<u>.537</u>	.360	.172
3. follows the athletic trainer's instructions during rehabilitation sessions.	.337	<u>.593</u>	.060
4. follows the prescribed rehabilitation plan.	-.044	<u>.815</u>	.074
5. complies with physical activity restrictions.	.116	.367	.308
6. completes all tasks assigned by the athletic trainer.	.197	<u>.677</u>	.139
7. completes exercises correctly in rehabilitation sessions.	.280	.286	.097
8. completes assigned home exercises.	.265	.124	.183
9. completes home rehabilitation modalities (i.e., ice, heat, etc.).	.147	.268	.180
10. communicates well with the athletic trainer.	.382	.186	.485
11. asks questions about his/her rehabilitation.	.231	-.087	-.024
12. communicates with the athletic trainer if there is a problem with the exercises.	.105	.162	.264
13. provides the athletic trainer feedback about the rehabilitation program.	-.013	.299	.200
14. reports pain or discomfort when appropriate.	-.044	-.068	.242
15. has a positive attitude during rehabilitation sessions.	.277	.096	<u>.788</u>
16. has a positive attitude toward the rehabilitation process.	.118	.098	<u>.834</u>
17. is easy to work with in rehabilitation.	.363	.361	.395

18. gives 100% effort in rehabilitation sessions.	<u>.622</u>	.159	.294
19. is self-motivated in rehabilitation sessions.	<u>.615</u>	.250	.187
20. is an active participant in the rehabilitation process.	<u>.504</u>	.278	.291
21. stays focused while doing rehabilitation exercises.	<u>.562</u>	-.061	-.126
22. is motivated to complete rehabilitation.	<u>.584</u>	.260	.290
23. is prepared for rehabilitation sessions.	.334	.473	.286
24. works well on his/her own during rehabilitation sessions.	.270	.248	.171
25. shows interest in the rehabilitation process.	<u>.545</u>	.191	.413
<b>Initial Eigenvalues</b>	9.57	1.87	1.36
<b>% of Variance</b>	38.28	7.47	5.43
<b>Cumulative % Variance</b>	38.28	45.75	51.18

#### Rotated component matrix – Forced 2 factors

Items	Components	
	1	2
1. attends scheduled rehabilitation sessions.	.433	<u>.622</u>
2. arrives at rehabilitation on time.	<u>.537</u>	.360
3. follows the athletic trainer's instructions during rehabilitation sessions.	.337	<u>.593</u>
4. follows the prescribed rehabilitation plan.	-.044	<u>.815</u>
5. complies with physical activity restrictions.	.116	.367
6. completes all tasks assigned by the athletic trainer.	.197	<u>.677</u>
7. completes exercises correctly in rehabilitation sessions.	.280	.286
8. completes assigned home exercises.	.265	.124

9. completes home rehabilitation modalities (i.e., ice, heat, etc.).	.147	.268
10. communicates well with the athletic trainer.	.382	.186
11. asks questions about his/her rehabilitation.	.231	-.087
12. communicates with the athletic trainer if there is a problem with the exercises.	.105	.162
13. provides the athletic trainer feedback about the rehabilitation program.	-.013	.299
14. reports pain or discomfort when appropriate.	-.044	-.068
15. has a positive attitude during rehabilitation sessions.	.277	.096
16. has a positive attitude toward the rehabilitation process.	.118	.098
17. is easy to work with in rehabilitation.	.363	.361
18. gives 100% effort in rehabilitation sessions.	<u>.622</u>	.159
19. is self-motivated in rehabilitation sessions.	<u>.615</u>	.250
20. is an active participant in the rehabilitation process.	<u>.504</u>	.278
21. stays focused while doing rehabilitation exercises.	<u>.562</u>	-.061
22. is motivated to complete rehabilitation.	<u>.584</u>	.260
23. is prepared for rehabilitation sessions.	.334	.473
24. works well on his/her own during rehabilitation sessions.	.270	.248
25. shows interest in the rehabilitation process.	<u>.545</u>	.191
<b>Initial Eigenvalues</b>	9.57	1.87
<b>% of Variance</b>	38.28	7.47
<b>Cumulative % Variance</b>	38.28	45.75

**Component matrix – Forced 1 factors**

Items	Component 1
1. attends scheduled rehabilitation sessions.	.433
2. arrives at rehabilitation on time.	<u>.537</u>
3. follows the athletic trainer's instructions during rehabilitation sessions.	.337
4. follows the prescribed rehabilitation plan.	-.044
5. complies with physical activity restrictions.	.116
6. completes all tasks assigned by the athletic trainer.	.197
7. completes exercises correctly in rehabilitation sessions.	.280
8. completes assigned home exercises.	.265
9. completes home rehabilitation modalities (i.e., ice, heat, etc.).	.147
10. communicates well with the athletic trainer.	.382
11. asks questions about his/her rehabilitation.	.231
12. communicates with the athletic trainer if there is a problem with the exercises.	.105
13. provides the athletic trainer feedback about the rehabilitation program.	-.013
14. reports pain or discomfort when appropriate.	-.044
15. has a positive attitude during rehabilitation sessions.	.277
16. has a positive attitude toward the rehabilitation process.	.118
17. is easy to work with in rehabilitation.	.363

18. gives 100% effort in rehabilitation sessions.	<u>.622</u>
19. is self-motivated in rehabilitation sessions.	<u>.615</u>
20. is an active participant in the rehabilitation process.	<u>.504</u>
21. stays focused while doing rehabilitation exercises.	<u>.562</u>
22. is motivated to complete rehabilitation.	<u>.584</u>
23. is prepared for rehabilitation sessions.	.334
24. works well on his/her own during rehabilitation sessions.	.270
25. shows interest in the rehabilitation process.	<u>.545</u>
<hr/>	
<b>Initial Eigenvalues</b>	9.57
<b>% of Variance</b>	38.28
<b>Cumulative % Variance</b>	38.28
<hr/>	

APPENDIX O

FORCED FACTOR ANALYSIS: 16 ITEMS

### Rotated component matrix – Forced 2 factors

Items	Components	
	1	2
1. attends scheduled rehabilitation sessions.	.433	<u>.622</u>
2. arrives at rehabilitation on time.	<u>.537</u>	.360
3. follows the athletic trainer's instructions during rehabilitation sessions.	.337	<u>.593</u>
4. follows the prescribed rehabilitation plan.	-.044	<u>.815</u>
5. complies with physical activity restrictions.	.116	.367
6. completes all tasks assigned by the athletic trainer.	.197	<u>.677</u>
7. completes exercises correctly in rehabilitation sessions.	.280	.286
8. completes assigned home exercises.	.265	.124
9. completes home rehabilitation modalities (i.e., ice, heat, etc.).	.147	.268
10. communicates well with the athletic trainer.	.382	.186
11. asks questions about his/her rehabilitation.	.231	-.087
12. communicates with the athletic trainer if there is a problem with the exercises.	.105	.162
13. provides the athletic trainer feedback about the rehabilitation program.	-.013	.299
14. reports pain or discomfort when appropriate.	-.044	-.068
15. has a positive attitude during rehabilitation sessions.	.277	.096
16. has a positive attitude toward the rehabilitation process.	.118	.098
17. is easy to work with in rehabilitation.	.363	.361
18. gives 100% effort in rehabilitation sessions.	<u>.622</u>	.159
19. is self-motivated in rehabilitation sessions.	<u>.615</u>	.250
20. is an active participant in the rehabilitation process.	<u>.504</u>	.278
21. stays focused while doing rehabilitation exercises.	<u>.562</u>	-.061
22. is motivated to complete rehabilitation.	<u>.584</u>	.260
23. is prepared for rehabilitation sessions.	.334	.473

24. works well on his/her own during rehabilitation sessions.	.270	.248
25. shows interest in the rehabilitation process.	<u>.545</u>	.191
<b>Initial Eigenvalues</b>	9.57	1.87
<b>% of Variance</b>	38.28	7.47
<b>Cumulative % Variance</b>	38.28	45.75

APPENDIX P

FACTOR ANALYSIS: LEAST & AVERAGE DATA

**Least Adherent Athlete Data**

<b>Items</b>	<b>Components</b>		
	<b>1</b>	<b>2</b>	<b>3</b>
1. attends scheduled rehabilitation sessions.	-.032	.778	.261
2. arrives at rehabilitation on time.	.216	.696	.083
3. follows the athletic trainer's instructions during rehabilitation sessions.	.432	.677	.054
4. follows the prescribed rehabilitation plan.	.311	.716	.085
6. completes all tasks assigned by the athletic trainer.	.316	.679	.203
11. asks questions about his/her rehabilitation.	.156	.093	.701
12. communicates with the athletic trainer if there is a problem with the exercises.	.138	.137	.830
13. provides the athletic trainer feedback about the rehabilitation program.	.217	.200	.746
15. has a positive attitude during rehabilitation sessions.	.627	.347	.105
16. has a positive attitude toward the rehabilitation process.	.668	.279	.146
18. gives 100% effort in rehabilitation sessions.	.799	.271	.030
19. is self-motivated in rehabilitation sessions.	.795	.015	.152
20. is an active participant in the rehabilitation process.	.693	.110	.273
21. stays focused while doing rehabilitation exercises.	.668	.329	.100
22. is motivated to complete rehabilitation.	.669	.239	.231
25. shows interest in the rehabilitation process.	.615	.182	.456
<b>Initial Eigenvalues</b>	6.74	1.50	1.48
<b>% of Variance</b>	42.13	9.35	9.25
<b>Cumulative % Variance</b>	42.12	51.48	60.73

Items	Components		
	1	2	3
1. attends scheduled rehabilitation sessions.	-.032	.778	.261
2. arrives at rehabilitation on time.	.216	.696	.083
3. follows the athletic trainer's instructions during rehabilitation sessions.	.432	.677	.054
4. follows the prescribed rehabilitation plan.	.311	.716	.085
6. completes all tasks assigned by the athletic trainer.	.316	.679	.203
11. asks questions about his/her rehabilitation.	.156	.093	.701
12. communicates with the athletic trainer if there is a problem with the exercises.	.138	.137	.830
13. provides the athletic trainer feedback about the rehabilitation program.	.217	.200	.746
15. has a positive attitude during rehabilitation sessions.	.627	.347	.105
16. has a positive attitude toward the rehabilitation process.	.668	.279	.146
18. gives 100% effort in rehabilitation sessions.	.799	.271	.030
19. is self-motivated in rehabilitation sessions.	.795	.015	.152
20. is an active participant in the rehabilitation process.	.693	.110	.273
21. stays focused while doing rehabilitation exercises.	.668	.329	.100
22. is motivated to complete rehabilitation.	.669	.239	.231
25. shows interest in the rehabilitation process.	.615	.182	.456
<b>Initial Eigenvalues</b>	6.74	1.50	1.48
<b>% of Variance</b>	42.13	9.35	9.25
<b>Cumulative % Variance</b>	42.12	51.48	60.73

### Least Adherent Athlete Data

<b>Items</b>	<b>Component</b>
1. attends scheduled rehabilitation sessions.	.503
2. arrives at rehabilitation on time.	.574
3. follows the athletic trainer's instructions during rehabilitation sessions.	.712
4. follows the prescribed rehabilitation plan.	.655
6. completes all tasks assigned by the athletic trainer.	.685
11. asks questions about his/her rehabilitation.	.437
12. communicates with the athletic trainer if there is a problem with the exercises.	.498
13. provides the athletic trainer feedback about the rehabilitation program.	.558
15. has a positive attitude during rehabilitation sessions.	.696
16. has a positive attitude toward the rehabilitation process.	.705
18. gives 100% effort in rehabilitation sessions.	.753
19. is self-motivated in rehabilitation sessions.	.657
20. is an active participant in the rehabilitation process.	.680
21. stays focused while doing rehabilitation exercises.	.715
22. is motivated to complete rehabilitation.	.717
25. shows interest in the rehabilitation process.	.732
<b>Initial Eigenvalue</b>	6.74
<b>% of Variance</b>	42.13

### Average Adherent Athlete Data

Items	Components		
	1	2	3
1. attends scheduled rehabilitation sessions.	-.064	.301	.753
2. arrives at rehabilitation on time.	.242	.067	.737
3. follows the athletic trainer's instructions during rehabilitation sessions.	.490	.067	.615
4. follows the prescribed rehabilitation plan.	.404	.226	.627
6. completes all tasks assigned by the athletic trainer.	.658	-.064	.315
11. asks questions about his/her rehabilitation.	.177	.811	.166
12. communicates with the athletic trainer if there is a problem with the exercises.	.195	.708	.347
13. provides the athletic trainer feedback about the rehabilitation program.	.286	.736	.075
15. has a positive attitude during rehabilitation sessions.	.635	.176	.225
16. has a positive attitude toward the rehabilitation process.	.774	.181	.089
18. gives 100% effort in rehabilitation sessions.	.752	.268	.360
19. is self-motivated in rehabilitation sessions.	.723	.340	.167
20. is an active participant in the rehabilitation process.	.673	.471	.066
21. stays focused while doing rehabilitation exercises.	.651	.198	.077
22. is motivated to complete rehabilitation.	.694	.297	.217
25. shows interest in the rehabilitation process.	.593	.531	.117
<b>Initial Eigenvalues</b>	7.34	1.36	1.30

<b>% of Variance</b>	45.90	8.51	8.15
<b>Cumulative % Variance</b>	45.90	54.41	62.56

---

**Average Adherent Athlete Data**

<b>Items</b>	<b>Component</b>
1. attends scheduled rehabilitation sessions.	.417
2. arrives at rehabilitation on time.	.530
3. follows the athletic trainer's instructions during rehabilitation sessions.	.668
4. follows the prescribed rehabilitation plan.	.684
6. completes all tasks assigned by the athletic trainer.	.605
11. asks questions about his/her rehabilitation.	.600
12. communicates with the athletic trainer if there is a problem with the exercises.	.640
13. provides the athletic trainer feedback about the rehabilitation program.	.609
15. has a positive attitude during rehabilitation sessions.	.666
16. has a positive attitude toward the rehabilitation process.	.717
18. gives 100% effort in rehabilitation sessions.	.857
19. is self-motivated in rehabilitation sessions.	.789
20. is an active participant in the rehabilitation process.	.772
21. stays focused while doing rehabilitation exercises.	.626
22. is motivated to complete rehabilitation.	.766
25. shows interest in the rehabilitation process.	.761
<b>Initial Eigenvalue</b>	7.34
<b>% of Variance</b>	45.90

---

## APPENDIX Q

### CORRELATION MATRIX

	<b>16-item RAAdMAT</b>	<b>Attend./Part. Subscale</b>	<b>Communication Subscale</b>	<b>Attitude/Effort Subscale</b>
<b>Adherence level</b>	r=.811* r <sub>s</sub> =.818*	r=.829* r <sub>s</sub> =.843*	r=.704* r <sub>s</sub> =.707*	r=.730* r <sub>s</sub> =.738*
<b>SIRAS total</b>	r=.898* r <sub>s</sub> =.893*	r=.868* r <sub>s</sub> =.871*	r=.744* r <sub>s</sub> =.739*	r=.858* r <sub>s</sub> =.847*

\*p<.01

APPENDIX R

PARTICIPANT COMMENTS

**Question: Do you think poor rehabilitation adherence is a problem in sport injury rehabilitation?**

---

Highly dependent on coaches, I believe. Overbearing coaches have less compliant athletes; reasonable & responsible coaches have more compliant athletes. Div I looks to have more overbearing, high pressure coaching staffs/situations that are manifest in their athletes.

We don't allow it to be optional. Athlete's have rehab appointments and once we determine they need rehab we have a No rehab, no practice rule in effect. If they don't show we don't let them participate.

Most athletes in my training room think stim and ice/heat are treatment enough in and of itself. And of course they hate to stretch.

It is dependent upon so many non athletic issues such as academics, personal relationships, detachment from team... for example

I feel most of the problem is lack of one-on-one attention. If they have personal attention the adherence goes way up.

The only thing that keeps it from being a major problem is that often times these athletes are in such great shape before they get hurt that they are able to come back to participation even though they haven't fully adhered to the rehabilitation program.

Depends on the athlete and the respect between athlete and rehabilitation specialist.

At my junior college, the primary obstacle is attendance.

I think it's completely dependent on the athlete's personality & drive to be an athlete.

Intensity of the athletes to compete may affect their communication of their true pain level.

I believe that most athletes are motivated to return to their activity and therefore adhere to their rehabilitation protocol.

Many athletes are more interested in a quick fix. Also making time for rehab seems to have become a problem with the increasing demands placed on the student athletes.

i think it greatly depends on the age of the athlete, whether or not this is their first major injury, and the severity of the injury

Lack of adherence is a major obstacle to ensuring proper progression of our rehab protocols.

An athletic trainer must clearly state to the athlete what is expected of them and the importance of adherence to the rehab program. Issues with non-compliance are reported to the coaching staff.

Dependant on length of rehab.

No doubt, rehab is a process that takes time and often a lot of teaching, not just training

I think that if you have good communication skills from the very beginning with your athletes, they will have more pride and ownership with their therapy than if they just come in and do what their told to do. I like to give them ownership of their treatment...their much more compliant that way (for me at least). Of course that doesn't work with them all.

It is up to the athlete to adhere. As the ATC, we can not want the athlete to get better more than the athlete...

Poor adherence leads to longer rehab times and diminished effects.

Depends on the athlete and type of school you are at. But there are usually poor adherers.

It's definitely a challenge in our profession. I also may have more insight into this issue b/c my master's thesis was on rehabilitation adherence in collegiate athletes and I try to apply what I learned from that. It seems to me that injury severity is one of the variables that makes a huge difference.

I think sometimes you do encounter difficult athletes, however it is the responsibility of the ATC to find a way to connect with that athlete. If you have a good relationship with the athletes they will do what you ask them to do.

I've yet to have an athlete successfully rehab when he/she did not adhere to the protocol.

Consistency is a must for proper healing!

Because seasons are so short, I have players who will do just enough to get back and play under 100%, once they are back on the field/court they no longer feel the need for rehab.

Adherence is a problem if you fail to properly educate the individual doing the rehab on what/why they are performing rehab.

All want the "Polaroid fix"

especially in 3rd degree or severe injuries. Motivation seems lacking; hence the need for mental skills alongside physical skills.

its hard to put work into someone who doesn't want it, but as healthcare providers we have to... even if they don't, cause we will be the first one to hear the complaints from the athlete, parents and coaches

I think that it has a tremendous effect on their outcome.

**Question: Do you have athletes that have poor rehabilitation adherence?**

---

Maybe 1 clinker per year; this year I've had 2 extreme cases.

younger athletes, sometimes their role prior to the injury - starter vs coming off the bench

Good relationships and communication with coaches enables me to enforce the necessity of rehabilitation with all athletic injuries for every athlete.

Most of these athletes are those who do rehab "on their own", or come in during busy times

They are able to still compete at the college level, even though hindered slightly by their injury. There are athletes that it is sometimes difficult to get to buy completely into the rehab process, especially during the course of the season.

Yes, but they display the same poor adherence in many other facets of their life.

They show up initially, but fail to follow through. Mostly the coaches do not have consequences for not adhering to the rehab plan.

Due to a very supportive coaching staff, i rarely have any trouble with adherence. Our rehab sessions are treated just like a practice. so there is discipline for "no showing" to Rehab sessions. i am fortunate though, i have been on the other side, in that case, it is a major problem and ATCs tend to have more problems with non-adherence

Usually it is the athlete that struggle with all aspects of things (i.e. attending classes, meetings,

Personality plays a factor.

Lots and deal with a lot of chronic complaints because of it

It doesn't happen very often b/c of the rapport that I have with my athletes. My non-adherent athlete that I referred to in this survey had ALOT of outside issues (life stress) going on at that particular time during rehab which may have made the difference.

These individuals I feel are normally not "star" athletes. Or individuals who do not contribute a lot to the team. Key players and individual sport athletes I feel have a tendency to be more compliant because they have a desire to return to play as soon as possible.

In D III, I've found that the majority of athletes do not want to perform rehab, they just want to play.

However, I feel as if the poor rehabilitation adherence is a reflection on the head athletic trainers inability to communicate with the athletes, staff, and other athletic trainers

Depends on the team and how the coach is.

Football players at times are the worst due to what I perceive as the "mind-set" of the sport, if they are injured and in rehab., coaches and players use derogatory comments, name calling and such, most will give up on rehab. just so they don't seem "weak"

Adherence is a problem if you fail to properly educate the individual doing the rehab on what/why they are performing rehab.

Especially with long-term rehabs

thankfully most want to get better, there are only a few bad apples

I think we have a wide range of adherence. It seems that the older the athlete the more adherence or better effort is applied

**Question: Do you have athletes that are over-adherent (e.g., do too much, do not comply with activity restrictions, etc.)?**

---

internet access and other acquaintances giving advice on injuries/rehab/return to play seem to have negatively impacted how 'engaged' the injured athlete is with the rehab process. Lots of doc-shopping these days! Athletes still looking for the FASTEST way to return to play (whoever offers the speediest plan) --- and we're now seeing the negative effects of accelerated/aggressive rehab...coupled with more overuse conditions that result in undesirable compensation movement patterns.

This is usually the very motivated athlete who wants to get better as quickly as possible. Usually though I am able to explain to the athlete the reason behind the periods of rest and how it contributes to their overall health and they comply.

There are those that we no occasionally need to "reel in"

They start out being over adherent when you tell them that doing too much can over do, they can't see that and after about a couple weeks they becoming frustrated and discourage with the rehab

most coaches are aware and try to help us restrict what the athletes are doing- also have an athletic training student/staff present at practices helps with monitoring

I have had a few athletes who think if 1 is good then 3 is great, and they end up over-working themselves.

several athletes are given an inch and want to go a mile, especially with mild injuries that tend to linger.

These athletes seem to think that doing more will increases the speed of their return to participation. These are the most challenging athletes for me personally. You can control what they do in your training room and on the field, but you lose that control when they are away from the program.

Occurs very rarely. Again good communication a must.

seldom too much rehab but disobeying sport restrictions

Yes, but I feel it is much easier to reign in the over-adherent than it is to push/prod the under-adherent.

the athletes that I work with are usually very good about only doing the activities that we allow them to do.

Yes, i have had athletes that try and push themselves too quickly. Once they have that first setback though, due to them overdoing it, they usually start sticking to the program.

Clear guidelines and good communication with their coach is important.

Over-adherent is a tough phrase. I would classify someone who does not comply with activity restrictions as not adherent; meaning they are not following a progression back to activity and potentially harming themselves.

Adherence is a problem if you fail to properly educate the individual doing the rehab on what/why they are performing rehab.

YES! Female athletes seems to be the ones here. Female soccer is the sport at my university that is highly successful and has over-achievers in abundance! This carries over into rehabilitation and they do too much too soon. Example, running on an ACL repair at 10 weeks.

there are always the athletes that think they know better.... its about having a good support system, the coaches and other players, if they know what the player should or shouldn't be doing, then it opens more eyes to the situation

Many times with education of their injury and what we are trying to accomplish it helps. Sometimes we get an athlete that will do what they want until they can't physically perform then they are ready to listen.