

The Transtheoretical Model: An Exploratory Look at its Applicability to Injury Rehabilitation

Damien Clement

Context: The transtheoretical model has been widely used in the investigation of how people adapt to new behaviors; however, the literature appears to be lacking documentation of any assessment/s administered to injured athletes to determine their readiness for rehabilitation, which depending on the severity of the injury, could possibly represent a behavior change for that individual. **Objective:** To validate the application of the transtheoretical model to injury rehabilitation and assess the impact of stages of change on athletes' adherence and compliance rates. **Design:** Descriptive correlational. **Setting:** Large Mid Atlantic Division I institution. **Participants:** Seventy injured athletes. **Main Outcome Measures:** Readiness was assessed using the Transtheoretical Model. Adherence was assessed using the percentage of rehabilitation attendance and compliance was assessed using the Sport Injury Rehabilitation Scale. **Results:** Participants who were advanced in their stages of change generally reported an increase in self efficacy, utilization of pros versus cons, and the use of behavioral processes instead of experiential processes of change. No significant relationships were found between stages of change and athletes' adherence and compliance. **Conclusion:** Although no statistical significance was found between stages of change and adherence and compliance the results did validate the application of the transtheoretical model to injury rehabilitation.

Ideally, sports medicine professionals would expect that injured athletes would both adhere to and comply with their rehabilitation programs since the primary function of rehabilitation is to return the body to its preinjury level of functioning. However, despite the relative importance of rehabilitation, these professionals have found themselves questioning the commitment of athletes to their rehabilitation programs.¹ For whatever reason, some athletes thoroughly engross themselves in rehabilitation while others have a much more listless approach. Furthermore, athletes have been found to drop out or fail to properly adhere to or comply with even the best conceived rehabilitation programs.² Thus, it may be worthwhile to ascertain what could be done before rehabilitation to determine an individual's readiness for this stage of the injury recovery process to enhance the rehabilitation experience and thereby positively affect adherence and compliance rates.

The author is with the College of Physical Activity and Sport Sciences at West Virginia University in Morgantown. E-mail: dclement@mix.wvu.edu.

Precedence for prerehabilitation assessment has not been set within the context of injury rehabilitation. Such an assessment has been incorporated into investigating how people adapt to new behaviors in other settings, however.³⁻⁵ Within these studies, the Transtheoretical Model (TTM) revealed that individuals who were advanced in their stages of change exhibited high levels of self-efficacy, perceived more pros than cons, and used more behavioral as opposed to experiential processes of change thereby indicated their readiness to embark on a new behavior.

This assessment, using the TTM, could possibly be used to help athletic trainers get a better understanding of injured athletes' readiness to embark on a new behavior, that is, injury rehabilitation. It must be stated that the author firmly believes that commencing a rehabilitation protocol can be likened to adapting a new behavior. While some athletes may have previously attended and successfully completed rehabilitation, a new behavior in the current context refers an injured athlete now having to participate in activities (ie, rehabilitation) that are not a part of daily living. These newly injured athletes can no longer participate in games or practice sessions or even travel with the team. Instead, these athletes now have to schedule treatment and attend rehabilitation sessions in addition to fulfilling doctor appointments instead of performing the normal duties of a student athlete. Wong⁶ affirmed this assumption by stating that athletes who are about to commence rehabilitation most often experience a change in their "pre-injury daily routine."⁶

The TTM, which has been widely documented in the behavior change literature, was developed to assess the processes that individuals go through en route to a behavior change. The original central constructs of this model were the stages of change and the processes of change. The stages of change are thought to reflect the varying degrees of readiness experienced by individuals as they embark on new behaviors.⁷ Prochaska and DiClemente⁸ postulated that the TTM consists of five different stages: precontemplation (no intention of making any changes), contemplation (considering making some changes), preparation (making small changes), action (actively participating in the new behavior), and maintenance (continuing the new behavior over an extended period of time).

The processes of change are thought to be the techniques and strategies used by individuals as they move through the aforementioned stages.⁸ These processes can be categorized into experiential and behavioral processes. Experiential processes focus on the individual's awareness and the feelings experienced while embarking on the behavior change. Behavioral processes, however, refer to the overt activities that an individual will engage in during the course of behavior modification. Self-efficacy is an additional construct that has been incorporated into the TTM. Self-efficacy refers to the confidence an individual has in his/her ability to perform a behavior.⁹ The final construct of the TTM, decisional balance, is derived from the Decision Making Model.¹⁰ This construct is thought to assess the perceived benefits versus the costs of embarking on a new behavior.

Udry, Shelbourne, and Gray¹¹ have pioneered the TTM construct within the sports medicine context with patients before anterior cruciate ligament (ACL) surgery. Results from this study revealed that participants who were deemed ready for surgery exhibited high levels of self-efficacy, perceived more pros than cons with regard to their impending surgery, and used more behavioral as opposed to experiential processes of change before their surgery. Thus, it could be reasoned that a similar assessment of injured athletes, using the TTM could potentially be

quite beneficial in determining their readiness to commence their rehabilitation programs.

These rehabilitation programs, according to Kraus and Conroy,¹² are usually mandatory for injured athletes who have sustained injuries. It is debatable in the literature as to how much consideration is currently being given to athletes' readiness before embarking on this stage of the injury recovery process, however. The author believes that by assessing athletes' readiness using the TTM before the commencement of rehabilitation, the sports medicine staff may get an indication of which athletes are ready for rehabilitation. Consequently, as the sports medicine staff becomes aware of athletes who are not ready to rehabilitate, suitable interventions could be used and appropriate referrals made. In addition, this assessment could possibly help in the construction and tailoring of rehabilitation programs to meet athletes' needs to facilitate a more rapid return to the field of play.

Therefore, due to the dearth of research in this area and the potential applicability of the TTM, the main purpose of this research study was to validate the TTM in relation to injury rehabilitation. A secondary purpose of this study was to assess the impact that stages of change, a construct of the TTM, had on athletes' adherence and compliance rates with respect to their rehabilitation programs. It was hypothesized, based on the theoretical literature, that individuals who were rated as ready for their rehabilitation will be more advanced in their stages of change, exhibit a high level of self efficacy, indicate perceiving more pros than cons with respect to commencing their rehabilitation programs, and use experiential processes earlier while using more behavioral processes later in the rehabilitation process. Furthermore, individuals who are advanced in their stages of change will comply and adhere more closely to their rehabilitation programs when compared with those who are not advanced in their stages of change.

Methods

Subjects

Injured college athletes ($N = 70$) were recruited as participants in the study during the fall and spring semesters of the 2004 to 2005 academic year and also during the fall semester of the 2005 to 2006 academic year by one of the assistant athletic trainers of a large Mid Atlantic Division I institution. This represented a sample of convenience that the author thought was appropriate due to the exploratory nature of the study. All participants sustained their athletic injuries during their off season, during training, or during competition. These injuries sustained were categorized as either second degree (an injury that involved a partial tear of a ligament, muscle, or tendon¹³ and resulted in an athlete missing one to three weeks of practice or competition; $n = 44$; 62.9%) or third degree (an injury that involved a complete tear of a ligament, muscle, or tendon¹³ and resulted in an athlete missing more than three weeks of practice or competition;¹³ $n = 26$; 37.1%). Males made up 55.7% ($n = 39$) of the sample while females made up 44.3% ($n = 31$) of the sample. In addition, the highest percentage of the sample ($n = 26$; 37.1%) indicated that they were in the freshman year of their studies. The most prominent sport among participants was men's soccer ($n = 27$; 38.5%), followed by women's soccer ($n = 22$; 31.5%) and wrestling ($n = 9$; 12.8%). Football was not included in the study since access

to these athletes was not gained. No information was collected with regard to the specific type of the injuries sustained by the participants.

Measures

Demographics and Background Information

Demographic and background information were obtained from the participants via the use of questionnaires consisting of open-ended questions, closed-ended questions, and subjective-rating questions. Demographic information elicited from the injured athletes consisted of participants' gender, varsity sport they participated in, academic year in school, and the season in which the injury occurred. Furthermore, background information with respect to participants' previous involvement in rehabilitation was also obtained.

Stages of Change

Participants' Stages of Change was assessed using a modified version of the Stages of Exercise Scale (SOES¹⁴). The SOES¹⁴ recognizes that individuals may be at different degrees of readiness with respect to the adaptation of an exercise behavior. This instrument consisted of a ladder-like diagram, with each rung representing one of the five stages of change. Items on this instrument are rated on a five-point ordinal scale ranging from 0 *precontemplation* to 4 *maintenance*. This instrument was modified by Wong⁶ to include references to rehabilitation. Minor word changes were made by the author, however, to make this instrument more specific for the purposes of this study. Participants were asked to indicate on the ladder which of the five stages best represented their level of preparedness for their impending rehabilitation. Concurrent validity of the SOES¹⁴ was established by comparing the SOES¹⁴ to three physical indices, and test-retest reliability (over a 2-week period) was established with Spearman's rho for the SOES¹⁴ being 1.00.¹⁴

Processes of Change

The processes of change experienced by participants as they embarked on their rehabilitation program were assessed using Wong's⁶ version of the Processes of Change Questionnaire for Injury Rehabilitation (POCQ-IR). No further modifications were made by the investigators. The POCQ-IR consisted of 10 subscales each with 3 questions for a total of 30 items. Participants responded to each item using a five-point ordinal scale, ranging from 1 *never* to 5 *frequently*, on how frequently they used experiential or behavioral processes of change during their rehabilitation. Internal reliability coefficients for all the scales of the POCQ-IR ranged from 0.71 to 0.88 with the exception of consciousness raising. This, however, was resolved by the elimination of the first item of that scale that resulted in a Cronbach alpha of 0.70.¹¹ For the purposes of the current study, only

two scores (totals of the experiential processes of change and behavioral processes of change) were utilized during data analysis.

Decisional Balance

Participants' decisional balance with respect to their involvement in rehabilitation was assessed using a version of a 16-item measure initially used by Marcus and Owen.¹⁵ The original measure consisted of 10 items representing pros and 6 items representing cons with respect to exercise. Udry et al¹¹ modified this instrument to make it more specific to surgery. Minor word changes, though, were made by the author to make this instrument more specific for the purposes of this study. Participants responded to these items on a five-point ordinal scale ranging from 1 *not very important* to 5 *extremely important*, depending on whether they assessed those items as having served as benefits or costs during the course of their rehabilitation. Internal consistency for the pro scale was 0.87 whereas it was 0.90 for the con scale.¹⁵ Furthermore, principal component analyses revealed both scales were stable across samples, thus supporting the construct validity of the measure.¹⁵

The Sports Injury Rehabilitation Beliefs Survey

The Sports Injury Rehabilitation Beliefs Survey (SIRBS¹⁶) was used to assess participants' expectations of rehabilitation but specifically their self efficacy. The SIRBS¹⁶ consists of 19 items measured on a seven-point Likert scale ranging from 1 *very strongly disagree* to 7 *very strongly agree*. This instrument consisted of 5 subscales that assessed participants' beliefs in their susceptibility, treatment efficacy, self efficacy, rehabilitation value, and injury severity. No modifications were made to this instrument because it was already deemed rehabilitation specific. Cronbach alpha reliability coefficients of 0.79 (self-efficacy), 0.83 (treatment efficacy), 0.83 (susceptibility), and 0.63 (injury severity) were reported for the SIRBS.¹⁶ For the purposes of the current study, however, only responses to the self-efficacy subscale were utilized during data analysis.

The Sport Injury Rehabilitation Adherence Scale

The Sport Injury Rehabilitation Adherence Scale (SIRAS¹⁷) was used to assess participants' compliance to their rehabilitation procedures. The SIRAS,¹⁷ a 3-item instrument, was initially developed from the exercise adherence literature by Brewer and colleagues.¹⁷ The athletic trainer rated participants using a five-point ordinal scale ranging from 1 *minimum effort* to 5 *maximum effort* on their ability to complete their rehabilitation exercises with the required intensity, the frequency with which they followed instructions, and the degree to which these athletes were receptive to changes made in their rehabilitation programs. A total score was derived for the 3 items. Internal consistency of the SIRAS¹⁷ was reported as 0.82 and test-retest reliability (over a 2-week period) was found to 0.81.¹⁷ Validity was established when participants scores on the measure were found to be somewhat correlated ($r = .21, P < .05$) with attendance at rehabilitation sessions.¹⁷

Attendance

The ratio of scheduled rehabilitation appointments attended relative to the number scheduled, defined as adherence, was obtained from the athletic training room treatment log. This, as a measure of adherence ratio, has been used effectively in previous research.¹⁷

Protocol

Before commencing this study, a pilot study was conducted to orient the athletic trainer as to what would be expected throughout the duration of the study. More importantly, this pilot study was used to determine if any changes should have been made to the methodology of the study in addition to gaining feedback on the clarity of the questionnaires and the instructions provided to the athletic trainer. Results from the pilot study revealed that no significant changes needed to be made to the questionnaires, and the athletic trainer understood the required protocol for data collection. Before commencing the current study, approval had been obtained from the Institutional Review Board for the Protection of Human Subjects and informed consent was obtained from each participant.

Inclusion criteria for this study was as follows: Participants had to be over the age of 18 and must have sustained a sport-related injury either during their off season, training, or competition. In addition, these injuries should have been, at a minimum, second-degree injuries as evaluated by the athletic trainer.

Once prospective athletes met those criteria, they were asked by the athletic trainer to participate in the study. All athletes were administered the battery of questionnaires when they first came in for treatment and not during the course of the study. After obtaining informed consent, participants were then asked to complete a demographic questionnaire. They then completed the stages of change instrument, the processes of change questionnaire, the sports injury rehabilitation beliefs survey, and the decisional balance questionnaire. These questionnaires were administered in random order to reduce the possibility of a testing effect. Furthermore, participants were asked to complete these questionnaires based on their current injury and their reactions to their impending rehabilitation. These questionnaires were distributed to the participants by the athletic trainer.

Once questionnaires were completed, they were placed in a provided sealed envelope by the author. All of these sealed envelopes were stored in a locked cabinet in the athletic trainer's office until retrieved by the author. Upon a participant's completion of his/her rehabilitation program, the athletic trainer completed the SIRAS¹⁷ immediately after the athlete's discharge with regard to that particular participant's compliance to his/her rehabilitation program. This completed questionnaire was also placed in a sealed envelope and stored in the athletic trainer's office until retrieved by the author. Lastly, adherence records were then obtained from treatment logs and recorded by the author.

Data Analysis

Descriptive statistics were calculated for the selected variables used in the study. One-way ANOVAs were used to examine the differences between groups

categorized by their stages of change and their corresponding self efficacy, pros and cons, experiential, and behavioral processes of change scores. One-way ANOVAs were also used to determine if individuals who were advanced in the stages of change adhered and complied with their rehabilitation programs when compared with those who scored lower on the stages of change measure.

Results

Demographics

Approximately 52.9% (n = 37) of the sample indicated that their injuries occurred in the preseason. An evaluation of findings from the demographic information sheet also revealed that 78.6% (n = 55) have previously been injured and have attended rehabilitation at some point in their career. Furthermore, 55.7% (n = 39) indicated that they were currently rehabilitating an injury they had successfully rehabilitated previously. Participants rated their mean past rehabilitation experience as a 3.96 (SD= 0.96) on a five-point Likert scale where scores closer to 5 indicated a favorable past rehabilitation experience. They also indicated a mean ratings of 3.39 (SD = 0.91) when asked about the amount of stress they were currently experiencing where scores closer to 5 indicated participants were experiencing a great deal of stress dealing with their injuries. With regard to the degree to which they were finding their injury difficult to deal with, participants indicated a mean value of 3.14 (SD = 0.95) based on a five-point Likert scale ranging from 1 *not perceiving their injury as difficult to deal with* to 5 *perceiving their injury as difficult to deal with*. Participants' mean SIRAS and attendance scores were 11.51 (on a fifteen-point scale indicating high compliance) and 97.24 (on a 100-point scale indicating high attendance). Please refer to Table 1 for more detailed demographic information. Lastly, it must be mentioned that the sample size was initially slightly larger; however, three surveys were not used in the data analyses due to missing data.

Stages of Change

Participants in the study were asked to rate themselves into one of the five stages of change with respect to their psychological readiness for rehabilitation. The classifications and frequencies for the stages were as follows: precontemplation (n = 13; 18.5%), contemplation (n = 11; 15.7%), preparation (n = 28; 40%), action (n = 18; 25.7%), and maintenance (n = 0; 0%). Initially, one-way ANOVAs were completed using the four stages of change groups; however, no statistically significant findings were found when comparing the four groups on the dependent variables. Therefore, due to the distribution of scores and in an effort to maximize statistical power, the participants indicating that they were in precontemplation or contemplation stages were combined into one group. Thus, three stages of change groups were examined and compared: precontemplation/contemplation, preparation, and action. Previous research by Wong⁶ has provided precedence for collapsing these stages to maximize statistical power. Table 2 presents the means and standard deviations for self-efficacy, decisional balance- pros and cons, experiential, and behavioral processes of change, compliance scores, and adherence percentages for the three assigned stages of change groups.

Table 1 Demographic Characteristics of Injured Athletes (N = 70)

	%	N	M	SD
Gender				
Male	55.7	39		
Female	44.3	31		
Varsity Sport				
Men's Soccer	38.5	27		
Women's Soccer	31.5	22		
Wrestling	12.8	9		
Baseball	7.1	5		
Swimming	4.3	3		
Academic Year				
Freshman	37.1	26		
Sophomore	30	21		
Junior	21.4	15		
Senior	11.4	8		
When did injury occur?				
Preseason	52.9	37		
Beginning of Season	28.6	20		
Mid Season	8.6	6		
End of Season	10	7		
Previously attended rehabilitation				
Yes	78.6	55		
No	21.4	15		
Previously attended rehabilitation for current injury				
Yes	55.7	39		
No	42.9	30		
Previously attended rehabilitation for another injury				
Yes	65.7	46		
No	32.9	23		
Experiencing stress due to injury*			3.39	.91
Difficult to deal with Injury *			3.14	.95
Rating of past rehabilitation experience*			3.96	.86

*Note—on a scale of 1–5

Self-Efficacy

A one-way ANOVA comparing the three stages of change groups on self-efficacy with a follow up Tukey post hoc statistical analysis indicated that the action groups' mean score on self-efficacy was significantly higher than the mean self-efficacy score of the precontemplation/contemplation group, $F_{2,67} = 17.30$, $P < .01$, $ES = 0.34$. Furthermore, the mean self-efficacy score for the preparation group was also found to be significantly higher than the mean self-efficacy score for precontemplation/contemplation group, $F_{2,67} = 25.32$, $P < .01$, $ES = 0.25$. Although, the mean score

Table 2 Descriptive Statistics for the Three Stages of Change Groups for Self-Efficacy, Decisional Balance, Processes of Change, Compliance Rates, and Adherence Rates

	Precontemplation/ contemplation (n = 24)		Preparation (n = 28)		Action (n = 18)	
	M	SD	M	SD	M	SD
Athlete's readiness						
Self-efficacy	15.75	8.06	23.46	3.37	24.11	2.95
Decisional balance						
Pros	24.29	8.58	32.83	6.50	33.86	5.70
Cons	19.67	6.99	14.17	3.29	12.68	4.57
Processes of change						
Behavioral	36.17	13.29	49.11	13.10	53.00	10.03
Experiential	57.96	8.69	51.06	12.64	40.04	9.80
Athletic training ratings						
Compliance rates	11.75	1.45	11.07	2.59	11.72	1.95
Adherence rates	97.88	3.47	96.49	5.95	97.35	.33

Note. All respondents (N = 70)

for the action group was higher than the mean score for the preparation group there was no statistically significant difference between groups. The Cronbach alpha coefficient for the self-efficacy scale was found to 0.96.

Decisional Balance

A one-way ANOVA comparing the three stages of change groups on pros with a follow up Tukey post hoc statistical analysis indicated that the action groups' mean score on pros was significantly higher than the mean pros score of the precontemplation/contemplation group, $F_{2,67} = 13.21$, $P < .01$, ES = 0.28. In addition, the mean pros score for the preparation group was also found to be significantly higher than the mean pros score for the precontemplation/contemplation group, $F_{2,67} = 17.89$, $P < .01$, ES = 0.56. However, there were no statistically significant differences in mean pros scores between the preparation and action groups. The Cronbach alpha coefficient for the pro items used in this study was 0.92.

A one-way ANOVA comparing the three stages of change groups on cons with a follow up Tukey post hoc statistical analysis indicated that the action groups' mean score on cons was significantly lower than the mean cons score of the precontemplation/contemplation group, $F_{2,67} = 12.71$, $P < .01$, ES = 0.28. The mean cons score for the preparation group was also found to be significantly lower than the mean cons score for the precontemplation/contemplation group, $F_{2,67} = 10.67$, $P < .01$, ES = 0.41. Lastly, although the mean score for the action group was lower than the mean score for the preparation group, there was no statistically significant difference in mean cons scores between the groups. The Cronbach alpha coefficient for the cons scale was found to be 0.86.

Processes of Change

A one-way ANOVA comparing the three stages of change groups on experiential processes with a follow up Tukey post hoc statistical analysis indicated that the action group's mean score on experiential processes was significantly lower than the mean experiential processes score of the preparation group, $F_{2,67} = 18.54, P < .01, ES = 0.36$. Furthermore, the mean experiential processes score for the action group was also found to be significantly lower than the mean experiential processes score for the precontemplation/contemplation group, $F_{2,67} = 10.34, P < .01, ES = 0.12$. Although the mean score for the preparation group was lower than the mean score for the precontemplation/contemplation group, this difference was not statistically significant. The Cronbach alpha coefficient score for this scale was 0.92.

A one-way ANOVA comparing the three stages of change groups on behavioral processes of change with a follow up Tukey post hoc statistical analysis indicated that the action group's mean score on behavioral processes of change was significantly higher than the mean behavioral processes of change score of the precontemplation/contemplation group, $F_{2,67} = 9.53, P < .01, ES = 0.22$. In addition, the mean behavioral processes of change score for the preparation group was also found to be significantly higher than the mean behavioral processes of change score for the precontemplation/contemplation group, $F_{2,67} = 19.09, P < .01, ES = 0.60$. On the other hand, although the mean score for the action group was higher, there was not a statistically significant difference in the scores between the preparation and action groups. The Cronbach alpha coefficient for this scale was found to be 0.93.

Adherence and Compliance

Are there differences Between athletes' stages of change and their compliance ratings and adherence rates with respect to their rehabilitation programs? Two one-way ANOVAs, comparing the three stages of change groups on mean compliance rates and mean adherence rates indicated that there were no statistically significant differences between the groups' mean scores on compliance rates and adherence rates. Thus, the study's second hypothesis was not supported.

Discussion

Results from the current study provided some preliminary support for the application of the TTM to the rehabilitation context. First, it was revealed that participants who rated themselves as advanced in their stages of change generally reported an increase in their self efficacy. This finding is consistent with the work of Wong⁶ and Prochaska and DiClemente,⁸ who found that individuals lower in their stages of change (precontemplation and contemplation) rate their self-efficacy lower while those advanced in their stages of change (action and maintenance) generally report higher self-efficacy scores. Higher self-efficacy scores, within the context of rehabilitation, usually reflect individuals' increased confidence in their perceived ability to complete assigned rehabilitation exercises in addition to adhering to required rehabilitation protocols.

Second, it was found that individuals who rated themselves as advanced in their stages of change reported perceiving more pros than cons associated with their participation in rehabilitation. As a result, findings from the current study also supported the literature with regard to participants' perceiving more pros than cons when more advanced in their stages of change. Marcus and Owen¹⁵ supported this claim since they reported a high pro to con ratio for individuals advanced in their stages of change. The high rating with regard to pros versus cons, in the author's opinion reflected participants' perceived beliefs that the benefits derived from participating in rehabilitation vastly outweighed the cons (that is, not participating in rehabilitation).

Results also revealed a general increase in the use of behavioral processes of change from the precontemplation/contemplation group to the action group. This increase has been documented in the literature.⁷ With regard to the use of experiential processes of change, participants reported an opposite but similar trend between the groups. That is, there was a general decrease in the use of experiential processes of change from the precontemplation/contemplation group to the action group. The author believes that the aforementioned trend took place because as individuals progressed in their rehabilitation they tended to move away from cognitive based strategies (such as increasing their knowledge about their injury and rehabilitation protocols as well as increasing their awareness of the risk of not adhering to their rehabilitation program in addition to the benefits they can derive from diligently adhering to their rehabilitation program) that they initially used to convince themselves of the viability of attending rehabilitation. On the other hand, there was a general increase in the use of behavioral processes of change from the precontemplation/contemplation group to the action group. As a result, the author postulated that as participants progressed in their stages of change they began to gravitate toward more overt strategies (such as enlisting social support and rewarding themselves for diligent rehabilitation adherence) to sustain their involvement in rehabilitation.

Therefore, it is believed that, for the most part, the TTM appears valid in terms of hypothesizing group differences on self efficacy, pros/cons, and behavioral and experiential processes of change based on stages of change. The author believed, therefore, that because the TTM has been shown to be quite useful with regard to behavioral change in other settings, and given the findings of the current study, it could possibly be successfully used in predicting compliance and adherence rates in rehabilitation.

Results from the current study, however, did not reveal any significant differences between participants categorized by their stages of change and compliance and adherence rates. Thus, the study's second proposed hypothesis was not supported. Perhaps one reason why this hypothesis was not supported, in part, was that the compliance rates as assessed by the SIRAS¹⁷ revealed little variance in the scores obtained between participants from the athletic trainer. The author, because of the time spent in the athletic training room collecting data for the current study, found that the relationship and rapport between the athletic trainer and the injured athletes was quite remarkable. This rapport appeared to stem from the genuine interest by the athletic trainer in the athletes' well-being. Furthermore, these athletes seemed to listen to whatever the athletic trainer told them and followed the directions and

instructions given. As a result, it was not surprising that the compliance scores lacked much variance. It was also possible that the athletic trainer could have completed the SIRAS¹⁷ in a very similar fashion for each participant in the study in spite of the instructions given to the athletic trainer for the administration of the SIRAS.¹⁷

Likewise, adherence rate scores also lacked variability as most of the participants attended rehabilitation when they were supposed to. The rapport, understanding, and education provided by the athletic trainer made it easy to see why attendance at this particular athletic training room was rarely a problem. In addition, most coaching staffs usually mandate rehabilitation for athletes who are injured and this might have played a significant role in the lack of variability obtained in the adherence scores. Moreover, 62% of the injuries sustained were classified as second-degree injuries, and this could potentially have influenced rehabilitation attendance. Second-degree injuries are relatively serious in nature and, consequently, warrant medical care to efficiently promote recovery. Thus, it could have been reasoned that the athletic trainer's ability to educate athletes with regard to the nature of their injuries might have been very effective.

It must also be mentioned that compliance and adherence rates could also have been influenced by the fact that 78.6% of the participants had previous experience with rehabilitation while 55.7% were currently rehabilitating a previously injured body part. Thus, it could be reasoned that because these individuals have already experienced rehabilitation and the potential benefits that could be derived from it, that stage of change would not discriminate compliance and adherence rates. Furthermore, participants' rating of a 3.96 (on a five-point scale) when asked about their previous rehabilitation experience could indicate that collectively these athletes had a positive regard with respect to their past rehabilitation experiences. Consequently, given their past, presumably good rehabilitation experiences, these individuals may be more receptive toward rehabilitation exercises and protocols thereby advancing in their stages of change with regard to rehabilitation. Moreover, if these individuals are indeed more advanced in their stage of change and more receptive, it would stand to reason that there will be a lack of variability in the rehabilitation attendance scores. Last, 52.9% of the injuries sustained by the participants occurred during preseason. Thus, participants may have figured they had a chance of being able to return to the field of play later in the season. Consequently, they would have been encouraged by this and, as a result, more likely to attend rehabilitation.

Future research perhaps should be directed toward obtaining a larger sample size to further validate the use of the TTM within the context of injury rehabilitation. Perhaps, also, a different method of assessing compliance and adherence could be used to determine if a relationship does exist between readiness and compliance and adherence. Another limitation of the current study, which could be addressed in future research, is to take into consideration the variability of injuries included in the study. The current study included all injury types; it is quite possible that athletes' readiness for rehabilitation could be influenced by the interaction of the type and severity of injury they have sustained.

Conclusion

It appears that the present exploratory study found support for the construct validity of the TTM within the rehabilitation context. That is, individuals who rated themselves as advanced in their stages of change exhibited high levels of self-efficacy, perceived more pros than cons and used more behavioral as opposed to experiential processes of change, thereby indicating their readiness to commence their rehabilitation programs; however, the predictive validity of the stages of change construct of the TTM in terms of compliance and adherence rates was not supported. Thus, it could be reasoned, based on the results of the current study, that the TTM could be valuable to athletic trainers within the context of rehabilitation. The authors believe that the TTM could primarily be used by athletic training staffs to get an indication of which athletes are ready for rehabilitation. Then suitable interventions could be used and appropriate referrals made. Interventions that could be used include cognitive strategies such as increasing athletes' knowledge about their injury and rehabilitation protocols and increasing athletes' awareness of the risks of not adhering to their rehabilitation programs. Behavioral interventions can also be used, such as enlisting social support and the use of a reward system for rehabilitation adherence. This assessment of athletes' readiness and the results derived from it has the potential to be able to facilitate a more rapid return to the field of play for an injured athlete.

References

1. Fisher AC. Adherence to sports injury. *Sports Med.* 1990;9:151–158.
2. Fisher AC, Domm MA, Wuest DA. Adherence to sports injury rehabilitation programs. *Phys Sportsmed.* 1988;16:47–52.
3. Herrick AB, Stone WJ, Mettler MM. Stages of change, decisional balance, and self efficacy across four health behaviors in a worksite environment. *Am J Health Promot.* 1997;12:49–56.
4. Prochaska JO, Velicer WF, Rossi JS, et al. Stages of change and decisional balance for twelve health behaviors. *H Psychol.* 1994;16:161–190.
5. Marcus BH, Banspach SW, Leefebvre RC, et al. Using the Stages of Change Model to increase the adoption of physical activity among community participants. *Am J Health Promot.* 1992;6:424–429.
6. Wong IE. *Injury Rehabilitation Behavior: An Investigation of Stages and Processes of Change in the Athlete-Therapist Relationship.* [Thesis]. Eugene: University of Oregon; 1998.
7. Marcus BH, Rossi JS, Selby VC, Niaura RS, Abrams DB. Process of change questionnaire. *Health Psychol.* 1992;11:386–395.
8. Prochaska JO, DiClemente CC. Stages and processes of self-change in smoking: toward an integrative model of change. *J Consult Clin Psychol.* 1983;51:390–395.
9. Bandura A. Self efficacy: towards a unifying theory of behavior change. *Psychol Rev.* 1977;84:191–215.
10. Janis JL, Mann L. *Decision Making: A Psychological Analysis of Conflict, Choice and Commitment.* New York: Free Press; 1977.

11. Udry E, Shelbourne KD, Gray T. Psychological readiness for anterior cruciate ligament surgery: describing and comparing the adolescent and adult experiences. *J Athl Train*. 2003;38:167–171.
12. Kraus JF, Conroy C. Mortality and morbidity from injuries in sports and recreation. *Annu Rev Public Health*. 1984;5:163–173.
13. Booher JM, Thibodeau GA. *Athletic Injury Assessment*. Boston, MA: McGraw Hill; 1996.
14. Cardinal BJ. The stages of exercise scale and stages of exercise behavior in female adults. *J Sports Med Phys Fitness*. 1995;35:87–92.
15. Marcus BH, Owen N. Motivational readiness, self efficacy, and decision making. *J Appl Soc Psychol*. 1992;22:3–16.
16. Taylor AH, May S. Threat and coping appraisal as determinants of compliance with sports injury rehabilitation: an application of protection motivation theory. *J Sports Sci*. 1996;14:471–482.
17. Brewer BW, Van Raalte JL, Petipas AJ, et al. Preliminary psychometric evaluation of a measure of adherence to clinic-based sport injury rehabilitation. *Phys Ther Sport*. 2000;1:68–74.