



Original research

A preliminary development of the Re-Injury Anxiety Inventory (RIAI)

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ABSTRACT

Objectives: The present paper outlines the initial development of an instrument to measure re-injury anxiety.**Methods:** Face, content and factorial validity were examined over three stages of exploratory factor analyses.**Participants:** 248 injured sport participants completed the scale.**Results:** A 28-item measure was produced to measure re-injury anxiety, comprising of two factors: re-injury anxieties regarding rehabilitation (RIA-R: 15 items) and re-injury anxieties regarding returning to training/competition (RIA-RE: 13 items). These two factors accounted for 80.56% of the total variance. The internal consistency for both factors was above the .70 criterion value; rehabilitation re-injury anxiety ($\alpha = .98$); re-entry into competition re-injury anxiety ($\alpha = .96$).**Conclusions:** Future research needs to test the proposed 2-factor model presented in the current research using confirmatory factor analysis.

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1. Introduction

It has increasingly been recognised that physical and psychological readiness to return to sport following injury are not synonymous (Crossman, 1997; Ford & Gordon, 1998; Podlog & Eklund, 2006). Anecdotal and clinical reports indicate that an injured athlete tends to have fears or anxieties about re-injury (Andersen, 2001; Bianco, 2001; Bianco, Malo, & Orlick, 1999; Cassidy, 2006; Driediger, Hall, & Callow, 2006; Gallagher & Gardner, 2007; Gould & Udry, 1994; Gould, Udry, Bridges, & Beck, 1997; Heil, 1993; Johnston & Carroll, 1998; Kvist, Ek, Sporrstedt, & Good, 2005; Podlog & Eklund, 2005, 2006; Tripp, Ebel-Lam, Stanish, & Brewer, 2007). Johnston and Carroll (1998) stated that fear of re-injury was the predominant emotion associated with returning to sport following sporting injury. The way athletes appraise the risk of returning to sport has been recognised as an important component of injury rehabilitation (Johnston & Carroll, 1998). Häggglund, Waldén, Bahr, and Ekstrand (2005) stated that re-injury is usually defined as “an injury occurring after an initial injury of the same type and location”.

Heil (1993) speculated that fear of injury is always present for all athletes. It is suggested that fear of injury results in physiological

and psychological changes that impact on performance and ultimately increase the risk of actual injury (Heil, 1993). Psychological changes are suggested to include both skill-based (e.g., diminishing concentration and increasing distractibility; Heil, 1993) and interpretive changes (e.g., decreasing self-confidence and increasing pain awareness; Heil, 1993). Physiological changes are suggested to include muscular (e.g., generalised muscular tension and guarding the injured site; Heil, 1993) and autonomic changes (e.g., over-arousal evident through increased heart rate and neurochemical changes; Heil, 1993).

The athlete who fears injury is said to be preoccupied with the physical sensations arising from the injured site or with slight reductions in performance (e.g., brief loss of balance; Andersen & Williams, 1988; Feltz, 1986; Petitpas & Danish, 1995; Rotella & Heyman, 1986; Williams & Roepke, 1993). These are suggested to affect performance through decreased efficiency in the biomechanics of skill execution, poor use of energy resources, and decreased attention (Heil, 1993). These performance effects/detriments may then bring about a mutually reinforcing, self-perpetuating cycle and increase the risk of injury (Heil, 1993; Williams & Andersen, 1998).

Although Heil (1993) presented this idea regarding fear of injury the same process can be assumed to relate to re-injury. Fear of re-injury is suggested to produce psychological decrements such as reduced confidence and poor focus that inhibit progression in the return to sport (Chase, Magyar, & Drake, 2005; Taylor & Taylor, 1997; Tripp et al., 2007). Taylor and Taylor (1997) also suggest that

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re-injury fears cause the same physiological changes proposed by Heil (1993) which are likely to increase the risk of actual re-injury. Taylor and Taylor (1997) stated that fear of re-injury develops from a lack of trust in the injured site. They suggested that this lack of confidence and trust can influence the onset of re-injury via the mechanisms proposed by Heil (1993) and produce a hesitant/tentative performance in rehabilitation and on return to training/competition, a proposal also suggested by Chase et al. (2005), Johnston and Carroll (1998), and Petitpas and Danish (1995). Hesitancy will produce a substandard performance that will perpetuate the cycle, and doubts will cause decreased co-ordination and increased muscle tension and bracing (Gould & Udry, 1994) that are suggested to increase actual re-injury occurrence.

Based on anecdotal evidence, Taylor and Taylor (1997) stated that on return to competition athletes often report being 'rusty' and are challenged to return to the comfort and ease of skill execution that was evident prior to injury, also suggested by Podlog and Eklund (2006) and Rotella and Heyman (1986). The injured athlete is often preoccupied with the details of technique to the detriment of natural feelings associated with well-practised and learnt skills (Taylor & Taylor, 1997). Kvist et al. (2005) stated that many individuals complain that their performance was worse after compared to before the injury and that re-injury anxieties may influence injured athlete's not returning to their sport.

It must be noted that much of the literature to date on fear of re-injury or re-injury anxiety is anecdotal, including the causal relationships discussed above. Walker (2006) explored the longitudinal responses to athletic injury in three case participants. Using phenomenological interviews to explore the meaning of injury, the research identified that re-injury concerns were a universal response amongst all case participants through rehabilitation and on return to training and competition. These worries appeared to reflect anxiety as opposed to fear as indicated in some reports (Bianco, 2001; Bianco et al., 1999; Johnston & Carroll, 1998; Kvist et al., 2005; Podlog & Eklund, 2005, 2006). It is worthwhile to note that the majority of studies do not offer conceptual clarification when discussing re-injury anxiety or fear of re-injury.

1.1. Conceptual clarity: fear of re-injury or re-injury anxiety?

Fear of re-injury (Heijne, Axelsson, Wener, & Biguet, 2008; Kvist et al., 2005; Rotella & Campbell, 1983; Tripp et al., 2007) and re-injury anxiety (Cassidy, 2006; Castillo, Cremades, & Butcher, 2002; Cupal & Brewer, 2001; Short, Reuter, Brandt, & Short, 2005) are commonly mentioned in the sport psychology literature but authors rarely define their conceptual framework (Cassidy, 2006; Kleinert, 2002).

Hackfort and Schwenkmezger (1993) summarised the fear-anxiety debate and stated that fear is a fundamental biological mechanism, whereas anxiety is composed of different elements (e.g., cognitive and somatic) and is associated with learning and social processes. Fear is defined as being stimulus-specific and is associated with definite danger whereas anxiety is connected to the anticipation and imagination of ambiguity and uncertainty. Therefore anxiety is more a feeling of what might happen and not a response to an obvious fear-provoking situation. Walker (2006) reported that case participants thought about their injury re-occurring during rehabilitation exercises, functional rehabilitation exercises, and on return to training and competing. The case participants experienced feeling images of the injury and these images were played over in their minds. The case participants also felt nauseous, sweaty, and tense. These symptoms represent cognitive (e.g., negative thoughts, and worry) and somatic (e.g., physiological response) anxiety as opposed to fear. Hackfort and Schwenkmezger (1993) identified that with fear there is certainty

regarding sources of danger and therefore there are actions of escape. Walker (2006) identified that the injured case participants did not discuss escape actions, despite being anxious about re-injury during rehabilitation and on return to training and competition. For example, all case participants continued to engage in rehabilitation activities throughout the programme, although often with some hesitation.

Injury is a definite danger in sport but there is no certainty or clarity regarding the extent of injury risk and the character of injury situations. Therefore, athletes associate the risk of injury with situations of varying general characteristics and degrees of uncertainty (Kleinert, 2002). This implies that perceived injury risk is individual and dynamic, and is a different experience of each athlete, for any given situation and time. As a high degree of ambiguity remains regarding injury situations and the injury itself, a more accurate term appears to be re-injury anxiety rather than fear of re-injury. Moreover, Kleinert (2002) states that injury-related concerns and anxieties are in many respects not fundamental or biological, but result from previous experience (e.g., the original injury experience) and other developmental factors (e.g., quality of rehabilitation). This kind of emotional development is more typical of anxiety than fear (Kleinert, 2002). Hence, in striving for conceptual clarity, the term re-injury anxiety is perceived by the present authors to be more appropriate than fear of re-injury.

1.2. Measuring re-injury anxiety

Brewer (2001) comments that the development of psychological measures specific to the sport injury rehabilitation setting will help to provide researchers with standardised instruments and enable specific research questions to be answered. The use of standardised psychometric tools allows researchers to measure the same construct in the same way and obtain reliable results. A lack of appropriate measures by which athletes' responses to injury may be accurately assessed has required a reliance on nonpopulation specific measures (Brewer, 2001; Evans, Hardy, & Mullen, 1996; Evans, Mitchell, & Jones, 2006). As a result of relying on non-population specific measures they may lack content and predictive validity (Evans, Hardy, Mitchell, & Rees, 2008). The development and use of appropriate injury specific measures is vital in order to assess relevant constructs, such as re-injury anxiety, and answer significant research questions (Brewer, 2001; Evans et al., 2006).

Given the potential implications of re-injury anxiety on performance and psychological readiness during rehabilitation, return to training, return to competition, and the increased likelihood of actual re-injury, it is important to address coping strategies and interventions that could be employed to assist athletes in managing their re-injury anxieties. The development of a valid and reliable instrument to measure re-injury anxiety would enhance the understanding of this little understood construct, its developmental patterns, and facilitate research to assess the efficacy of coping strategies and interventions to address re-injury anxiety. However, at present there is no valid and reliable means of measuring re-injury anxiety and the lack of such a tool presents limitations to current research on re-injury anxiety. Previous research has tended to employ single-item Likert type scale measures (Cupal & Brewer, 2001) or employ other instruments, such as the Competitive State Anxiety Inventory-2 (CSAI-2; Martens, Vealey, & Burton, 1990), that are designed to measure other constructs and not re-injury anxiety. For example, Castillo et al. (2002) used the CSAI-2 to measure re-injury anxiety when in fact the CSAI-2 measures competition anxieties. Therefore, the aim of the current study was to develop a scale which measures re-injury anxiety.

2. Method

2.1. Overview of stages of development

2.1.1. Stage 1: item development

Re-Injury Anxiety Inventory (RIAI) items were initially generated by adapting the CSAI-2 items. This decision was based on the suggestion by Cupal and Brewer (2001) to use an existing multi-item tool for development. This will go some way to overcome the limitations inherent with single-item scales. The CSAI-2 was selected as a suitable instrument on which to begin the initial development of the RIAI as injured athletes have appeared to express anxiety related emotions when discussing their injury concerns (Cassidy, 2006; Walker, 2006). Many responses to athletic injury, including re-injury anxiety, are reported to be transient (Granito, 2001; Johnston & Carroll, 1998) and are influenced by dynamic factors (e.g., length of time in rehabilitation, severity of injury) (Wiese-Bjornstal, Smith, Shaffer, & Morrey, 1998). Therefore, it was deemed appropriate to measure re-injury anxiety as a state construct rather than one that is stable over time, hence, providing further justification for the initial use of the CSAI-2. Furthermore, Walker (2006) identified that injured athletes discussed cognitive and somatic symptoms in response to re-injury concerns and described reductions in re-injury anxiety in relation to increased self-confidence as the number of successful weeks without actual re-injury increased. The inclusion of items related to these three constructs (i.e., self-confidence, cognitive and somatic anxiety) therefore adds to the argument of using the CSAI-2 as a basis from which a measure of re-injury anxiety can be developed.

Stage 1 involved rewording and modifying the CSAI-2 items to reflect re-injury anxiety rather than competitive state anxiety (Form A). Following the suggestions of Lane, Sewell, Terry, Bartram, and Nesti (1999) a second adaptation was produced, where all items were reworded using the term 'worried' (Form B). Lane et al. (1999) identified that at stage 5 of the CSAI-2 development the term 'worried' was replaced with the term 'concerned' to reduce the influence of social desirability. The semantic difference between these two words however may have threatened the conceptual integrity of the scale. An athlete may be concerned about something but may not necessarily be anxious. Therefore, the term 'worried' was used in development of the re-injury anxiety measure.

2.1.2. Stage 2: item suitability, face and content validity

Scrutiny of the items in Form B took place by experts in the field ($N = 2$) for item suitability, face and content validity. The experts were both Sport Psychologists with experience in inventory development. Suggested modifications were made based on grammar and separating items that attempted to measure both re-injury anxieties about rehabilitation and re-entry into competition (Form C). Form C underwent further scrutiny by Sport Therapy personnel ($N = 2$). These personnel suggested modifying the Likert scale from 1–4 to 0–3 to accommodate the absence of any anxiety (Form D). Form C used a 1–4 Likert scale with descriptors "not at all" and "very much so" representing opposite ends of the scale. The modified Form D used the same descriptors to represent the opposite ends of a 0–3 scale. Form D underwent further scrutiny by Sports Physiotherapy personnel ($N = 2$). It was suggested that all items should explore anxieties regarding rehabilitation and re-entry into competition and not only some items. This increased the inventory from 31 to 54 items. Furthermore, rewording suggestions (e.g., clammy changed to sweaty) were made to improve the clarity of the items and make the inventory more universally understood (Form E). Form E was scrutinised by a further expert in the field who was experienced in inventory development ($N = 1$). Formatting changes

were suggested including rewording repetitive items (Form F). Form F was administered to injured athletes ($N = 8$) for item comprehension using an item comprehension questionnaire developed for the purpose of the study. Athletes were sampled from a range of sports and all were participating in rehabilitation programmes at the same rehabilitation clinic. Athletes had sustained moderate to severe injuries across a range of sites and were in various stages of rehabilitation. 75% of the sample stated that they did not understand some of the 54 items. They reported that some items were lengthy and unclear, hence adaptations were made to combat these issues (Form G). Form G, a 54 item instrument, was administered to injured sports participants to assess the instrument's construct/factorial validity. A set of anti-social desirability instructions were taken and modified from the CSAI-2 and used when administering Form G to the injured sports participants.

2.1.3. Stage 3: construct/factorial validity

Using the maximum likelihood extraction method of exploratory factor analysis (EFA), with oblimin rotation, the instrument's initial construct/factorial validity was examined.

2.2. Participants

248 injured sport participants (126 females, 132 males) aged 17–39 years ($M = 26.44$, ± 5.86 years) completed adaptation seven of the scale (Form G). This provided almost a 5:1 participant to item ratio. Guadagnoli and Velicer (1988) stated that an N of 150 was sufficient for 40 or 50 items on an inventory, a ratio of 3:1. Gorsuch (1997) suggested that 200–300 participants are suitable for assessing an instrument's construct/factorial validity. However, they did suggest examining Bartlett's test of significance as a safeguard. The results of Bartlett's test of Sphericity ($p < .05$) indicated that the sample size was sufficient.

Criteria for inclusion required that participants had sustained an injury as a result of sports participation and were currently receiving sports injury treatment from a qualified Sports Therapist or Physiotherapist. The volunteers participated in several sports, including association football ($n = 96$), rugby league ($n = 67$), rugby union ($n = 47$), martial arts ($n = 16$), field hockey ($n = 10$), swimming ($n = 6$), and triathlon ($n = 6$). They competed at different levels including club level ($n = 127$), University level ($n = 78$), semi-professional ($n = 10$), professional ($n = 17$), and national ($n = 16$).

2.3. Procedure

The RIAI was administered to athletes within 30 min prior to a participant's rehabilitation session. The athletes were told to read the instructions at the head of the RIAI and to complete the instrument as directed indicating their agreement/disagreement with each statement regarding how they felt at that moment.

2.4. Data analysis

Using the maximum likelihood extraction method of exploratory factor analysis (EFA), with oblimin rotation, the instrument's initial construct/factorial validity was examined. EFA has been widely used as a technique in the initial development of inventories (1997). EFA was deemed appropriate at this stage as Gorsuch (1997) stated, "confirmatory factor analysis requires clear predictions as to which factors exist, how they relate to the variables and how the relate to each other". Without these predictions, as in the current study, EFA are required initially. EFA was utilised opposed to principle component analysis because EFA takes into account an error term (Gorsuch, 1983) and therefore assumes that the, "variables are conceptualised as reproduced perfectly by the factors"

(Gorsuch, 1997). Maximum likelihood extraction is the preferred extraction method (Fabrigar, Wegener, MacCallum, & Strahan, 1999). This method allows the computation of assorted indices of goodness of fit, of the data to a model, and the testing of the significance of loadings and correlations between factors. With regards to rotations there is a strong preference for oblique rotations as opposed to orthogonal solutions (Fabrigar et al., 1999). If latent variables are correlated then an oblique rotation, such as oblimin rotation, is suggested to produce a better estimate of the true factors and a better factor structure than an orthogonal rotation (Fabrigar et al., 1999).

The number of factors produced is initially identified by eigenvalues greater than 1.00 as a measure of how much variance in all the data is explained by a single factor (Brace, Kemp, & Snelgar, 2003). Salient factors were then identified by exploring where items loaded greater than ± 0.50 on the structure matrix output (Vlachopoulos, Karageorghis, & Terry, 2000) and where a factor had the highest loading for this item (Gorsuch, 1997). Dual loading items, where item loadings were greater than ± 0.50 on more than one factor and item loadings on >2 factors that were within .100 of each other, were removed. Dual loading items were ambiguous and as there were a total of 54 items it was deemed appropriate to remove ambiguous items and reduce the total number of items to a more manageable number for injured athletes to read and score in the final scale. Where a factor was only comprised of one or two items and/or had dual loadings with items loading higher on other salient factors the factor was removed, as suggested by Gorsuch (1997) who labelled these trivial factors. As recommended by

Gorsuch (1997), following the removal of items further maximum likelihood extraction analyses, with oblimin rotations, were conducted ($N=2$). Internal consistency of the factors was assessed using Cronbach's (1951) alpha. An alpha coefficient for an internally consistent scale should be at least .70 (Tabachnick & Fidell, 1996).

3. Results

The analysis revealed a two-factor structure accounting for 80.56% of the total variance (56.42% and 21.13% respectively). The various indicators of factoriability were good, and the residuals indicated that the solution was good. The Kaiser–Meyer–Olkin ($KMO = .857$) indicates good factoriability (Brace et al., 2003) and Bartlett's test of Sphericity ($p < .05$) indicates that the data appear to be factoriable (Brace et al., 2003). Within these two factors there are two items that have negative loadings (see Table 1). These items are negatively worded, hence require reverse scoring. Items were removed from factor 1 following the guidelines outlined previously. The content of these items were related to re-injury anxiety in rehabilitation (RIA-R). All items loading onto factor 2 were related to re-injury anxiety regarding re-entry into competition (RIA-RE).

3.1. Internal consistency

The internal consistency for both factors was above the .70 criterion value (Nunnally & Bernstein, 1994; Tabachnick & Fidell, 1996); rehabilitation re-injury anxiety ($\alpha = .98$); re-entry into competition re-injury anxiety ($\alpha = .96$).

Table 1
Final factor structure with corresponding item loadings.

	Factor	
	Rehabilitation re-injury anxiety	Re-entry into competition re-injury anxiety
I am worried about becoming re-injured during rehabilitation	.965	
I am worried about becoming re-injured during re-entry into competition		.980
I feel nervous about becoming re-injured during rehabilitation	.989	
I feel nervous about becoming re-injured during re-entry into competition		.959
I have doubts that I will remain injury free during rehabilitation	.924	
I have doubts that I will remain injury free during re-entry into competition		.899
I feel on edge about becoming re-injured during rehabilitation	.930	
I feel on edge about becoming re-injured during re-entry into competition		.881
I am worried that I may not do as well as I could in rehabilitation due to re-injury worries	.975	
I am worried that I may not do as well as I could on returning to competition due to re-injury worries		.895
My body feels tense about rehabilitation because of re-injury worries	.934	
My body feels tense about re-entering competition because of re-injury worries		.867
I feel confident that I will not become re-injured during re-entry into competition ^a		–.813
I am worried about failing during rehabilitation due to my re-injury worries	.969	
I am worried about failing when re-entering into competition due to re-injury worries		.945
Re-injury worries about rehabilitation make my body feel tense	.970	
Re-injury worries about re-entry into competition make my body feel tense		.889
I am worried about performing poorly during rehabilitation due to re-injury worries	.931	
I am worried about performing poorly during re-entry into competition due to re-injury worries		.895
I am worried about failing to achieve full re-entry into competition due to re-injury worries		.856
I feel my stomach sinking due to re-injury worries during rehabilitation	.852	
I am worried that others will be disappointed if I become re-injured during re-entry into competition		.805
The thought of re-injury during re-entry into competition makes my palms sweaty		.834
I am confident about not becoming re-injured during rehabilitation because I mentally picture myself staying injury free ^a	–.546	
I am worried about concentrating during rehabilitation because of re-injury worries	.838	
I am worried about concentrating during re-entry into competition because of re-injury worries		.669
My body feels tight due to re-injury worries during rehabilitation	.928	
My body feels tight due to re-injury worries during re-entry into competition		.861

^a Item requires reverse scoring (e.g., 0 would score 3, 1 would score 2, 2 would score 1, and 3 would score 0).

3.2. Independence of the RIAI constructs

Using the RIAI Form G a second set of data were collected separated by a two week interval from the first data collection. Significant correlations ($p < .05$) were identified for between RIA-R and RIA-RE constructs. Correlations between the two constructs ranged from .41 to .65 over the two data collection periods ($M = .53$). This relationship between the two constructs reflects that athletic injury elicits both re-injury anxieties in rehabilitation and re-injury anxieties when re-entering training/competition and both constructs are somewhat related.

3.2.1. Re-Injury Anxiety Inventory (RIAI)

The effects of athletic injury can be powerful and very different among athletes. The inventory you are about to complete measures how you feel about re-injury at the moment you are responding. Re-injury means an injury of the same type and location of a previous injury. Please complete this inventory as honestly as you can. Sometimes athletes feel they should not admit to any nervousness, anxiety, or worry they experience regarding re-injury concerns because this is undesirable. Actually, these feelings are quite common, and to help us understand them we want you to share your feelings with us candidly. If you are worried about re-injury please indicate these feelings accurately on the inventory. Equally, if you feel calm and relaxed, indicate those feelings as accurately as you can. Your answers will not be shared with anyone. We will be looking only at group responses.

Below are several statements that athletes have used to describe their feelings regarding re-injury worries. Read each statement and circle the appropriate number to indicate how you feel right now, at this moment (0 = not at all; 1 = somewhat; 2 = moderately so; 3 = very much so). There are no right or wrong answers, please do not spend too much time on any one statement.

4. Discussion

The aim of this study was to develop and conduct an initial validation of a scale to assess re-injury anxiety in injured athletes. This initial study has indicated that the items of the RIAI had good factoriability. Following three procedures of EFA, where trivial factors were removed and salient factors determined the items of the RIAI were explained by two constructs (factors) accounting for 80.56% of the total variance. After examination of the content of these items it was clear that factor one was comprised of items that related to rehabilitation re-injury anxiety ($N = 13$) accounting for 56.42% of the total variance. Factor two was comprised of items related to re-entry into competition re-injury anxiety ($N = 15$) accounting for 24.13% of the total variance. Hence, the two constructs measured by the RIAI were labelled: rehabilitation re-injury anxiety (RIA-R) and re-entry into competition re-injury anxiety (RIA-RE). The Table below contains the RIAI derived from the current research.

The final tool is a 28-item multidimensional measure of re-injury anxiety and takes approximately 5 min to complete. Injured athletes are required to read each statement and circle the appropriate number indicating how they feel right at that moment in time. The RIAI is scored by computing a separate score for the two constructs by adding together the scores for the items corresponding to each construct. Scores for items 1, 3, 5, 7, 9, 11, 14, 16, 18, 21, 24, 25, 27 are added to calculate an athlete's RIA-R (item 24 requires reverse scoring). A minimum score of 0 would indicate a complete absence of RIA-R and a maximum score of 39 would indicate that the athlete was extremely anxious about re-injury in rehabilitation. Scores on items 2, 4, 6, 8, 10, 12, 13, 15, 17, 19, 20, 22, 23, 26, and 28 are added to calculate an athlete's RIA-RE (item 13 on this construct also requires reverse scoring). A minimum score of 0 would indicate a complete absence of any RIA-RE and a maximum

	Not at all	Somewhat	Moderately so	Very much so
1. I am worried about becoming re-injured during rehabilitation	0	1	2	3
2. I am worried about becoming re-injured during re-entry into competition	0	1	2	3
3. I feel nervous about becoming re-injured during rehabilitation	0	1	2	3
4. I feel nervous about becoming re-injured during re-entry into competition	0	1	2	3
5. I have doubts that I will remain injury free during rehabilitation	0	1	2	3
6. I have doubts that I will remain injury free during re-entry into competition	0	1	2	3
7. I feel on edge about becoming re-injured during rehabilitation	0	1	2	3
8. I feel on edge about becoming re-injured during re-entry into competition	0	1	2	3
9. I am worried that I may not do as well as I could in rehabilitation due to re-injury worries	0	1	2	3
10. I am worried that I may not do as well as I could on returning to competition due to re-injury worries	0	1	2	3
11. My body feels tense about rehabilitation because of re-injury worries	0	1	2	3
12. My body feels tense about re-entering competition because of re-injury worries	0	1	2	3
13. I feel confident that I will not become re-injured during re-entry into competition	0	1	2	3
14. I am worried about failing during rehabilitation due to my re-injury worries	0	1	2	3
15. I am worried about failing when re-entering into competition due to re-injury worries	0	1	2	3
16. Re-injury worries about rehabilitation make my body feel tense	0	1	2	3
17. Re-injury worries about re-entry into competition make my body feel tense	0	1	2	3
18. I am worried about performing poorly during rehabilitation due to re-injury worries	0	1	2	3
19. I am worried about performing poorly during re-entry into competition due to re-injury worries	0	1	2	3
20. I am worried about failing to achieve full re-entry into competition due to re-injury worries	0	1	2	3
21. I feel my stomach sinking due to re-injury worries during rehabilitation	0	1	2	3
22. I am worried that others will be disappointed if I become re-injured during re-entry into competition	0	1	2	3
23. The thought of re-injury during re-entry into competition makes my palms sweaty	0	1	2	3
24. I am confident about not becoming re-injured during rehabilitation because I mentally picture myself staying injury free	0	1	2	3
25. I am worried about concentrating during rehabilitation because of re-injury worries	0	1	2	3
26. I am worried about concentrating during re-entry into competition because of re-injury worries	0	1	2	3
27. My body feels tight due to re-injury worries during rehabilitation	0	1	2	3
28. My body feels tight due to re-injury worries during re-entry into competition	0	1	2	3

score of 45 would indicate that the injured athlete was extremely anxious about re-injury in re-entry into training/competition. Both RIA-R and RIA-RE demonstrated high internal consistency above the .70 criterion value (Tabachnick & Fidell, 1996). When exploring the independence of the RIAI constructs a moderate correlation ($r = .53$) was evident. This reflects that re-injury anxieties concerning rehabilitation and re-entry are not totally independent constructs. It is therefore likely that an injured athlete exhibiting re-injury anxieties regarding re-entry into competition would have some re-injury anxieties during their rehabilitation.

It is accepted that establishing the validity of an instrument is an ongoing process (Anastasi & Urbina, 1997). Therefore further analyses of the RIAI are advocated. It should be noted that items 9, 14, 15, 18–20, 25, and 26 appear to reflect meta-worries (i.e., worries about worries).¹ For these items respondents are being asked to perform what seems to be a difficult task, differentiating worries about re-injury from worries about worries from re-injury. However, during the item comprehension analyses no athlete reported that they found these items difficult to respond to. These items could be reworded so not to require respondents to respond to meta-worries. This could be explored in further analyses of the RIAI. It is recommended that the validity of the RIAI is tested further the extent to which findings from the present study are consistent across samples. Future studies should compare the responses of severely and non-severely injured athletes, and presently injured and recovered athletes to assess concurrent validity. Future research is also needed to explore the predictive validity of the RIAI. Predictive validity can be determined by an accumulation of evidence or hypotheses that operational definitions of the RIAI constructs are related to other constructs as predicted. For example, exploring whether contact sport participants are likely to have higher RIA-RE than non-contact sport participants. Taylor and Taylor (1997) proposed that re-injury anxiety impacts on performance on the return to competition. The RIAI could be used to explore differences between athletes who produce good performances on re-entry into competition and those who do not. Performance in rehabilitation could also be explored, in particular, rehabilitation adherence could be examined. Pizzari, McBurney, Taylor, and Feller (2002) reported reduced adherence to rehabilitation where re-injury anxiety is manifest. The nature of this relationship warrants further examination. Heil (1993) proposed that injury anxiety in rehabilitation could potentially impact on the speed of rehabilitation. This relationship could be explored in a homogeneous sample of injured athletes related to re-injury anxiety. The developed scale could also be used to examine proposed links between re-injury anxieties and physiological and psychological effects (e.g., muscle tension and distraction) as suggested by Heil (1993). Furthermore, given the potential impact of re-injury anxiety the RIAI could be used as the measurement tool to explore the usefulness of psychological interventions that could be employed to assist athletes in managing their re-injury anxieties and used to identify athletes who may need interventions.

Future research should attempt to explore the RIAI's convergent validity because convergent validity is an area in which the RIAI is currently deficient. In examining convergent validity the researcher determines the degree to which the current measure is similar to other measures to which it should be theoretically. For example, researchers could examine the degree to which the RIAI converges with the Tampa Scale of Kinesiophobia (TSK; Kori, Miller, & Todd, 1990).

5. Conclusion

Prior to the current research no researchers had attempted to develop a valid and reliable tool to measure re-injury anxiety. Therefore, there were no a priori predictions as to which constructs exist, how they would relate to the items on the inventory, and how the constructs relate to each other. Without these predictions EFA is required (Fabrigar et al., 1999). However, following the present study confirmatory factor analysis (CFA) is now recommended in order to test the proposed 2-factor model presented in the current research. CFA has the advantage of testing the data against a proposed model and the fit of the model is assessed using more stringent criteria (Lane et al., 1999). Research is ongoing to explore the RIAI using CFA.

Conflict of Interest Statement

No author of the current manuscript has any conflict of interest.

Ethical Approval

All procedures were approved by the School of Health Ethics Committee at the University of Surrey, St. Mary's College.

References

- Anastasi, A., & Urbina, S. (Eds.). (1997). *Psychological testing* (7th ed.). NJ: Prentice Hall.
- Andersen, M. B. (2001). Returning to action and the prevention of future injury. In J. Crossman (Ed.), *Coping with sports injuries: Psychological strategies for rehabilitation* (pp. 162–173). New York: Oxford University Press.
- Andersen, M. B., & Williams, J. M. (1988). A model of stress and athletic injury: prediction and prevention. *Journal of Sport & Exercise Psychology*, 10(3), 294–306.
- Bianco, T. (2001). Social support and recovery from sport injury: elite skiers share their experiences. *Research Quarterly for Exercise & Sport*, 72(4), 376–388.
- Bianco, T., Malo, S., & Orlick, T. (1999). Sport injury and illness: elite skiers describe their experiences. *Research Quarterly for Exercise & Sport*, 70(2), 157–169.
- Brace, N., Kemp, R., & Snelgar, R. (2003). *SPSS for psychologists: A guide to data analysis using SPSS for windows* (2nd ed.). NJ: Lawrence Erlbaum Associates.
- Brewer, B. W. (2001). Psychology of sport injury rehabilitation. In R. N. Singer, H. A. Hausenblas, & C. M. Janelle (Eds.), *Handbook of sport psychology* (2nd ed.). (pp. 787–809) New York: Wiley.
- Cassidy, C. M. (2006). Understanding sport-injury anxiety. *Athletic Therapy Today*, 11(4), 57–58.
- Castillo, R., Cremades, J. G., & Butcher, M. (2002). Relaxation techniques as a method to reduce re-injury anxiety in athletes. *Journal of Sport and Exercise Psychology*, 24, 42.
- Chase, M., Magyar, M., & Drake, B. M. (2005). Fear of injury in gymnastics, self-efficacy and psychological strategies to keep on tumbling. *Journal of Sports Sciences*, 23(5), 465–475.
- Cronbach, L. J. (1951). Coefficient alpha and internal structure of tests. *Psychometrika*, 16, 297–334.
- Crossman, J. (1997). Psychological rehabilitation from sports injuries. *Sports Medicine*, 23(5), 333–339.
- Cupal, D. D., & Brewer, B. W. (2001). Effects of relaxation and guided imagery on knee strength, re-injury anxiety and pain following anterior cruciate ligament reconstruction. *Rehabilitation Psychology*, 46, 28–43.
- Driediger, M., Hall, C., & Callow, N. (2006). Imagery use by injured athletes: a qualitative analysis. *Journal of Sports Sciences*, 24(3), 261–271.
- Evans, L., Hardy, L., Mitchell, I., & Rees, T. (2008). The development of a measure of psychological responses to injury. *Journal of Sport Rehabilitation*, 16, 21–37.
- Evans, L., Hardy, L., & Mullen, R. (1996). The development of the psychological responses to sport injury inventory. *Journal of Sport & Exercise Science*, 14, 27–28.
- Evans, L., Mitchell, I., & Jones, S. (2006). Psychological responses to sport injury: a review of current research. In S. Hanton, & S. D. Mellalieu (Eds.), *Literature reviews in sport psychology* (pp. 289–319). New York: Nova Science.
- Fabrigar, L. R., Wegener, D. T., MacCallum, R. C., & Strahan, E. J. (1999). Evaluating the use of exploratory factor analysis in psychology research. *Psychological Methods*, 4, 272–299.
- Feltz, D. L. (1986). The psychology of sports injuries. In P. E. Vinger, & E. F. Hoerner (Eds.), *Sports injuries: The unthwarted epidemic* (2nd ed.). (pp. 336–344) Boston, MA: John Wright.

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- Ford, I. W., & Gordon, S. (1998). Perspectives of sport trainers and athletic therapists on the psychological content of their practice and training. *Journal of Sport Rehabilitation*, 7, 79–94.
- Gallagher, B. V., & Gardner, F. L. (2007). An examination of the relationship between early maladaptive schemas, coping, and emotional response to athletic injury. *Journal of Clinical Sport Psychology*, 1, 47–67.
- Gorsuch, R. L. (1983). *Factor analysis* (2nd ed.). NJ: Lawrence Erlbaum Associates.
- Gorsuch, R. L. (1997). Exploratory factor analysis: its role in item analysis. *Journal of Personality Assessment*, 68, 532–560.
- Gould, D., & Udry, E. (1994). The psychology of knee injuries and injury rehabilitation. In L. Y. Griffin (Ed.), *Rehabilitation of the injured knee* (2nd ed.). (pp. 86–98) St. Louis, MO: Mosby.
- Gould, D., Udry, E., Bridges, D., & Beck, L. (1997). Stress sources encountered when rehabilitating from season-ending ski injuries. *Sport Psychologist*, 11(4), 361–378.
- Granito, V. J. (2001). Athletic injury experience: a qualitative focus group approach. *Journal of Sport Behavior*, 24(1), 63–85.
- Guadagnoli, E., & Velicer, W. F. (1988). Relation of sample size to the stability of component patterns. *Psychological Bulletin*, 10, 265–275.
- Hackfort, D., & Schwenkmezger, P. (1993). Anxiety. In R. N. Singer, M. Murphy, & L. K. Tennant (Eds.), *Handbook of research on sport psychology* (pp. 328–364). New York: MacMillan.
- Häggglund, M., Waldén, M., Bahr, R., & Ekstrand, J. (2005). Methods for epidemiological study of injuries to professional football players: developing the UEFA model. *British Journal of Sports Medicine*, 39, 340–346.
- Heijne, A., Axelsson, K., Wener, S., & Biguet, G. (2008). Rehabilitation and recovery after anterior cruciate ligament reconstruction: patients' experiences. *Scandinavian Journal of Medicine and Science in Sports*, 18, 325–335.
- Heil, J. (1993). *Psychology of sport injury*. Champaign, IL: Human Kinetics.
- Johnston, L. H., & Carroll, D. (1998). The context of emotional responses to athletic injury: a qualitative analysis. *Journal of Sport Rehabilitation*, 7, 206–220.
- Kleinert, J. (2002). An approach to sport injury trait anxiety: scale construction and structure analysis. *European Journal of Sport Science*, 2(3), 49–57.
- Kori, S. H., Miller, R. P., & Todd, D. D. (1990). Kinesophobia: a new view of chronic pain behaviour. *Pain Management* 35–43.
- Kvist, J., Ek, A., Sporrstedt, K., & Good, L. (2005). Fear of re-injury: a hindrance for returning to sports after anterior cruciate ligament reconstruction. *Knee Surgery, Sports Traumatology, Arthroscopy*, 13(5), 393–397.
- Lane, A. M., Sewell, D. F., Terry, P. C., Bartram, D., & Nesti, M. S. (1999). Confirmatory factor analysis of the Competitive State Anxiety Inventory-2. *Journal of Sports Sciences*, 17, 505–512.
- Martens, R., Vealey, R. S., & Burton, D. (1990). *Competitive anxiety in sport*. Champaign, IL: Human Kinetics.
- Nunnally, J., & Bernstein, I. (1994). *Psychometric Theory*. New York: McGraw-Hill.
- Petitpas, A., & Danish, S. (1995). Caring for the injured athlete. In S. Murphy (Ed.), *Sport psychology interventions* (pp. 255–284). Champaign, IL: Human Kinetics.
- Pizzari, T., McBurney, H., Taylor, N., & Feller, J. (2002). Adherence to anterior cruciate ligament rehabilitation: a qualitative analysis. *Journal of Sport Rehabilitation*, 11(2), 89–101.
- Podlog, L., & Eklund, R. C. (2005). Return to sport after serious injury: a retrospective examination of motivation and psychological outcomes. *Journal of Sport Rehabilitation*, 14, 20–34.
- Podlog, L., & Eklund, R. C. (2006). A longitudinal investigation of competitive athletes' return to sport following serious injury. *Journal of Applied Sport Psychology*, 18(1), 44–68.
- Rotella, R. J., & Campbell, M. S. (1983). Systematic desensitization: psychological rehabilitation of injured athletes. *Athletic Training*, 18, 140–142.
- Rotella, R. J., & Heyman, S. R. (1986). Stress, injury, and the psychological rehabilitation of athletes. In J. M. Williams (Ed.), *Applied sport psychology: Personal growth to peak performance* (pp. 343–364). Palo Alto, CA: Mayfield.
- Short, S. E., Reuter, J., Brandt, J., & Short, M. W. (2005). The relationship among three components of perceived risk of injury, previous injuries and gender in contact sport athletes. *Athletic Insight*, 7(1), 20–42.
- Tabachnick, B. G., & Fidell, L. S. (1996). *Using multivariate statistics* (3rd ed.). New York: Harper Collins.
- Taylor, J., & Taylor, S. (1997). *Psychological approaches to sports injury rehabilitation*. MD: Aspen.
- Tripp, D. A., Ebel-Lam, A., Stanish, W., & Brewer, B. W. (2007). Fear of reinjury, negative affect, and catastrophizing predicting return to sport in recreational athletes with anterior cruciate ligament injuries at 1 year postsurgery. *Rehabilitation Psychology*, 52(1), 74–81.
- Vlachopoulos, S. P., Karageorghis, C. I., & Terry, P. C. (2000). Hierarchical confirmatory factor analysis of the Flow State Scale in an exercise setting. *Journal of Sports Sciences*, 18, 815–824.
- Walker, N. C. (2006). The meaning of sports injury and re-injury anxiety assessment and intervention. Unpublished doctorate, University of Wales, Aberystwyth, Aberystwyth.
- Wiese-Bjornstal, D. M., Smith, A. M., Shaffer, S. M., & Morrey, M. A. (1998). An integrated model of response to sport injury: psychological and social dynamics. *Journal of Applied Sport Psychology*, 10(1), 46–69.
- Williams, J. M., & Andersen, M. B. (1998). Psychosocial antecedents of sport injury: review and critique of the stress and injury model. *Journal of Applied Sport Psychology*, 10(1), 5–25.
- Williams, J. M., & Roepke, N. (1993). Psychology of injury and injury rehabilitation. In R. N. Singer, M. Murphy, & L. K. Tennant (Eds.), *Handbook of research on sport psychology* (pp. 815–839). New York: MacMillan.