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Research Paper

Psychosocial Factors in Injury Recovery and Return-to-Sport Outcomes among Competitive Athletes: A Prospective Observational Study

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ABSTRACT

Background: Return to sport (RTS) following athletic injury is a complex, multidimensional process influenced by both physical recovery and psychosocial factors. While advances in sports medicine have improved surgical and rehabilitative outcomes, a substantial proportion of athletes fail to return to their pre-injury level of competition. Psychological constructs such as fear of reinjury, kinesiophobia, pain catastrophizing, motivation, self-efficacy, and social support have been increasingly recognized as critical determinants of rehabilitation success. **Purpose:** To investigate the influence of psychosocial factors on injury recovery and return-to-sport outcomes among state- and national-level athletes using validated psychological assessment tools. **Study Design:** Prospective observational cohort study. **Methods:** Eighty competitive athletes (aged 20–25 years) undergoing rehabilitation for sports-related injuries were followed over a 12-month period. Psychosocial variables were assessed using the Tampa Scale for Kinesiophobia (TSK-11), Pain Catastrophizing Scale (PCS), Athletic Injury Self-Efficacy Scale, and Multidimensional Scale of Perceived Social Support (MSPSS). Return-to-sport status was evaluated at 12 months post-injury. Statistical analyses included independent t-tests, Pearson correlation, and multivariate logistic regression. **Results:** At 12 months, 62.5% of athletes returned to their pre-injury level of sport. Athletes who returned demonstrated significantly lower kinesiophobia and pain catastrophizing scores and higher self-efficacy and social support ($p < .001$). Kinesiophobia emerged as the strongest independent predictor of RTS after controlling for demographic and injury-related variables. **Conclusion:** Psychosocial factors significantly influence injury recovery and return-to-sport outcomes. Incorporating psychological screening and targeted interventions into sports rehabilitation programs may enhance RTS success and long-term athletic performance.

Keywords: *Return to sport; sports injury rehabilitation; kinesiophobia; psychosocial factors; athletic recovery*

Sports Injury and the Return-to-Sport Challenge

Sports participation at competitive levels inherently carries a risk of injury, with musculoskeletal injuries representing one of the most common causes of time loss among athletes. Epidemiological studies consistently report high injury incidence across both contact and non-contact sports, particularly among athletes competing at state and national

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levels (1). While many injuries heal adequately from a biological standpoint, successful return to sport (RTS) remains a major clinical and performance challenge.

RTS is not merely the absence of pain or restoration of physical function; rather, it is a multifactorial outcome involving physical readiness, psychological preparedness, and contextual influences such as coaching expectations and social support systems (2). Despite advancements in surgical techniques, physiotherapy, and sports rehabilitation protocols, studies indicate that 30–40% of athletes do not return to their pre-injury level of sport, even after being medically cleared (3). This discrepancy has prompted growing attention toward non-physical determinants of recovery.

Historically, injury rehabilitation models emphasized biomechanical healing and physical performance metrics. However, over the past two decades, sports medicine research has increasingly acknowledged the limitations of a purely biomedical approach (4). Psychological responses to injury—such as fear, anxiety, frustration, and loss of confidence—are now recognized as integral components of the recovery process (5). Failure to address these factors may result in suboptimal rehabilitation adherence, prolonged recovery timelines, and premature dropout from competitive sport.

Psychosocial Responses to Athletic Injury

Athletic injury represents a significant psychological stressor, often disrupting an athlete's identity, routine, and future career aspirations. Wiese-Bjornstal et al. proposed one of the most influential frameworks in sports injury psychology, describing injury response as an interaction between cognitive appraisals, emotional responses, and behavioral outcomes (6). According to this model, how an athlete interprets the injury—rather than the injury itself—plays a critical role in shaping recovery behaviors.

Negative psychological responses such as depression, anxiety, anger, and fear of reinjury are commonly reported during rehabilitation (7). Among these, fear-related constructs have gained particular attention due to their consistent association with delayed RTS. Fear of reinjury may lead athletes to subconsciously restrict movement, reduce training intensity, or avoid sport specific tasks, even when physical healing is complete (8).

Pain catastrophizing, characterized by rumination, magnification, and feelings of helplessness toward pain, has also been linked to poorer functional outcomes and increased disability across orthopedic and sports populations (9). Athletes who catastrophize pain may misinterpret normal rehabilitation discomfort as a sign of reinjury, reinforcing avoidance behaviors and increasing psychological distress.

Kinesiophobia and Fear-Avoidance Behavior

Kinesiophobia, defined as an excessive and irrational fear of physical movement due to a perceived risk of injury or reinjury, is a central construct within fear-avoidance models (10). Originally studied in chronic pain populations, kinesiophobia has increasingly been applied to athletic injury contexts, particularly following ligamentous injuries such as anterior cruciate ligament (ACL) tears.

Multiple studies have demonstrated that elevated kinesiophobia scores are associated with reduced physical performance, lower functional scores, and failure to return to competitive sport (11–13). Importantly, fear of reinjury has been shown to persist even in the absence of

pain or objective physical deficits, highlighting its psychological rather than physiological origin (14).

The Tampa Scale for Kinesiophobia (TSK) is one of the most widely used instruments for assessing fear of movement. Adapted versions such as the TSK-11 have demonstrated strong reliability and validity in athletic populations (15). Given its predictive value for functional outcomes, kinesiophobia represents a critical target for psychological assessment and intervention during rehabilitation.

Role of Self-Efficacy and Motivation in Rehabilitation

While fear-based constructs may hinder recovery, positive psychological attributes can facilitate successful rehabilitation. Self-efficacy, defined as an individual's belief in their capability to execute behaviors necessary to achieve specific outcomes, has been consistently associated with improved rehabilitation adherence and performance (16).

Athletes with high self-efficacy are more likely to engage fully in rehabilitation exercises, tolerate discomfort, and maintain motivation during prolonged recovery periods (17). In contrast, low self-efficacy has been associated with increased dropout rates, reduced effort, and slower functional recovery (18).

Motivation, particularly intrinsic motivation, further influences rehabilitation success. According to Self-Determination Theory, athletes who perceive rehabilitation as personally meaningful and autonomy-supportive demonstrate greater persistence and psychological well-being (19). Studies have shown that alignment between athlete and therapist motivation enhances rehabilitation outcomes and satisfaction (20).

Social Support and the Rehabilitation Environment

Social support plays a vital yet often underappreciated role in injury recovery. Support from coaches, teammates, family members, and healthcare professionals can buffer psychological stress, enhance coping strategies, and improve adherence to rehabilitation programs (21). Perceived social support has been positively associated with confidence, reduced anxiety, and psychological readiness to return to sport (22).

Conversely, negative social pressures—such as fear of letting the team down or premature return expectations—may exacerbate stress and fear of reinjury (23). The rehabilitation environment, therefore, functions as a social system that can either facilitate or impede recovery.

Rationale and Study Objectives

Despite growing recognition of psychosocial influences on injury recovery, empirical research examining multiple psychosocial constructs simultaneously in competitive athletes remains limited. Many studies focus on single injury types or isolated psychological variables, reducing generalizability across sports contexts.

Therefore, the primary objective of this study was to examine the association between key psychosocial factors—kinesiophobia, pain catastrophizing, self-efficacy, motivation, and social support—and return-to-sport outcomes in state- and national-level athletes aged 20–25 years. A secondary objective was to identify independent psychological predictors of RTS using multivariate analysis.

THEORETICAL FOUNDATIONS OF PSYCHOSOCIAL RESPONSES TO SPORTS INJURY

Integrated Model of Psychological Response to Injury

The psychological response to sports injury is best understood through multidimensional theoretical frameworks. Among the most influential is the Integrated Model of Psychological Response to Sport Injury, proposed by Wiese-Bjornstal and colleagues (6). This model conceptualizes injury response as a dynamic interaction between personal factors (e.g., personality traits, previous injury history), situational factors (e.g., type of sport, social environment), and cognitive appraisals of the injury.

According to this framework, an athlete's cognitive interpretation of the injury—such as perceived severity, expected recovery time, and threat to athletic identity—shapes emotional responses including fear, anxiety, anger, and depression (6). These emotional responses subsequently influence behavioral outcomes, including rehabilitation adherence, risk-taking behaviors, and return-to-sport decisions. Importantly, the model emphasizes bidirectional feedback loops, whereby emotional and behavioral responses can further modify cognitive appraisals over time.

Empirical support for this model has been demonstrated across various injury types and athletic populations. Athletes who appraise injury as a catastrophic or career-threatening event are more likely to experience maladaptive emotional responses and exhibit avoidance behaviors during rehabilitation (24). Conversely, athletes who interpret injury as a manageable setback tend to demonstrate adaptive coping strategies and higher rehabilitation engagement.

Fear-Avoidance Model and Kinesiophobia

The Fear-Avoidance Model provides a complementary theoretical explanation for how fear-related constructs influence physical recovery (10). Originally developed in chronic pain research, this model has been increasingly applied to sports injury rehabilitation. According to the model, individuals who catastrophize pain are more likely to develop fear of movement, leading to avoidance behaviors that perpetuate disability and delayed recovery.

In athletic populations, fear-avoidance behavior manifests as reduced willingness to perform sport-specific movements, hesitancy during high-demand tasks, and decreased confidence in physical capabilities (11). Over time, such avoidance may result in deconditioning, altered movement patterns, and increased reinjury risk, thereby reinforcing fear beliefs (25).

Kinesiophobia, as measured by the Tampa Scale for Kinesiophobia, is considered a central construct within the fear-avoidance framework. Studies have consistently demonstrated elevated kinesiophobia scores among athletes who fail to return to sport following injury, particularly after ACL reconstruction and shoulder instability (12,13,26). Importantly, kinesiophobia has been shown to predict RTS outcomes independently of objective physical function, underscoring its psychological nature (14).

Cognitive Appraisals and Pain Catastrophizing

Pain catastrophizing represents another cognitive construct with significant implications for injury recovery. Defined as an exaggerated negative orientation toward pain stimuli and experiences, catastrophizing involves rumination, magnification, and feelings of

helplessness (9). In injured athletes, pain catastrophizing has been associated with increased pain perception, emotional distress, and reduced tolerance for rehabilitation discomfort (27). Several studies have demonstrated that athletes with high catastrophizing scores report poorer functional outcomes despite similar injury severity and physical rehabilitation protocols (28). Catastrophizing may amplify fear of reinjury by reinforcing maladaptive interpretations of pain sensations, thereby contributing to avoidance behaviors (29).

Within the integrated psychological response framework, catastrophizing functions as a maladaptive cognitive appraisal that intensifies emotional distress and disrupts behavioral engagement in rehabilitation. Addressing catastrophizing through cognitive-behavioral strategies has therefore been proposed as a critical component of comprehensive injury rehabilitation programs (30).

POSITIVE PSYCHOLOGICAL CONSTRUCTS IN INJURY REHABILITATION

Self-Efficacy and Rehabilitation Adherence

While negative psychological constructs may hinder recovery, positive psychological resources play a crucial role in facilitating successful rehabilitation. Self-efficacy, derived from Bandura's social cognitive theory, refers to an individual's belief in their capacity to perform specific behaviors required to achieve desired outcomes (16).

In the context of sports injury, self-efficacy influences an athlete's willingness to engage in rehabilitation exercises, tolerate discomfort, and persist through setbacks (17). Athletes with high rehabilitation self-efficacy demonstrate greater adherence to prescribed programs and report higher satisfaction with recovery outcomes (31).

Longitudinal studies have shown that self-efficacy measured early in rehabilitation predicts functional outcomes and RTS status months later, even after controlling for injury severity (32). Interventions aimed at enhancing self-efficacy—such as mastery experiences, verbal persuasion, and modeling—have been associated with improved rehabilitation engagement (33).

Motivation and Self-Determination Theory

Motivation represents another key psychological determinant of rehabilitation success. Self-Determination Theory (SDT) distinguishes between intrinsic motivation, extrinsic motivation, and amotivation, emphasizing the role of autonomy, competence, and relatedness in fostering sustained behavioral engagement (19).

Athletes who perceive rehabilitation as autonomous and personally meaningful are more likely to demonstrate persistence, psychological well-being, and adaptive coping strategies (34). In contrast, externally controlled motivation—such as pressure from coaches or contractual obligations—may undermine intrinsic motivation and increase psychological stress (35).

Research has demonstrated that alignment between athlete and therapist motivational orientations enhances rehabilitation adherence and outcomes (20). Rehabilitation environments that support autonomy, provide clear feedback, and foster relatedness have been shown to enhance intrinsic motivation and psychological readiness for RTS (36).

SOCIAL SUPPORT AND ENVIRONMENTAL INFLUENCES

Types of Social Support

Social support encompasses emotional, informational, and instrumental assistance provided by significant others. In the context of sports injury rehabilitation, support may be derived from coaches, teammates, family members, medical professionals, and peers (21).

Emotional support—such as empathy and encouragement—has been associated with reduced anxiety and depressive symptoms during recovery (22). Informational support, including education about injury and rehabilitation progress, enhances confidence and reduces uncertainty (37). Instrumental support, such as logistical assistance and access to resources, facilitates rehabilitation adherence.

Social Environment and Return-to-Sport Readiness

The social environment surrounding an injured athlete can either facilitate or impede psychological recovery. Positive rehabilitation climates characterized by trust, open communication, and supportive leadership are associated with improved psychological readiness to return to sport (38). Conversely, negative social pressures—such as fear of replacement or pressure to return prematurely—may exacerbate fear of reinjury and stress (23).

Recent studies emphasize the importance of educating coaches and teammates about psychological recovery processes to foster supportive environments that promote safe and confident RTS (39). Integrating psychosocial education into sports organizations has been proposed as a strategy to optimize long-term athlete health and performance.

GAPS IN EXISTING LITERATURE

Despite substantial theoretical and empirical advances, several gaps remain in the literature. First, many studies focus on single injury types, limiting generalizability across sports contexts. Second, psychological variables are often examined in isolation, despite evidence that multiple psychosocial factors interact to influence recovery outcomes. Third, limited research has examined competitive athletes in early adulthood (20–25 years), a critical period for athletic development and career progression.

Furthermore, few studies have employed multivariate models to identify independent psychosocial predictors of RTS while controlling for demographic and injury-related variables. Addressing these gaps is essential for developing comprehensive, evidence-based rehabilitation strategies.

Study Hypotheses

Based on the reviewed literature and theoretical frameworks, the following hypotheses were formulated:

1. Athletes who return to sport will demonstrate significantly lower kinesiophobia and pain catastrophizing scores compared to athletes who do not return to sport.
2. Athletes who return to sport will report significantly higher levels of self-efficacy and perceived social support.
3. Kinesiophobia will emerge as an independent predictor of return-to-sport outcomes after controlling for demographic variables.

METHODOLOGY

Study Design

This study employed a prospective observational cohort design to examine the relationship between psychosocial factors and return-to-sport (RTS) outcomes following sports injury. A prospective design was selected to allow temporal assessment of psychosocial variables during rehabilitation and subsequent evaluation of RTS status at a defined follow-up period. Observational methodology was deemed appropriate due to ethical and practical constraints surrounding experimental manipulation of psychological variables in injured athletes.

The study was conducted in accordance with the principles outlined in the Declaration of Helsinki and adhered to internationally accepted ethical standards for research involving human participants (40).

Study Setting

Participants were recruited from sports medicine departments, physiotherapy rehabilitation centers, and institutional sports academies affiliated with state and national sports federations. All rehabilitation programs followed evidence-based physical therapy protocols tailored to injury type and sport demands. Psychological interventions were not systematically introduced during the study period, allowing natural variation in psychosocial responses to be observed.

Participants

Sample Size and Characteristics

A total of 80 competitive athletes participated in the study. The sample size was determined based on previous psychosocial RTS studies demonstrating adequate statistical power with cohorts ranging from 60 to 120 athletes (13,14). Participants included 52 males (65%) and 28 females (35%), with a mean age of 22.3 ± 1.5 years.

All athletes competed at state or national levels in sports including athletics, football, basketball, volleyball, hockey, badminton, and kabaddi. Injuries involved both contact and non-contact mechanisms and affected multiple anatomical regions.

Injury Characteristics

Injury distribution within the sample was as follows:

- Lower-limb injuries: 55%
- Upper-limb injuries: 30%
- Trunk and spinal injuries: 15%

Common diagnoses included ligament sprains, muscle strains, meniscal injuries, shoulder instability, and stress fractures. Injury severity ranged from moderate (4–6 weeks time loss) to severe (>12 weeks time loss).

Inclusion and Exclusion Criteria

Inclusion Criteria

1. Age between 20 and 25 years
2. State- or national-level competitive athlete
3. Sports-related musculoskeletal injury requiring structured rehabilitation
4. Minimum rehabilitation duration of four weeks
5. Willingness to provide informed consent

Exclusion Criteria

1. Neurological or traumatic brain injury
2. History of diagnosed psychiatric disorder
3. Concurrent chronic pain conditions unrelated to sport injury
4. Previous major surgery within 12 months unrelated to the index injury

Ethical Considerations

Ethical approval was obtained from the Institutional Ethics Committee prior to data collection. All participants provided written informed consent after receiving a detailed explanation of study objectives, procedures, potential risks, and benefits. Confidentiality was maintained by anonymizing data and restricting access to research personnel only.

Participants were informed that refusal to participate or withdrawal from the study would not affect their medical care or athletic status.

Psychosocial Assessment Instruments

To ensure methodological rigor, validated and widely used psychometric instruments were employed to assess psychosocial constructs relevant to injury recovery.

- **Tampa Scale for Kinesiophobia (TSK-11):** The Tampa Scale for Kinesiophobia (TSK-11) was used to assess fear of movement and reinjury (9). The instrument consists of 11 items rated on a 4-point Likert scale, with higher scores indicating greater kinesiophobia. The TSK-11 has demonstrated strong reliability (Cronbach's $\alpha = .79–.83$) and validity in athletic and orthopedic populations (15,41).
- **Pain Catastrophizing Scale (PCS):** Pain catastrophizing was assessed using the Pain Catastrophizing Scale, which includes 13 items measuring rumination, magnification, and helplessness (10). Participants rate the frequency of catastrophic thoughts related to pain on a 5-point Likert scale. The PCS has been extensively validated in musculoskeletal injury populations and exhibits excellent internal consistency ($\alpha > .90$) (27).
- **Athletic Injury Self-Efficacy Scale:** Self-efficacy related to injury rehabilitation was measured using the Athletic Injury Self-Efficacy Scale (11). This scale assesses confidence in performing rehabilitation exercises, coping with discomfort, and progressing through recovery milestones. Higher scores indicate greater perceived self-efficacy. Previous studies have demonstrated strong predictive validity for rehabilitation adherence and functional outcomes (32).
- **Multidimensional Scale of Perceived Social Support (MSPSS):** Perceived social support was measured using the MSPSS, a 12-item scale assessing support from family, friends, and significant others (12). Responses are rated on a 7-point Likert scale. The MSPSS has demonstrated robust psychometric properties across diverse populations, including athletes (21).

Data Collection Procedure

Baseline psychosocial assessments were conducted midway through rehabilitation to capture stable psychological responses rather than acute injury reactions. Participants completed questionnaires under the supervision of trained researchers to ensure comprehension and minimize missing data.

Return-to-sport status was assessed 12 months post-injury via structured interviews and verification with coaching staff or medical records. RTS was operationally defined as return to pre-injury level of competitive participation.

Outcome Variables

The primary outcome variable was return-to-sport status (yes/no). Secondary outcome variables included:

- Time to return to sport
- Self-reported confidence at return
- Perceived readiness to perform sport-specific tasks

Statistical Analysis

Data analysis was conducted using SPSS (Version 26.0). Descriptive statistics were computed for demographic, injury, and psychosocial variables. Normality was assessed using the Shapiro–Wilk test.

- Independent t-tests were used to compare psychosocial variables between RTS and non-RTS groups.
- Pearson correlation coefficients assessed relationships between psychosocial variables and RTS outcomes.
- Multivariate logistic regression analysis identified independent predictors of RTS after controlling for age, sex, and injury severity.
- Statistical significance was set at $p < .05$.

RESULTS

Participant Flow and Follow-Up

All 80 enrolled athletes completed baseline psychosocial assessments. At the 12-month follow-up, return-to-sport (RTS) status was successfully obtained for 100% of participants, with no loss to follow-up. This complete follow-up enhances the internal validity of the study and reduces attrition bias (42).

Return-to-Sport Outcomes

At 12 months post-injury:

1. 50 athletes (62.5%) returned to their pre-injury level of sport
2. 30 athletes (37.5%) did not return to pre-injury competitive level

Among the non-returning athletes, reasons cited included fear of reinjury (43%), lack of confidence (27%), persistent pain despite physical clearance (17%), and external factors such as academic or occupational commitments (13%).

Demographic and Injury Characteristics

No statistically significant differences were observed between the RTS and non-RTS groups with respect to age, sex, or injury location ($p > .05$), indicating that demographic variables did not confound RTS outcomes.

Variable	RTS (n = 50)	Non-RTS (n = 30)	p
Age (years)	22.2 ± 1.4	22.5 ± 1.6	.41
Male (%)	64%	67%	.78
Lower-limb injury (%)	56%	53%	.81

Psychosocial Variables: Group Comparisons

1. Kinesiophobia (TSK-11)

Athletes who returned to sport demonstrated significantly lower kinesiophobia scores compared with those who did not return.
RTS group: 25.3 ± 5.1
Non-RTS group: 34.7 ± 4.9
Mean difference: 9.4 (95% CI: 6.5–12.3)
$t(78) = 8.21$, $p < .001$

This represents a large effect size (Cohen's $d = 1.45$), indicating a clinically meaningful difference in fear of movement between groups. These findings are consistent with prior research identifying kinesiophobia as a major barrier to RTS (11,14).

2. Pain Catastrophizing (PCS)

Pain catastrophizing scores were significantly higher in the non-RTS group.
RTS group: 12.4 ± 4.6
Non-RTS group: 21.8 ± 5.2
$t(78) = 8.04$, $p < .001$
Subscale analysis revealed that rumination and helplessness scores were particularly elevated among non-returning athletes. This aligns with literature suggesting that catastrophic pain cognitions amplify fear-avoidance behavior and impair rehabilitation progress (9,27).

3. Self-Efficacy

Self-efficacy scores were significantly higher among athletes who successfully returned to sport.
RTS group: 4.2 ± 0.5
Non-RTS group: 3.4 ± 0.7
$t(78) = 5.67$, $p < .01$

Athletes with higher self-efficacy reported greater confidence in performing sport-specific movements and managing rehabilitation challenges. These findings support previous evidence that self-efficacy predicts rehabilitation adherence and functional outcomes (16,32).

4. Perceived Social Support

Perceived social support differed significantly between groups.
RTS group: 68.5 ± 9.2
Non-RTS group: 54.3 ± 10.1
$t(78) = 6.34$, $p < .001$
Family and coach support subscales showed the strongest associations with RTS outcomes, highlighting the role of the social environment in recovery processes (21,38).

Correlation Analysis

Pearson correlation coefficients revealed significant relationships between psychosocial variables and RTS status:

Variable	Correlation with RTS
Kinesiophobia (TSK)	$r = –0.52$
Pain catastrophizing	$r = –0.47$

Self-efficacy r = 0.49
Social support r = 0.45
All correlations were statistically significant ($p < .01$). These results indicate that lower fear and catastrophizing, and higher self-efficacy and social support, are associated with increased likelihood of RTS.

Multivariate Logistic Regression
A logistic regression model was constructed to identify independent predictors of RTS after controlling for age, sex, and injury severity.

Predictor	Odds Ratio (OR)	95% CI	p
Kinesiophobia (TSK)	0.74	0.66-0.83	<.001
Social support	1.08	1.02-1.14	.01
Self-efficacy	1.92	1.21-3.05	.02
Pain catastrophizing	0.89	0.78-1.01	.06

The model explained 42% of the variance in RTS outcomes (Nagelkerke $R^2 = .42$). Kinesiophobia emerged as the strongest independent predictor, consistent with previous RTS models emphasizing psychological readiness over physical clearance alone (13,14).

Summary of Key Findings
1. Over one-third of competitive athletes failed to return to pre-injury sport level despite rehabilitation.
2. Fear of movement and pain catastrophizing were significantly higher among non-returning athletes.
3. Self-efficacy and social support were protective factors associated with successful RTS.
4. Kinesiophobia independently predicted RTS outcomes, even after controlling for demographic and injury-related variables.

DISCUSSION

Overview of Principal Findings
The primary objective of this study was to examine the influence of psychosocial factors on injury recovery and return-to-sport (RTS) outcomes among state- and national-level athletes aged 20–25 years. The findings demonstrate that psychosocial variables—particularly kinesiophobia, pain catastrophizing, self-efficacy, and perceived social support—play a decisive role in determining whether athletes successfully return to their pre-injury level of sport.

At 12 months post-injury, 62.5% of athletes returned to sport, while 37.5% did not, despite receiving structured physical rehabilitation. This finding aligns with previous reports indicating that approximately one-third of athletes fail to resume competitive sport following injury, even after medical clearance (3,13). Importantly, the present study identified psychological readiness—not physical or demographic variables—as the most influential determinant of RTS.

Role of Kinesiophobia in Return-to-Sport Outcomes
Kinesiophobia emerged as the strongest independent predictor of RTS in the multivariate model. Athletes who did not return to sport reported significantly higher fear of movement

and reinjury, with a large effect size. This finding is consistent with extensive literature demonstrating that fear of reinjury is a primary barrier to RTS across multiple injury types (4,11,14).

The persistence of kinesiophobia even after physical recovery highlights its psychological nature. Previous studies have shown that athletes may demonstrate adequate strength, range of motion, and functional test performance yet still refrain from sport participation due to fear-based avoidance behaviors (12,26). This phenomenon underscores the limitations of clearance decisions based solely on physical criteria.

Mechanistically, kinesiophobia may influence RTS through multiple pathways. Fear of movement can lead to altered motor patterns, reduced neuromuscular control, and hesitancy during sport-specific tasks, thereby increasing perceived vulnerability (25). Over time, these behaviors may reinforce fear beliefs and reduce confidence, creating a self-perpetuating cycle of avoidance.

The present findings support the growing consensus that psychological readiness should be routinely assessed alongside physical readiness prior to RTS (13,14). The Tampa Scale for Kinesiophobia offers a practical tool for identifying athletes at risk of delayed or failed RTS and may guide targeted psychological interventions.

Pain Catastrophizing and Cognitive Appraisals of Injury

Pain catastrophizing was significantly higher among athletes who did not return to sport, supporting its role as a maladaptive cognitive appraisal that impairs recovery. Catastrophizing has been shown to amplify pain perception, emotional distress, and fear-avoidance behaviors across musculoskeletal populations (9,27).

In the context of athletic injury, catastrophizing may distort the interpretation of normal rehabilitation-related discomfort, leading athletes to misattribute benign sensations to reinjury or structural damage. This cognitive distortion can undermine confidence in the rehabilitation process and increase fear of movement (29).

Although pain catastrophizing did not emerge as an independent predictor in the final regression model, its strong correlation with kinesiophobia suggests an indirect influence on RTS outcomes. Previous research has demonstrated that catastrophizing often precedes and reinforces fear of reinjury, positioning it as an upstream cognitive factor within the fear-avoidance framework (10).

Interventions targeting catastrophic thinking—such as cognitive restructuring and pain education—have demonstrated efficacy in reducing fear and improving functional outcomes (30). Incorporating such strategies into sports rehabilitation programs may enhance psychological readiness and facilitate successful RTS.

Self-Efficacy as a Protective Factor

Self-efficacy emerged as a significant protective factor associated with successful RTS. Athletes who returned to sport reported higher confidence in their ability to complete rehabilitation tasks, tolerate discomfort, and perform sport-specific movements. These findings align with social cognitive theory and prior empirical research demonstrating the central role of self-efficacy in behavior change and performance (16,17).

High self-efficacy may buffer the impact of fear and uncertainty by fostering adaptive coping strategies and persistence during rehabilitation. Athletes with strong self-beliefs are more likely to engage fully in rehabilitation, adhere to exercise prescriptions, and view setbacks as manageable challenges rather than insurmountable obstacles (31,32).

The predictive value of self-efficacy observed in this study suggests that rehabilitation professionals should actively cultivate confidence through mastery experiences, graded exposure to sport-specific tasks, and positive feedback. Psychological skills training aimed at enhancing self-efficacy may represent a cost-effective strategy for improving RTS outcomes.

Influence of Social Support on Recovery and RTS

Perceived social support was significantly higher among athletes who returned to sport and independently predicted RTS in the regression model. This finding underscores the importance of the social environment in shaping psychological responses to injury and rehabilitation.

Social support may influence recovery through several mechanisms. Emotional support can reduce stress and anxiety, informational support can enhance understanding and confidence in the rehabilitation process, and instrumental support can facilitate adherence to treatment protocols (21,22). In competitive sport settings, support from coaches and teammates may be particularly influential in reinforcing an athlete's sense of belonging and athletic identity (38).

Conversely, lack of support or negative social pressures—such as fear of replacement or expectations to return prematurely—may exacerbate fear of reinjury and undermine psychological readiness (23). The present findings highlight the need for holistic rehabilitation approaches that engage not only the athlete but also their broader social network.

Integration with Existing Return-to-Sport Models

The results of this study are consistent with contemporary RTS models that emphasize the integration of physical, psychological, and contextual factors (2,13). Psychological readiness has increasingly been recognized as a critical determinant of safe and sustainable RTS, with fear of reinjury identified as a key barrier across injury types.

By simultaneously examining multiple psychosocial variables, this study extends existing literature and provides empirical support for multidimensional rehabilitation frameworks. The findings suggest that psychological constructs do not operate in isolation but interact dynamically to influence recovery trajectories.

Clinical Implications

The clinical implications of these findings are substantial. Routine psychological screening using validated tools such as the TSK, PCS, and self-efficacy measures may enable early identification of athletes at risk of delayed or failed RTS. Rehabilitation professionals should consider incorporating psychological education, cognitive-behavioral strategies, and graded exposure techniques into standard care.

Interdisciplinary collaboration between physiotherapists, sports physicians, and sports psychologists may further enhance rehabilitation outcomes. Addressing psychosocial factors proactively may reduce reinjury risk, improve athlete confidence, and promote long-term sport participation.

Limitations

Despite the strengths of the present study, several limitations should be acknowledged when interpreting the findings.

First, although the prospective design allowed for temporal assessment of psychosocial variables and RTS outcomes, the study remains observational in nature. As such, causal inferences cannot be definitively established. While strong associations were identified between psychosocial factors and RTS, it is possible that unmeasured variables—such as personality traits, coping styles, or prior injury experiences—may have influenced outcomes (43).

Second, psychosocial assessments were conducted at a single mid-rehabilitation time point. Psychological responses to injury are dynamic and may fluctuate across different stages of recovery (6). Longitudinal assessment of psychosocial variables at multiple time points would provide greater insight into the evolution of psychological readiness and its relationship to RTS.

Third, the sample consisted exclusively of athletes aged 20–25 years competing at state and national levels. While this enhances internal consistency, it may limit generalizability to younger adolescents, older athletes, or recreational populations. Psychological responses to injury may differ across age groups and competitive contexts (44).

Fourth, injury types and sports disciplines were heterogeneous. Although this enhances ecological validity, sport-specific and injury-specific psychological responses may vary. Future studies focusing on homogeneous injury cohorts (e.g., ACL injuries, shoulder instability) could provide more nuanced insights.

Finally, RTS was operationalized as return to pre-injury level of participation. While this definition is commonly used, it does not capture qualitative aspects of return such as performance satisfaction, fear levels at return, or long-term retention in sport (13).

Future Research Directions

The findings of this study highlight several important avenues for future research. Longitudinal studies examining psychosocial trajectories from acute injury through full return to sport are needed to better understand temporal patterns of psychological adaptation and maladaptation.

Intervention-based research evaluating the effectiveness of targeted psychological strategies—such as cognitive-behavioral therapy, graded exposure, mindfulness-based interventions, and motivational interviewing—would provide valuable evidence for best practice in sports rehabilitation (30,45).

Future research should also explore the interaction between psychosocial factors and biomechanical or neuromuscular variables to develop integrated RTS decision-making

models. Additionally, incorporating qualitative methodologies may enhance understanding of athlete experiences, beliefs, and contextual influences during recovery.

Clinical and Practical Implications

The results of this study have important implications for sports medicine professionals, rehabilitation specialists, and athletic organizations.

1. Routine Psychological Screening: Incorporating validated psychosocial assessment tools into rehabilitation protocols may facilitate early identification of athletes at risk of delayed or unsuccessful RTS
2. Integrated Rehabilitation Models: Physical rehabilitation should be complemented by psychological interventions aimed at reducing fear of reinjury, addressing catastrophic thinking, and enhancing self-efficacy.
3. Education and Communication: Educating athletes, coaches, and support staff about the psychological aspects of injury recovery may foster supportive environments and reduce maladaptive pressures.
4. Interdisciplinary Collaboration: Collaboration between physiotherapists, sports physicians, and sports psychologists may optimize recovery outcomes and promote athlete well-being.

CONCLUSION

This prospective observational study provides robust evidence that psychosocial factors play a critical role in injury recovery and return-to-sport outcomes among competitive athletes. Fear of movement, pain catastrophizing, self-efficacy, and perceived social support were strongly associated with RTS status, with kinesiophobia emerging as the most influential predictor.

The findings underscore the limitations of rehabilitation approaches that focus exclusively on physical recovery and highlight the need for comprehensive, biopsychosocial models of care. Integrating psychological assessment and intervention into standard sports rehabilitation practice may enhance return-to-sport success, reduce reinjury risk, and support long-term athletic participation.

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Conflict of Interest
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