Psychological Readiness to Return to Sport Following Injury: A State-of-the-Art Review

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Abstract

Psychological readiness to return to sport (RTS) after injury is a critical and timely area of research that has received significant research attention of late. Given the increased maturity of this field of research, it is now time to take stock of recent empirical developments and to chart a course for future work in this area. The purpose of this state of the-art review was to conduct the first narrative synthesis examining the literature on psychological readiness to RTS following injury. This review draws upon a growing body of literature spanning various disciplines (e.g., sport medicine, sport psychology, sociology of sport, and military medicine) and cultures/languages (e.g., Swedish, Italian, Farci, Spanish, Chinese). Our *a priori* aims were to: (a) examine how psychological readiness to RTS has been conceptualized and operationalized; (b) review factors that enable (and constrain) psychological readiness to RTS; and (c) consider implications of readiness to RTS. In the discussion, we offer critical reflections on the research to date, a definition of psychological readiness, and propose novel hypotheses and research questions for the next wave of research.

Introduction

Musculoskeletal injury is common among athletes (Arthur-Banning et al., 2018; Hootman et al., 2007). Once injured, the ultimate aim of many athletes is to return to sport (RTS; Podlog, Banham, Wadey & Hannon, 2015). As athletes achieve physical healing and functional rehabilitation progressions, the question of when the athlete is ready to RTS becomes increasingly relevant – both to the athlete and key stakeholders (e.g., teammates, coaches, administrators, medical team, and parents; Podlog et al., 2015). Traditionally, decisions regarding athletes' readiness to RTS have been based exclusively on assessment of physical function (Podlog et al., 2015). The assumption underlining physical test batteries to return is that individuals who pass them are ready to perform at or exceed previous performance standards and are less likely to incur re-injury or a new injury. Increasing evidence, however, suggests there may be problems with that assumption (Cheney et al., 2020; de Mille & Osmak, 2017; Webster & Hewett, 2019). In their meta-analytic examination of physical return-to-sport (RTS) tests after ACL surgery, Webster and Hewett (2019) found that only one out of 18 studies showed that passing RTS test batteries led to greater RTS rates. Counterintuitively, passing a RTS test battery increased the risk for a subsequent contralateral ACL injury (RR = 3.35 [95% CI 1.52-7.37]). These findings suggest that commonly employed tests (e.g., agility, strength, muscle mass/size) designed to assess athletes' readiness to RTS and avoid re-injury may be inadequate.

Towards a more multidisciplinary perspective, it has been suggested that psychology (i.e., thoughts, feelings, behaviours) can also play an important role in better understanding the nature of athletes' readiness to RTS and in developing inventories to evaluate it (Ardern et al., 2014; Glazer, 2009; Podlog et al., 2015; Thomeé et al., 2007). Heeding this recommendation, sport science scholars have proposed the concept of 'psychological readiness', studied factors

that facilitate and impede psychological readiness, and examined implications of it (Conti et al., 2019; Glazer, 2009; Gómez-Piqueras et al., 2014; Thomeé et al., 2007; Webster et al., 2008). Building from several preliminary studies (e.g., Glazer, 2009; Podlog et al., 2015; Webster et al., 2008), the issue of psychological readiness has received significant research attention of late, including work emanating from different countries, various research philosophies, and a multitude of sports. It is now time to take stock of this first wave of research and to identify fruitful avenues for further inquiry. Consistent with the typology of reviews offered by Grant and Booth (2009), our aim in the present paper was to conduct a state-of-the-art review on psychological readiness research. This type of review seemed appropriate for several reasons. First, given the proliferation of research on psychological readiness within the past 10 years, it seemed prudent to take stock of the current knowledge regarding the nature of psychological readiness and its implications for various post-injury outcomes. Second, despite a significant increase in interest in the topic of psychological readiness, there remains conceptual ambiguity. According to Grant and Booth (2009), state of the art reviews "… may offer new perspectives on an issue" (p. 95). As such, part of our aim was to review the literature to construct and propose a nomothetic definition of the concept of psychological readiness. Third, key features of a state-of the-art review – namely, a "narrative" synthesis of information with the option of tabular accompaniment, and articulation of priorities for future investigation – were consistent with our aims in the current review (Grant & Booth, 2009; Greenhalgh, Thorne & Malterud, 2018).

Method

According to Grant and Booth (2009) there are no standardized methodologies for conducting state-of-the-art reviews or any formal mechanisms for quality assessment. In conducting our literature search, our aim was not to be exhaustive or to employ methodologies

such as a systematic or scoping review. Nonetheless, in an effort to ascertain recent and/or relevant articles, our search was guided by the key question: "what is known about psychological readiness to return to sport?" We did a preliminary search in four databases using the EBSCO*host* platform (SPORTDiscus with Full Text, Medline, APAPsycInfo). As part of the preliminary search, we also examined Google Scholar, PubMed, and Scopus. We used combinations of the following search terms: 'psychological readiness'; 'return to sport; 'injury'; 'musculoskeletal'; 'concussion'; 'mild traumatic brain injury'; 'assessment'; 'inventory'; 'psychosocial'; and 'fear of re-injury'. Search terms were grouped using the Boolean operator 'OR' and terms listed above were combined using 'AND.' Inclusion of relevant literature was also maximized by the fact that our team of authors was comprised of an international group of subject matter experts on the psychological aspects of sport injury. A follow-up search was also conducted in conjunction with two research librarians from the lead author's institution (Meert, Torabi & Costella, 2016). The search was conducted in Medline from Ovid to ensure that articles germane to the topic at hand were retrieved. A combination of key words and controlled subject headings was used (see Appendix).

The first author screened titles and abstracts for eligibility criteria. Inclusion criteria for this review included: (a) any original study or literature review with the *a priori* aim of examining psychological readiness after injury; (a) any study that had psychological readiness as either an independent or dependent variable; and (a) any article that included reference to psychological readiness in the title of the article or abstract, irrespective of date of publication. Conference abstracts, dissertations, book chapters, non-English articles, and articles that outlined a study protocol but did not report empirical data, were excluded. Although non-English articles were excluded, there was one Spanish article by Gómez-Piqueras et al. (2014) in which the

authors developed a psychological readiness measure. The authors subsequently reported further validation in an English publication (Gómez-Piqueras, Ardern, et al., 2020). Given the relevance of the 2014 publication for the present review it was included in our analysis. Google translate was used to examine contents of the 2014 article. For any articles whose eligibility was unclear, the first author reviewed the full-text article. In any instances of further uncertainty, the authors reviewed the abstract or full-text article, and consensus reached through discussion. Following our database search, a manual search of the reference lists of all relevant articles was completed.

Studies were grouped into themes deductively based on their fit with our *a priori* aims of exploring inventories/studies examining the nature of psychological readiness (or psychometric tests of it), predictors of psychological readiness, or outcomes of it. Any disagreements about the categorization of studies into specific themes were resolved through discussion between the first and seventh author. All authors agreed on the final categorizations.

Consistent with our review aims, our presentation of results is divided into three sections. In section one, we examine how psychological readiness to RTS has been conceptualized and operationalized. Section one, also provides results of psychometric tests of various readiness inventories. In section two, we review predictors of psychological readiness to RTS, and in section three, we examine implications of readiness to RTS. Finally, in the discussion, we offer various critical reflections regarding research on psychological readiness, we define psychological readiness, and offer novel hypotheses for future research testing.

Results

What is Psychological Readiness to Return to Sport After Injury?

Quantitative Approaches

Three separate psychological readiness inventories have been developed, each offering a different operationalization of the construct: (1) Injury-Psychological Readiness to Return to Sport Scale (I-PRRS; Glazer, 2009); (2) Anterior Cruciate Ligament-Return to Sport after Injury Scale (ACL-RSI; Webster et al., 2008); and (3) Psychological Readiness of Injured Athlete to Return to Sport (PRIA-RS) Questionnaire for Injured Soccer players (Gómez-Piqueras et al., 2014). Three additional measures assess related – albeit conceptually distinct and/or constituent phenomena – namely, fear of movement (the Tampa Scale of Kinisiophobia [TSK]; Miller et al., 1991); anxiety associated with re-injury (Re-Injury Anxiety Inventory [RIAI]; Walker et al., 2010); and perceived self-efficacy in engaging in current and future activities (Knee Self Efficacy Scale (K-SES; Thomeé et al., 2007). Interestingly, researchers constructing quantitative measures of psychological readiness (Glazer, 2009; Gómez-Piqueras et al., 2014; Webster et al., 2008) appear to have attempted to measure the construct without having a clear conceptual understanding of what the construct actually is − a problematic described in further detail in the discussion. Table 1 summarizes various psychological readiness (and associated) measurement tools, as well as their constituent subscales. Nomothetic, injury-specific and sport-specific measures of psychological readiness are described in the following subsections.

[insert Table 1 here]

Nomothetic Measure. Glazer (2009) developed the I-PRRS scale, a unidimensional measure, to assess the extent to which athletes feel confident in their ability to perform well upon return to sport (Glazer, 2009). Using the Delphi survey method, Glazer solicited expert opinions from a panel of 7 individuals (4 certified athletic trainers who were also academic faculty and 3 coaches from NCAA Division III schools) who were instructed to "provide suggestions and questions that could be used on a scale to measure the construct of psychological readiness (p.

186).” The panel submitted 22 items which were subsequently reduced to 10 items, eliminating items that were sport or environment specific or not appropriate for all returning athletes. Example items include: “My overall confidence to play is;”, My confidence to play without pain is”, and “My confidence to not concentrate on the injury is”.

Glazer (2009) reported initial reliability as well as, content, concurrent, and external validity. Glazer also measured psychological readiness at four time points – after injury, before practice, before competition, and after competition. Repeated-measures ANOVA with polynomial contrast revealed a quadratic trend ($F_{1,21} = 68.26$, $P < .001$), indicating differences in I-PRRS scores between intervals. An increase occurred immediately after injury to before practice and from before practice to before competition. No difference was found between before competition and after competition. These findings indicate that psychological readiness – conceptualized solely as confidence in this measure – continues to improve as physical function increases over the course of rehabilitation, likely leveling off as athletes’ transition from sport specific training to competitive play.

Psychometric testing of the I-PRRS has occurred in a sample of professional soccer players [redacted]) and various language translations, including: Dutch (Slagers, Akker-Scheek, et al., 2019; Slagers, Reininga, et al., 2019; Vereijken et al., 2019), Persian (Naghdi et al., 2016), and Italian (Conti et al., 2019). Consistent with the original formulation, confirmatory factor analysis in a sample of 113 injured professional soccer players from 17 international leagues ([redacted]) revealed a unidimensional factor structure, good internal consistency ($\omega = .88$) and longitudinal measurement invariance (i.e., whether the same construct(s) are measured equally at different time-points ensuring that the development in scores can be attributed to development in the construct under investigation).

Factor analysis in the Persian sample revealed a two-factor solution, "Confidence to play" (items 1 and 2 from the original version) and "Confidence in the injured body part and skill level" (items 3-6 from the original version). Similarly, confirmatory factor analysis in the Italian sample demonstrated a two-factor solution consisting of "confidence in performance capability" (items 1,3,5 from the original version) and "confidence in recovery" (items 2,4,6 from the original version). The above findings suggest some uncertainty as to whether the I-PRRS represents a one or two factor scale. When working with small data sets, Costello and Osborne (2005) suggest that a stable factor should be comprised of at least 5 strongly loading items (i.e., .50 or better). Based on this recommendation, researchers and clinicians may wish to adopt a unidimensional scale, consistent with Glazer's (2009) original scale development.

Injury-Specific Measure. Moving beyond Glazer's unidimensional operationalization of psychological readiness, Webster and colleagues (2008) established the multidimensional, injury-specific ACL-Return to Sport after Injury (ACL-RSI) Scale to assess athletes:'(1) emotions ("Are you nervous about playing your sport?";" Do you find it frustrating to have to consider your knee with respect to your sport"?"; "Do you feel relaxed about playing your sport?"), (2) confidence in performance ("Are you confident that your knee will not give way by playing your sport?"; "Are you confident that you could play your sport without concern for your knee?"; "Are you confident about your ability to perform well at your sport?"), and (3) risk appraisal ("Do you think you are likely to re-injure your knee by participating in your sport?; "Do thoughts of having to go through surgery and rehabilitation again prevent you from playing your sport?") when returning to sport after ACL reconstructive surgery. Items were developed based on a review of literature pertaining to responses associated with the return to sport phase. Items reflecting the three subscales – emotions, confidence in performance and risk appraisal –

were incorporated into a 12-item ACL-Return to Sport after Injury (ACL-RSI) scale. Webster et al. (2008) suggest use of a single score in which the 12-items are summed and averaged.

The ACL-RSI has received further validation in numerous translations, including: Italian (Thiebat et al., 2021), Swedish (Kvist et al., 2013), Dutch (Slagers et al., 2017), Spanish (Sala-Barat et al., 2020), Norweigan (Faleide et al., 2020), Brazilian (Silva et al., 2018), French (Bohu et al., 2015), Chinese (Jia et al., 2018), Japanese (Hirohata et al., 2020), and Korean samples (Ha et al., 2019). Slagers, Akker-Scheek et al. (2019) also demonstrated sufficient responsiveness of the Dutch ACL-RSI (the ability to detect clinically important changes over time) among seventy patients with ACL reconstruction who completed the scale twice, once upon entry into the study and 2 months after initial questionnaire completion. Slagers, Reininga, et al. (2019) concluded that the ACL-RSI can be used to investigate the effectiveness of an intervention at the group level and can used in cross-sectional research and in clinical practice as a screening instrument to identify patients at risk of not returning to sport. Face, structural and construct validity, internal consistency, test-retest reliability and measurement error have all been demonstrated across the various studies. The Norweigan ACL-RSI-has also demonstrated good face validity with factor analysis indicating that the use of a sum score is reasonable. Internal consistency and test–retest reliability were excellent ($\alpha = 0.95$, ICC 0.94 (95% CI, 0.84–0.97) and measurement error low (SEM 5.7). Smallest detectable change SDC_{ind} was 15.8 points and SDC_{group} was 2.0 (Faleide et al., 2020). In the case of psychological readiness, use of test-retest reliability seems questionable. Test-retest reliability is most appropriate when the underlying construct is stable. Given Ohji et al. (2021) findings that ACL-RSI scores increased significantly from preoperative assessment to 6-months post-ACL reconstruction, examination of split-half reliability seems more appropriate than test-retest reliability.

Reflecting a shift towards the development of injury-specific measures, a short 6-item (Webster & Feller, 2018), and slightly amended versions of the ACL-RSI exist for use with shoulder (SI-RSI; Gerometta et al., 2018), hip arthroscopy (Hip-RSI; Jones, Webster, et al., 2020; Wörner et al., 2021), and ankle instability patients (ALR-RSI; Sigonney et al., 2020). Gerometta et al. (2018) assessed the psychological readiness to RTS after traumatic shoulder instability (SIRSI). The SIRSI demonstrated strong internal consistency (α = .96), excellent reproducibility of the test-retest (p = 0.93, 95% CI [0.89-0.96], and no ceiling/floor effects. Additionally, the SI-RSI was strongly correlated with reference questionnaires (r =.80, $p < 10^{-5}$), providing evidence of convergent validity. Recent validation of the SI-RSI by Olds and Webster (2021) revealed a four-factor structure, namely, performance confidence, reinjury fear and risk, emotions, and rehabilitation and surgery. Wörner et al. (2021) also modified the Swedish version of the ACL-RSI scale for use in patients undergoing hip arthroscopy. Item reduction resulted in a 6-item Hip-RSI scale with adequate content validity for the target population. Construct validity of the full and the item-reduced scale was demonstrated by correlation to HAGOS sport and iHOT12 inventories (rs = 0.631-0.752).

Sport-Specific Measure. A third, sport-specific readiness scale, the Psychological Readiness of Injured Athlete to Return to Sport (PRIA-RS) questionnaire, was developed to assess soccer player's psychological readiness to return to sport after injury (Gómez-Piqueras et al., 2014; Gómez-Piqueras, Ruiz-Barquín, et al., 2020). Preliminary items were developed based on the authors' review of the psychology of sport injury literature, which led to the creation of items pertaining to athletes' mood, motivation, coping, self-confidence, and "fear of relapse." Using a modified Delphi method, the preliminary list of items was reviewed by a panel of 16 experts in psychology, sports sciences, and sport medicine. This process resulted in a 10-item

inventory, that purported to assess returning athletes' "confidence, the individual perception, the insecurity and the fear of re-injury reported by the athlete at the end of the recovery process (Gómez-Piqueras, Ruiz-Barquín, et al., 2020, p. 2)." Sample items include: "How do you evaluate the progression you have experienced during the rehabilitation/sport functional recovery period since your injury?"; "How is your mood"; "What is your physical state in view of a potential return to the team?"; and "Are you feeling nervous about returning to regular training with the team?". Good convergent and divergent validity, reliability, internal consistency, and external psychometric examination (evaluating measures of patient-reported outcomes [EMPRO]) have been reported (Gómez-Piqueras, Ardern, et al., 2020).

***Related-Measures*.** Although no other quantitative measures explicitly address the construct of psychological readiness, researchers have developed three other injury relevant measures – the Tampa Scale of Kinisiophobia (TSK; Miller et al., 1991), the Re-Injury Anxiety Inventory (RIAI; Walker et al., 2010), and the Knee Self Efficacy scale (K-SES; Thomeé et al., 2007). Both the TSK and RIAI assess negatively valanced fears and apprehensions. Miller et al. (1991) developed the 17-item TSK to examine fear of movement/reinjury among chronic low back pain sufferers (e.g., "I'm afraid that I might injure myself if I exercise," "my pain would probably be relieved if I were to exercise"). Similarly, Walker, Thatcher, and Lavallee (2010) developed the RIAI to assess athletes' anxiety regarding reinjury during the rehabilitation phase (15 items; e.g., "I am worried about becoming re-injured during rehabilitation") and upon reentry into competitive sport (13 items; e.g., "I am worried about becoming reinjured during re-entry into competition").

Unlike Glazer who equated confidence with psychological readiness (Glazer, 2009; Thomeé et al., 2007), Thomeé et al. (2007) also developed a self-efficacy scale, focused

specifically on athlete's with knee injuries. As its name suggests, the Knee Self Efficacy scale (K-SES), was developed specifically to measure self-efficacy, without any reference to the notion of psychological readiness. In line with Bandura's (1977) conceptualization, self-efficacy was defined as "a judgement of one's potential ability to carry out a task, rather than a measure of whether or not once actually can or does perform the task (p. 181)." The K-SES, a 22-item inventory, is grouped into four categories: (A) daily activities (seven items; e.g., "How certain are you about: 1. Walking in the forest, 2. Climbing up and down a hill/stairs, 3. Going out dancing"); (B) recreation, exercise, and sporting activities (five items; e.g., "How certain are you about: 1. Cycling a long distance, 2. Cross country skiing, 3. Riding a horse,"); (C) physical activities (six items; e.g., "How certain are you about: 1. Squatting, 2. Jumping sideways from one leg to the others, 3. Working out hard a short time after the injury or surgery"); and (D) knee function in the future (four items; e.g., "How certain are you that you can return to the same physical activity level as before the injury?"; "How certain are you that you would not suffer any new injuries to your knee?"; "How certain are you that your knee will not ''break''?"). Each item is scored on an 11-point Likert scale from 0 = 'not at all confident' to 10 = 'very confident'. Final scores are calculated for two subscales: perceived present self-efficacy of knee function (K-SES present: categories a, b, & c) and perceived future self-efficacy of knee function (K-SES future: category d) with higher scores indicating better outcomes. While the K-SES has the benefit of being injury-specific, researchers or practitioners adopting the scale should be aware that some items may be more (or less) appropriate to the context (e.g., walking in the forest, cross-country skiing). Further, some of the items may be contrary to contemporary physical therapy guidelines. For instance, "working out hard, a short time after an injury or surgery" may be contraindicated, particularly in the case of certain injuries such as concussion.

Initial psychometric testing of the K-SES demonstrated good reliability, and good face, content, construct and convergent validity as well as responsiveness (Thomeé et al., 2007). The Swedish K-SES has been translated and cross-culturally adapted into English (Ezzat et al., 2021) and Dutch (van Lankveld et al., 2019). Ezzat et al. (2021) generated an English K-SES with face and content validity. The original two-factor structure was rejected based on CFA and a revised solution informed by exploratory factor analysis resulted in an adequate fit. The K-SES showed good internal consistency [Factor (F1: α=0.96; F2: α=0.73)], intra-rater reliability (ICC=0.92), and no systematic bias between repeated measurements (Ezzat et al., 2021). Questions regarding the factors structure have been raised in the Dutch K-SES. Although principal component analysis (PCA) revealed a two-factor solution reflecting present physical performance/function (all factor loadings > 0.70) and knee function in the future, the two-factor model was not confirmed in the confirmatory factor analysis. Inspection of the covariance matrix showed that in particular the 18 items relating to K-SES-$D_{present}$ did not show good fit in the CFA. These findings suggest that further research is needed to evaluate the construct validity of the K-SES in the Dutch version.

Qualitative Approaches

Researchers have also examined the nature of psychological readiness by taking a qualitative approach. Here, researchers have interviewed athletes about their definitions and experiences of psychological readiness (Kunnen et al., 2020; Podlog et al., 2015). As with prior work by Webster et al. (2008), Podlog and colleagues (2015) and Kunnen et al. (2020) also revealed that psychological readiness is multidimensional in nature. Definitions and key components of readiness identified by Podlog et al. (2015) and Kunnen et al. (2020) are highlighted in Table 2. Interestingly, both Kunnen et al. (2020) and Podlog et al. (2015), found

that the confidence component of readiness was multidimensional in that it consisted of a belief in the efficacy of one's rehabilitation program, confidence and trust in rehabilitation professionals, a belief that one's formerly injured body part was fully healed, and efficacy in one's performance capabilities.

[insert Table 2 here]

Predictors of Psychological Readiness to RTS

Nine studies examined predictors of psychological readiness to RTS after injury. In their qualitative study, Podlog and colleagues (2015) found a number of precursors that athletes believed contributed to the three readiness dimensions: confidence in returning to sport, realistic expectations of one's sporting capabilities, and motivation to regain previous performance standards. Having trust in the knowledge and expertise of rehabilitation providers, social support that satisfied one's recovery needs, and the achievement of physical standards, all contributed to increased confidence beliefs in ones' RTS. Similarly, patience, accepting one's post-injury limitations and effective goal setting all fostered realistic expectations. Finally, effective goal-setting, the boredom of injury, feeling wanted by significant others, and social support, were reported precursors of motivation to regain previous performance standards. Given the retrospective qualitative design, it is unclear if these factors actually preceded readiness – a limitation that could be addressed with longitudinal, repeated measure designs.

Several recent studies have also begun to illuminate relationships between demographic factors, functional abilities, and psychological readiness (Aizawa et al., 2020; Della Villa et al., 2021; Faleide, Magnussen, Bogen, et al., 2021a; Kuenze et al., 2021; Meierbachtol et al., 2018; Nagelli et al., 2019; Presley et al., 2021; Rogowski et al., 2020; Webster et al., 2018). Table 2, highlights a number of key studies examining predictors of psychological readiness. For

instance, research with a large cohort of 635 athletes undergoing ACLR revealed that a variety of demographic factors and perceptions of functional ability contributed to athlete's psychological readiness to return to sport (RTS) after ACLR (Webster et al., 2018). Univariate analysis for the entire group showed that all of the following had a positive effect on psychological readiness: male sex (β = 5.8; 95% CI, 2-10), younger age (β = −0.2; 95% CI, –0.4 to 0.01), a shorter interval between injury and surgery (β = −0.1; 95% CI, −0.1 to −0.02), a higher frequency of preinjury sport participation (β = 5.4; 95% CI, 2-9), greater limb symmetry (β = 0.5; 95% CI, 0.3-0.6), and higher subjective knee scores (β = 1.3; 95% CI, 1.1-1.4). In the multivariate model, subjective knee scores and age significantly accounted for 37% of the variance in psychological readiness ($r^2 = 0.37$, $P < .0001$). Male patients who participated frequently in sport before ACL injury had higher psychological readiness in comparison to those with less frequent pre-ACL sport participation. Conversely, no sex differences in psychological readiness were found by Kuenze et al. (2021) in their cross-sectional analysis of 45 men and 45 women age-matched ACL injured athletes. In their investigation, Della Villa (2021) found a statistically significant linear relationship between quadriceps strength symmetry and the I-PRRS score in patients who experienced a noncontact injury (n = 55; $p = 0.01$; $^{r2} = 0.24$). No such relationship was found for those who experienced a contact injury (n = 23; $p= 0.97$; $r^2 = 0.01$). Along these lines, Presley et al. (2021) examined the influence of mode-of-injury ('in-sport' versus 'out-of-sport') on psychological readiness for RTS after ACL reconstruction. They found that athletes sustaining 'in-sport' ACL injuries demonstrated poorer psychological readiness when compared to athletes injured outside their primary sport (55.3 ±12.9 versus 60.8 ±11.6, t = 2.747, $p < .001$) when in preparation for RTS following ACL reconstruction.

Aizawa et al. (2020) examined a range of factors associated with psychological readiness (ACL-RSI) following ACL reconstruction among 30 patients. Predictor variables included a range of demographic (age, sex, body mass index), functional abilities (knee strength, single leg hop [SLH] distances, leg anterior reach distance, perceived running ability), and fear of movement (Kinisiophobia). Results from the multivariate regression analysis revealed that higher subjective running ability, $\beta = 0.657$ (95% CI, 0.359 to 0.955), a lower kinisiophobia score, $\beta = –1.265$ (95% CI, –1.983 to –0.546), and greater limb symmetry in lateral SLH distance, $\beta = 0.421$ (95% CI, 0.063 to 0.778) were positively associated with psychological readiness. These findings were supported by Meierbachtol et al. (2018) who found that a 5-week group training program involving functional movements (single leg hop testing, triple, crossover triple, and timed hops) among 58 individuals undergoing ACL reconstruction, improved psychological readiness (ACL-RSI score pretraining = 60.1 ±19.3; ACL-RSI posttraining = 77.0 ±14.7, effects size $d = 1.04$). Nagelli et al. (2019) found that among 18 ACL injured athletes, greater frontal plane knee range of motion and lower frontal plane hip range of motion within the involved limb explained nearly 40% of the variability in ACL-RSI scores. Finally, Faleide et al. (2021a) found statistically significant associations between the ACL-RSI score and two tests of knee laxity – the Lachman test (rho = -0.18; $p = .046$) and KT-1000 arthrometer measurement (rho = -0.18; $p = .040$) – suggesting that patients with less knee laxity after ACLR felt more psychologically ready to RTS.

Unfortunately, with the exception of Faleide et al. (2021a), the cross-sectional designs among studies reviewed in this section, precludes definitive conclusions on whether these demographic variables, strength/limb symmetry, or perceptions/objective functional ability

preceded psychological readiness. As indicated, further longitudinal research examining predictors of readiness is needed.

Clinical and Performance Implications of Psychological Readiness to RTS

In recent years, studies (n = 24) focused on the implications of psychological readiness have proliferated (see Table 2 for a summary of key studies). The central question underlining this growing body of work is: does psychological readiness influence salient downstream consequences such as athletes' mental health, physical function, the likelihood of RTS, or one's risk of re-injury? Researchers have suggested that individuals who are ready to RTS will have a greater likelihood of actually returning and will experience more positive outcomes upon their return (Podlog et al., 2015). Conversely, athletes with lower levels of readiness are expected to experience deleterious outcomes. The ability to ascertain meaningful readiness cut-off scores that can predict differential RTS outcomes, can help guide clinical decisions as to whether athletes should or should not RTS.

Cross-sectional and longitudinal studies have supported hypothesized relationships in so far as greater psychological readiness is predictive of mental health (Conti et al., 2019; Glazer, 2009), physical function (Erickson et al., 2021; Peebles et al., 2021; Thomeé et al., 2007; Zarzycki et al., 2018), the likelihood of returning to pre-injury competitive levels (Albano et al., 2020; Ardern et al., 2014; Beischer et al., 2019; Faleide, Magnussen, Strand, et al., 2021b; Fältström et al., 2016; Kitaguchi et al., 2020; Webster et al., 2008, 2019; Webster & Feller, 2020; Wörner et al., 2021) and reinjury (McPherson et al., 2019a, 2019b). With regard to mental health profiles, Glazer (2009) and Conti et al. (2019) demonstrated that higher perceptions of readiness were inversely related with negative mood states over the course of rehabilitation. Along similar lines, Jones, Kemp, Crossley, Hart, and Ackerman's (2020) qualitative study with 17 Australian

adults aged 18-50 years who underwent hip arthroscopy, revealed that suboptimal psychological readiness to return to sport took a negative emotional toll on participants. In particular, a mismatch between expected and actual progress and a perceived inability to meet expected milestones, led to feelings of sadness and depression.

In terms of relationships between psychological readiness and functional status, Erickson et al. (2021) found that ACL-RSI scores measured at 3-months post- ACL reconstruction positively correlated with International Knee Documentation Committee (IKDC; $r = 0.565$, $p = 0.001$), Knee Injury and Osteoarthritis Outcome Score (KOOS) sport/recreational activities ($KOOS_{Sport}$; $r = 0.548$, $p = 0.002$) and quality of life ($KOOS_{QoL}$; $r = 0.431$, $p = 0.017$), and quadriceps strength ($r = 0.528$, $p = 0.003$) measured at 6-months post ACL reconstruction. Similarly, Hart et al. (2020) found that lower psychological readiness scores on the ACL-RSI were associated with poorer patient-reported function, assessed via the Knee Injury and Osteoarthritis Outcome Score (KOOS function in sport and recreation subscale) (β = .28; 95% CI, .14 to 0.41) and the International Knee Documentation Committee (IKDC) Subjective Knee Evaluation Form (β = .30; 95% CI, .21 to 0.38), as well as performance-based function (β = .14; 95% CI, .03 to 0.25).

Extending these findings, Zarzycki et al., (2018) sought to determine the relationship between psychological readiness to RTS following ACL reconstruction and kinematic and kinetic measures of knee symmetry during gait. In this controlled laboratory, cross-sectional study, 79 athletes (39 women) underwent gait analysis following impairment resolution after ACLR (i.e., full range of motion, minimal or no effusion, quadriceps strength index of 80% or greater). Significant negative correlations were observed between the ACL-RSI and 2 kinematic variables: knee flexion angle at initial contact ($r = -0.281$, $p = .012$) and peak knee flexion ($r =$

−0.248, p = .027). In general, lower scores on the ACL-RSI were associated with greater interlimb asymmetry. Along these lines, Peebles et al. (2021) found that among 38 patients recovering from primary unilateral ACL reconstruction, ACL-RSI scores were positively associated with peak knee extension moment limb symmetry index (LSI; r = 0.325; r^2 = 0.105, p = 0.047).

Both original studies and literature reviews have also found that higher levels of psychological readiness are associated with a greater likelihood of return to previous sport activities and/or competitive levels (Ardern, 2015; Ardern et al., 2013, 2014; Beischer et al., 2019; Faleide, Magnussen, Bogen, et al., 2021a; Grometta et al., 2018; Hart et al., 2020; Kitaguchi et al., 2020; Langford et al., 2009; Sadeqi et al., 2018; Webster et al., 2008, 2019; Webster & Feller, 2020; Wörner et al., 2021). Grometta et al. (2018) found that the mean SI-RSI scores were significantly higher in 62 patients who returned to rugby following an episode of shoulder instability. Similarly, Ardern and colleagues (2014) found that psychological readiness to return to sport and recreational activity (measured with the ACL-RSI scale), was most strongly associated with returning to the preinjury levels among 164 Swedish athletes of various competitive levels.

Langford et al. (2009) revealed that participants who had returned to competitive sport at 12 months, scored significantly higher on the ACL-RSI scale (reflecting a more positive psychological response about sport participation) at both 6 and 12 months than participants who had not returned to competitive sport. Similarly, in their prospective study, Sadeqi et al. (2018) found that at 2-year follow-up, 74.9% of patients had returned to running and 58.4% to their same preinjury sport. The ACL-RSI score was significantly higher at 6 months, 1-, and 2-years post-surgery in patients who had returned to sport and in those who returned to the same level of

play or higher ($p < .00001$). The optimal ACL-RSI score threshold to return to the same sport at 2-year follow-up was ≥65. Finally, Webster et al. (2008) found that participants who had given up sport scored significantly lower on the ACL-RSI scale (reflecting diminished readiness) than those who had returned or were planning to return to sport ($p = .001$). Collectively, these findings suggest that psychological readiness differentiates athletes who do, and do not, resume competitive activities following serious, long-term injury.

With regard to the outcome of re-injury, two studies have prospectively demonstrated that lower levels of psychological readiness are predictive of re-injury or secondary injury upon RTS (McPherson et al., 2019a, 2019b). McPherson et al. (2019a) investigated whether psychological readiness – as measured by ACL- RSI – predicted further injury, specifically, the incidence of second ACL injury. Among 329 patients who returned to sport after ACLR, 52 (16%) sustained a second ACL injury. No statistically significant difference in psychological readiness was observed at the preoperative time point, but patients who sustained a second injury trended toward lower psychological readiness at 12 months compared with non-injured patients (60.9 vs 67.2 points; $p = .11$; McPherson et al., 2019a). Additionally, younger (20 years) patients with injury had significantly lower psychological readiness to RTS than young non-injured patients (60.8 vs 71.5 points; $p = .02$), but no difference was found in older patients (60.9 vs 64.6 points; $p = .58$). In younger patients, receiver operating characteristic curve analysis revealed a cutoff score of 76.7 points with 90% sensitivity to identify younger patients who sustained a second ACL injury. The researchers concluded that younger patients with lower psychological readiness are at higher risk for a second ACL injury after RTS.

The aforementioned findings were extended in a follow up study by McPherson, Feller, Hewett and Webster (2019b) in which patients ≤20 years old at the time of surgery who had a

primary ACL reconstruction completed a short version of the ACL-RSI before their ACL reconstruction and again at 12 months after surgery. The primary outcome of interest was the relationship between the change in psychological readiness and second ACL injuries. Findings showed that among 115 young patients who returned to sport after ACL reconstruction, 21 (18%) experienced a second ACL injury. Injured patients did not show improvement in their ACL-RSI score between the preoperative assessment and 12-month time point (58.5 vs 60.8 points, $p = .60$) and had a significantly smaller change when compared with non-injured patients (9.2 vs 24.9 points, $p = .01$). When compared with the non-injured group, the secondary injured group reported they were more nervous about playing sport, less confident in playing sport without concern for the knee, more frustrated with having to consider the knee with respect to sport, and more fearful of reinjuring the knee by playing sport ($p \leq .05$). The authors concluded that the secondary injured patients exhibited less improvement in psychological readiness at a group level and reported different psychological characteristics with regard to return to sport at 12 months after ACL reconstruction as monitored by the ACL-RSI scale.

Discussion

This original and state of the art review sought to address what is known about the nature of psychological readiness, its predictors, and implications. We found three quantitative measures assessing psychological readiness to RTS including: 1. a nomothetic inventory (IPRRS), 2. an injury-specific measure (ACL-RSI short and long versions as well as three injury-specific variations [SIRSI, ALR-RSI, Hip-RSI]; 3. a sport-specific inventory (PRIA-RS); three measures assessing related and/or constituent constructs (TS; K-SES; RIAI); and two qualitative investigations examining the nature of psychological readiness. Results also revealed a number of factors (injury, individual differences, demographic, physical, functional) − some of which

may be modifiable − that predict psychological readiness. Further, we found evidence that greater psychological readiness was associated with enhanced mental and physical function, and a greater likelihood of return to previous sport activities and/or competitive levels. Finally, lower levels of psychological readiness have been associated with poorer physical function (i.e., interlimb asymmetry) and a greater risk of secondary injury upon RTS. Collectively, these findings suggest that psychological readiness – operationalized in different ways – appears to be an important construct of clinical relevance in the assessment of athletes' RTS after injury. In the remainder of the discussion, we offer a number of critical reflections of the findings, including suggestions for future research as well as a definition of psychological readiness to RTS. Finally, we offer summary conclusions.

How is Psychological Readiness to RTS Defined?

In developing various psychological readiness measures, researchers appear to have operationalized psychological readiness before having a clear conceptual understanding of the construct (Glazer, 2009; Gómez-Piqueras et al., 2014; Webster et al., 2008). For instance, in developing the IPRRS, Glazer (2009) appeared to instruct experts involved in his Delphi method of scale development to focus in on a single concept, namely, confidence. Similarly, Webster et al.(2008) and Gómez-Piqueras et al. (2014) asked experts to provide feedback on a set of pre-determined items in developing their psychological readiness assessments. In so doing, researchers likely limited potentially relevant components of psychological readiness, indicating that existing measures may lack content validity. Along these lines, Gómez-Piqueras et al.'s (2014) PRIA-RS inventory does not include separate subscales or factors representing the proposed dimensions of 'confidence', 'an individual appraisal' or 'insecurity/fear of re-injury'. As such, it is possible that the individual items do not fully capture the breadth of the intended

constructs (i.e., lacks content validity). Furthermore, the nature of various readiness dimensions themselves is ambiguous such that is it unclear what 'confidence' or an 'individual perception actually pertains to? Finally, no definition of psychological readiness was offered by Glazer (IPRRS; 2009), Webster et al., (ACL-RSI; 2008) or Gómez-Piqueras et al.'s (PRIA-RS; 2014) suggesting a lack of clarity on what is actually being measured.

Researchers have also failed to clarify whether "readiness" is about the relative absence of negative states (e.g., re-injury anxiety) or about experiencing the presence of positive states of mind. Questions remain whether athletes are psychologically ready to resume competitive activities when they possess certain "adaptive" psychological states – for example confidence – or whether psychological readiness is about the relative absence of negatively valanced states such as re-injury anxiety? Alternatively, there may be value in shifting away from "positive and "negative" binary notions of readiness towards an appreciation of the co-existence of positive and negative elements of readiness and the manner in which they dialectically interact over time. Such an approach is consistent with Hanin's (2000) Individual Zone of Optimal Functioning. Hanin identifies positive and negative emotions as independent dimensions rather than opposite poles on the same dimension; existing in a dynamic balance with success linked to a favorable idiosyncratic positive to negative affective balance. Other questions remain, such as to what extent are physical and psychological readiness independent of each other or do they directly influence one another (Cheney et al., 2020; O'Connor et al., 2021; Reider, 2018)?

Based on the above, it is evident that a lack of conceptual clarity exists regarding the nature of psychological readiness to RTS. Considering previous qualitative work (Podlog et al., 2015), outcomes of the current review, and our experience working with injured athletes returning to sport, we propose the following nomothetic definition of psychological readiness:

> Psychological readiness to RTS after injury reflects an individual's state of mental preparedness to resume sport-specific activities, that can shift over the course of one's recovery (i.e., is dynamic in nature) and which is comprised of three dimensions, including cognitive appraisals (confidence, expectations, motivations, risk appraisals, internal or external pressures), affective (anxiety about re-injury or movement, moods) and behavioral components (approach-avoidance behaviors to demonstrate physical function/neuromuscular control, and engage in sport-specific tasks).
>
> Noticeably absent from our definition is a physical, social, or contextual component.

While we contend that physical, social and contextual factors (e.g., history of injuries, social support, sub-cultural norms and values, interactions with injury stakeholders, titration of return-to-sport activity at conclusion of physical rehabilitation, access to rehabilitation facilities) may for instance, *impact* psychological readiness, such factors are not in and of themselves, *part of* psychological readiness, which we conceive of as an intra-individual state of mind. Furthermore, while we have offered a nomothetic definition of psychological readiness, we do not intend to suggest that consensus must be achieved on a single definition of psychological readiness or that the components of readiness identified in our definition transcend all sporting contexts and cultures. For instance, confidence may be a westernized construct that may or may not be a salient dimension of psychological readiness depending upon the setting in question. As such, a multiplicity of definitions may exist contingent upon the researcher's *a priori* interests and study purposes (e.g., examination of specific injury types, sports or social/cultural contexts). We therefore suggest that researchers determine whether they are interested in undertaking nomothetic, or idiographic research (e.g., injury or sport/culture specific research), that they clearly define psychological readiness, and that they select an appropriate readiness measure − assuming quantitative work is being undertaken.

In line with our proposed nomothetic definition, we postulate that different components of psychological readiness will fluctuate over the course of rehabilitation, consistent with injury

symptom resolution. Specifically, cognitive appraisals of confidence, expectations and motivations will increase consistent with symptom resolution, while risk appraisals and negative affectivity will decrease. Similarly, approach behaviors should increase in parallel with symptom resolution, while avoidance behaviors decrease as injury symptomology improves. While we believe psychological readiness is an intra-individual perception, we also contend that various biopsychosocial factors likely facilitate or undermine its development (Brewer et al., 2002). For instance, resolution of body system impairments (e.g., increased neuromuscular control), improvements in physical functioning (e.g., improvement in the ability to run), and resumption of social participation (e.g., graded resumption of practice with the team) improvements in objective biological and physical functioning (e.g., increased neuromuscular control) will facilitate enhance psychological readiness. Similarly, psychological characteristics of the individual (e.g., personality traits, athletic identity, pain tolerance, history of stressors) may positively or negatively influence readiness to RTS. Finally, socio-environmental factors (patient-practitioner interactions, social support, access to rehabilitation facilities, the high-performance context) may increase or decrease perceptions of psychological readiness. Further research is needed to test these hypotheses and to refine, amend or confirm the validity of our nomothetic definition.

The Nature of Psychological Readiness May Vary Depending on Context

While this review focused on psychological readiness in the context of sport, it seems likely that psychological readiness may be relevant in other performance domains such as tactical athletes (e.g., military, police, firefighters) and in performing artists (dancers). Initial work on psychological readiness has begun to emerge in the military (Radomski et al., 2018; Thelen et al., 2015). For instance, Thelen et al. (2015) reported good interrater reliability

(intraclass correlation coefficient [ICC (2,1)=0.88, (0.78, 0.94)] and moderate test-retest reliability [ICC (3,1)=0.57, (0.21, 0.79] of a gender-neutral RTD assessment with 34 active duty military participants (male=22 and female=12). The screening tool consisted of seven assessments, including six physical components (e.g., modified anterior reach, modified deep squat), but only ***one*** psychological component (perceived risk of future injury). To assess perceived risk of future injury, participants were asked "How would you describe your personal concern for sustaining a musculoskeletal injury within the next six months ("No concern for injury"; "Mild to moderate concern for injury" & "Significant concern for injury")?

In developing context specific definitions and measures, researchers are encouraged to incorporate the perspectives of relevant stakeholders and to examine unique features of the context in question. While some elements of psychological readiness may be similar across sport, aesthetic endeavors, military, and first responders, there may also be specific elements of each domain that should be distinguished in the development of a psychological readiness inventory (Caron et al., 2021; Fraser et al., 2020; Heil & Podlog, 2012; Hughes & Coakley, 1991). For example, there is substantial heterogeneity in physical and psychological demands across sports and tactical occupations, exposures to hazards in austere and dynamic environments, and disparity in social norms, cultures, and mission requirements between occupations/sport and organizations that likely influence psychological readiness to resume unrestricted activities. Further research is needed to examine potential conceptual distinctions of psychological readiness across different performance domains.

Research on Psychological Readiness, its Predictors, and Implications has been Largely Atheoretical and Cross-Sectional

There remains a lack of clarity on how or why certain factors facilitate/diminish psychological readiness or why readiness may increase or decrease certain RTS outcomes. To better understand the nature of psychological readiness, its precursors, and outcomes, researchers and practitioners can draw on theories from various fields of research – including sport psychology (or the parent discipline). For example, adoption of existing injury models such as Weise-Bjornstal's et al. (1998) integrated model of response to injury, the biopsychosocial model (Brewer et al., 2002) or Self-Determination Theory (Podlog & Eklund, 2007), may all be useful explanatory frameworks for developing and testing research hypotheses regarding psychological readiness, it's predictors and outcomes. Alternatively, the development of new theories and conceptual models that elucidate relationships of interest may be warranted. Such efforts can help shift the research from its current descriptive state towards more explanatory approaches that promote a deeper understanding of what readiness is "all about", why certain factors may facilitate or hinder its development and why it may help predict certain outcomes of interest (e.g., return to sport, re-injury occurrence, quality of post-injury performances, athlete well-being post return).

With respect to the prediction of readiness outcomes, current evidence suggests links between psychological readiness and various downstream outcomes (return versus non-return, functional status, biomechanical measures, re-injury). Questions remain however, regarding the mechanisms underlining such relationships. For example, it may be that psychological readiness impacts functional movement patterns because, the former frees attentional resources that allow for more efficient movement patterns. This supposition is supported by the findings of Taylor et al. (2020), who found that psychological factors were a robust and significant predictor for performance on the Y-balance test and the Functional Movement Screen in military tactical

athletes (Taylor et al., 2020). It may also be that lower levels of readiness create physiological stress that inhibit effective skill execution, reduce timing, and negatively impact muscle coordination. Based on available evidence, we hypothesize that the positive impact of psychological readiness on rehabilitation and sport specific outcomes will be mediated via physiological and behavioral mechanisms. Specifically, higher readiness will positively impact physiological parameters (e.g., cortisol, testosterone) and physiological healing (e.g., tissue healing) which in turn, will promote enhanced rehabilitation and sport-specific outcomes. Additionally, we predict that increased readiness will positively influence behavioral engagement in rehabilitation (e.g., increased rehabilitation adherence) which will thereby promote enhanced rehabilitation/RTS outcomes. Finally, we posit that higher levels of psychological readiness will facilitate enhanced rehabilitation (e.g., strength, functional movements, neuromuscular control) and sport-specific outcomes (skill execution, objective/subjective performance indices, re-injury). Further interdisciplinary research into the specific reasons *why* psychological readiness may be associated with variability in RTS outcomes, such as functional movement patterns, is a fruitful avenue for future research.

Our review of the research on predictors and implications of psychological readiness also highlights the cross-sectional nature of much of the work. It is therefore difficult to untangle time-order effects, that is, to determine whether particular variables are antecedents or outcomes of psychological readiness. Further longitudinal and repeated measures research is needed to address this issue. Toward this end, researchers could employ various quantitative and qualitative methodologies to imbed themselves in the environment in question, to gain a more nuanced understanding of what psychological readiness is, what precedes it, and what its implications are. Ethnographic approaches, case histories, phenomenological investigations or repeated interviews

would all be useful in uncovering athlete experiences of psychological readiness as they unfold in real-time.

Conclusions

Based on our review of the research, we offer several summary conclusions. First, researchers and practitioners should consider the type of injury, sport or cultural context when selecting a psychological readiness inventory. While a number of injury specific scales exist (i.e., ACL-RSI, HIP-RSI, ALR-RSI SI-RSI), a generic measure – the IPRRS – is also available. Several other related readiness measures include the RIAI, the TSK, and the KSES. Second, while the I-PRRS and ACL-RSI both demonstrate good reliability and construct validity, further testing of content validity is needed. Additional research is needed to better determine how the information obtained from the I-PPRS or ACL-RSI should be used. In the event an athlete has a low score (e.g., 20-30 for the I-PPRS or below 42 for the ACL-RSI), it is unclear whether the best course of action is to delay the RTS until the player feels more confident or to expose them to some form of training/competition to 'boost' confidence to handle sport-related demands (McCall et al., 2017). Regardless of which assessment is used, psychological readiness should be evaluated in conjunction with other indicators of readiness, such as functional strength, neuromuscular function, and execution of sport-specific movements. From a practical standpoint, having discussions with athletes about the potential deleterious implications of low levels of psychological readiness (e.g., diminished likelihood of return to previous sport activities or performance-based function, elevated risk of re-injury, greater interlimb asymmetry), may help mitigate the likelihood of a premature RTS.

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Table 1

Summary of Measurement Tools to Assess Psychological Readiness

Author(s)	Scale Name & Acronym	Length	Psychological Readiness Factors Assessed	Reliability: Internal Consistency Main Findings
Gerometta et al., 2018	Shoulder Instability-Return to Sport after Injury scale (SIRSI)	12-items, each answered on an 11-point Likert scale of 0 to 10 (higher scores indicate a more positive psychological response).	*Emotion*; *Confidence*; *Risk Appraisal*	$\alpha = 0.96$
Glazer, 2009	Injury-Psychological Readiness to Return to Sport Scale (I-PRRS)	10-items, each answered 0 (no confidence) to 100 (utmost confidence).	*Confidence*	$\omega = 0.88$
Gómez-Piqueras et al., 2014	Psychological Readiness of Injured Athlete to Return to Sport (PRIA-RS) Questionnaire for Injured Soccer Players	10-items, each answered on a scale of 1 to 5 (higher scores indicate a more positive psychological response).	Confidence; *Individual Perception*; *Insecurity and Fear of Re-injury*	$\alpha = 0.81$
Sigonney et al., 2020	Ankle Ligament Reconstruction-Return to Sport after Injury scale (ALR-RSI)	12-items, each answered on an 11-point Likert scale of 0 to 10 (higher scores indicate a more positive psychological response).	*Emotion*; *Confidence*; *Risk Appraisal*	$\alpha = 0.96$

Thomeé et al., 2007*	Knee Self Efficacy Scale (K-SES)	Total 22-items: 7-items on daily activities; 5-items on recreation, exercise, and sporting activities; 6-items on physical activities; 4-items on knee function in the future, each answered on an 11-point Likert scale from 0 (not at all confident) to 10 (very confident).	*Self-efficacy*	Factor 1; $\alpha = 0.96$ Factor 2; $\alpha = 0.73$
Walker et al., 2010	Re-Injury Anxiety Inventory (RIAI)	Total 28-items: 15-items on rehabilitation phase; 13-items on re-entry phase, each answered on a scale of 0 (not at all) to 3 (very much so).	*Anxiety for Re-Injury*	Rehabilitation phase; $\alpha = 0.98$ Re-entry phase; $\alpha = 0.96$
Webster et al., 2008; Webster & Feller, 2018	Anterior Cruciate Ligament-Return to Sport after Injury scale (ACL-RSI)	12-items (short version, 6-item), each answered on a 10 cm visual analog scale of 0 (not at all) to 10 (extremely).	*Emotion*; *Confidence*; *Risk Appraisal*	12-item; $\alpha = 0.95$ 6-item; $\alpha = 0.9$
Wörner et al., 2021	Hip-Return to Sport after Injury scale (Hip-RSI)	6-items, each answered on a scale of 0 to 100 (higher scores indicate a more positive psychological response).	*Emotion*; *Confidence*; *Risk Appraisal*	$\alpha = 0.90$

Table 2

Key Studies Included in this State-of-the-Art Review

Author(s)	Study Objective(s)	Study Design (qual., quant., mixed) and Methods	Injuries Assessed	Dimensions of Psychological Readiness Discussed	Main Findings
Conceptualizations of Psychological Readiness					
Kunnen et al. 2020	Understand (a) how athletes define psychological readiness and (b) when they knew they were ready to return to soccer following ACL reconstruction.	Qualitative; Open ended surveys with individual follow-up questions	Musculoskeletal; ACL tear	*Confidence; Love of the Game*	Participants defined psychological readiness as high levels of confidence (rehabilitation process, physical ability, exercise professionals, and low re-injury concerns) and "love of the game" presented as high intrinsic drive/motivation to RTS. Participants knew they were ready to RTS when their confidence and desire to return outweighed fears of re-injury.
Podlog et al., 2015	Examine 7 athletes' injury experiences and their perspectives of psychological readiness to return to sport following a serious injury.	Qualitative; Focus group and one-on-one interviews	Musculoskeletal; Assorted	*Confidence*; *Realistic Expectations*; *Motivation*	Three key psychological readiness attributes: 1) confidence in returning to sport, 2) realistic expectations of one's sporting capabilities, 3) motivation to regain previous performance standards. All three attributes had specific precursors. Readiness defined as a dynamic psychosocial process comprised of the three aforementioned elements that increase athletes' perceived

					likelihood of a successful return to sport.
Predictors of Psychological Readiness					
Aizawa et al., 2020	Identify factors that influence athletes' psychological readiness to RTS specifically requiring cutting, pivoting, and jump-landings after a primary ACL reconstruction.	Quantitative; Cross-sectional	Musculoskeletal; ACL tear	*Confidence*; *Emotion; Risk Appraisal* (ACL-RSI); *Fear of Movement/Re-Injury* (TSK)	High subjective running ability, low kinisiophobia, and more symmetrical lateral SLH distances were associated with greater psychological readiness.
Della Villa et al., 2021	Examine the association of quadricep muscle strength symmetry with female athletes' psychological readiness to RTS after ACL reconstruction.	Quantitative; Retrospective cohort	Musculoskeletal; ACL tear	*Confidence* (I-PRRS)	Injury mechanism influenced the association of psychological readiness to return to play and quadriceps muscle strength. Greater quadriceps muscle strength is associated with higher psychological readiness to RTS following a noncontact injury.
Webster et al., 2018	Identify factors associated with psychological readiness to RTS following an ACL reconstruction.	Quantitative; Cross-sectional using dependent and independent measures	Musculoskeletal; ACL tear	*Confidence*; *Emotion; Risk Appraisal* (ACL-RSI)	1) male sex, 2) younger age, 3) shorter interval between injury and surgery, 4) higher frequency of pre-injury sport participation, 5) greater limb symmetry, 6) higher subjective knee scores were positively associated with psychological readiness.

Clinical and Performance Implications of Psychological Readiness

Hart et al., 2020	Determine whether knee confidence, fear of movement due to re-injury, psychological readiness to return to sport, or pain are related to patient-reported and performance-based function and return to a pivoting sport one year after an ACL reconstruction.	Quantitative; Cross-sectional study	Musculoskeletal; ACL tear	*Fear of Movement/Re-Injury* (TSK)*; Emotion*; *Confidence*; *Risk Appraisal* (ACL-RSI)*; Confidence* (Knee Injury and Osteoarthritis Outcome Score; KOOS)	Fear of movement, knee confidence, psychological readiness to RTS, and pain are related to knee function. Higher ACL-RSI scores were associated with better patient-reported and performance-based function and greater odds of returning to pivoting sports one year after ACL reconstruction. No association between fear of movement due to re-injury and return to pivoting sport was found.
McPherson et al., 2019a	Examine if psychological readiness to RTS is associated with a second ACL tear.	Quantitative; Cohort study, longitudinal design	Musculoskeletal; ACL tear	*Emotion*; *Confidence*; *Risk Appraisal* (ACL-RSI)	No difference in psychological readiness at pre-operation time point. Those who were younger (≤20 years of age) and who had a lower psychological readiness at 12 months post-operation were at a higher risk of a second ACL tear.

Sadeqi et al., 2018	(a) Analyze the progression of the ACL-RSI score from preoperative stage to 2-year post-operative ACL reconstruction. (b) Assess the relationship and identify the factors associated with returning to preinjury sport.	Quantitative; Cohort study	Musculoskeletal; ACL tear	*Emotion*; *Confidence*; *Risk Appraisal* (ACL-RSI); *Confidence* (Knee Injury and Osteoarthritis Outcome Score; KOOS)	The ACL-RSI score was strongly associated with returning to running and the same preinjury sport regardless of follow-up period. Patients practicing their same preinjury sport at the 2-year follow-up had significantly higher mean ACL-RSI score than preoperative patients and at the other time points. Patient satisfaction at the 2-year follow-up was significantly and positively associated with the ACL-RSI score and returning to the same preinjury sport.
Zarzycki et al., 2018	Determine whether a relationship exists between psychological readiness scored on the ACL-RSI and kinematic and kinetic measures of knee symmetry during the gait of athletes who underwent ACL reconstruction.	Quantitative; Cross-sectional design	Musculoskeletal; ACL tear	*Emotion*; *Confidence*; *Risk Appraisal* (ACL-RSI)	Overall, lower scores on the ACL-RSI were associated with greater interlimb asymmetry. Significant negative correlations were discovered between the ACL-RSI and kinematic variables of knee flexion angle at initial contact and peak knee flexion. No relationships were observed with knee kinetic variables.

Note: RTS = return to sport; ACL = anterior cruciate ligament