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Psychosocial factors associated with outcomes of sports injury rehabilitation in competitive athletes: a mixed studies systematic review

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ABSTRACT

Background The prime focus of research on sports injury has been on physical factors. This is despite our understanding that when an athlete sustains an injury it has psychosocial as well as physical impacts. Psychosocial factors have been suggested as prognostic influences on the outcomes of rehabilitation. The aim of this work was to address the question: *which psychosocial factors are associated with sports injury rehabilitation outcomes in competitive athletes?*

Study Design Mixed Studies Systematic Review (PROSPERO reg.CRD42014008667).

Method Electronic database and bibliographic searching was undertaken from the earliest entry until 1st June 2015. Studies that included injured competitive athletes, psychosocial factors, with a sports injury rehabilitation outcome were reviewed by the authors. A quality appraisal of the studies was undertaken to establish the risk of reporting bias.

Results 25 studies were evaluated, spanning 3 decades, on a total of 942 injured competitive athletes. 20 studies not previously reviewed were appraised and synthesised. The research team adjudged the mean methodological quality of the studies to be 59% (moderate risk of reporting bias). Convergent thematic analysis uncovered three core themes across the studies i) emotion associated with rehabilitation outcomes ii) cognitions associated with rehabilitation outcomes and iii) behaviours associated with rehabilitation outcomes. Injury and performance related fears, anxiety, and confidence were related to rehabilitation outcomes. There is gender, age, and injury related bias in the reviewed literature.

Conclusions

The evidence reviewed indicates that psychosocial factors are associated with a range of sports injury rehabilitation outcomes. Practitioners need to recognise that an injured athlete's thoughts, feelings, and actions are related to the outcome of rehabilitation.

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What are the new findings?

- Psychosocial factors including how an athlete *thinks, feels*, and *acts* are associated with the outcomes of their rehabilitation.
- An athlete's *psychological readiness* to return to play appears to be a product of fear, anxiety, confidence in performing well, and remaining uninjured.
- Being female, young, having a limited experience of injury, negative emotion, and perceptions of isolation are factors related to less successful outcomes of rehabilitation.
- Our current interpretation of a successful rehabilitation is overly simplistic and associated with many biopsychosocial, technical, and tactical factors.
- This research topic has age, injury, and gender related bias that future research should address.

How might it impact on clinical practice in the near future?

- Practitioners need to be aware that injured athletes are emotionally vulnerable, and that their emotional integrity may be questionable during rehabilitation process.
- Practitioners need to ensure injured athletes are physically, psychologically, socially, tactically, and technically ready to return to sport.
- Practitioners shouldn't assume that physical and psychosocial recovery from injury occurs within the same timeframe.

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INTRODUCTION

The prime focus of research on sports injuries has been on physical factors.[1] This is despite our understanding that when an athlete sustains a sports injury it has psychosocial impacts.[2, 3] A common assumption has been that physical and psychosocial recovery occurs at the same time. Recently, it has been recognised that physical and psychological readiness to return to sport after injury do not always coincide.[4] This means that athletes may return to training and competition when they are physically but not psychologically ready.

Many athletes do not return to their pre-injury level of activity, and even less return to competition.[5, 6] Competitive athletes are less likely to return to a pre injury level of performance than recreational athletes.[6] As rehabilitation takes place within social contexts involving many people, a key to effective rehabilitation may lie with psychosocial factors.[7] Psychosocial factors can be described as '*pertaining to the influence of social factors on an individual's mind or behaviour, and to the interrelation of behaviour and social factors'.*[8 (p 1091)] These factors have been identified as being important prognostic influences in a range of sports pathologies.[5, 9-11]

Psychosocial factors are also present within a number of models that have been applied or developed within this area. [2, 12, 13] These draw on *stage based, cognitive appraisal*, or *biopsychosocial* approaches and give a conceptual framework to work from, although no single approach predominates the evidence.[4]

Three major systemic reviews have been published within this area.[14-16] These have addressed the need for transparency, methodological rigour and non-biased perspectives in reporting the empirical evidence.[17] Out of the three reviews two are exclusively focussed on psychosocial factors influencing anterior cruciate ligament (ACL) rehabilitation.[15, 16] Whilst ACL injury has high personal impact [18] this represents a narrow perspective and precludes any generalisation of the findings. To reduce injury related bias there is a need to include other injuries which have the same prevalence, severity and chronicity (e.g. high grade lateral ankle sprain, rotator cuff tendinopathy). All of these reviews agree that psychosocial factors influence rehabilitation outcomes. However, differences in constructs were apparent across the reviews. Prominent factors highlighted in these reviews include motivation, self-efficacy, perceived control[15]; autonomy, relatedness, competence[14]; and affect, cognition, behaviours. [16]

These reviews report only quantitative research designs despite the existence of peer reviewed qualitative empirical studies. Previous reviews which have excluded qualitative research have

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reduced the evidence on which they base their findings. There is recognition of the need for systematic methodologies to rigorously deal with diverse forms of evidence to address the disparity between academic research and practitioner experience.[19] Integrating statistical generalisation with the in-depth description of complex phenomenon gleaned from qualitative research has the potential to provide detailed, rich, and highly practical understanding of sport injury rehabilitation. It is thought assessing the overall contribution of a body of literature with contrasting paradigms and designs can be more relevant to the clinical decision making required by practitioners.[20]

The aim of this review was to understand the association between psychosocial factors and sports injury rehabilitation outcomes. This aim was underpinned by the research question: *which psychosocial factors are associated with sports injury rehabilitation outcomes in competitive athletes?* Practitioner facing implications and future research based directions will be given.

METHOD

The methodology of the review was informed by the PRISMA guidelines[17] and recommendations by Lloyd-Jones.[21] As an indicator of methodological quality the review was registered with PROSPERO in February 2014 (registration number: CRD42014008667). This is the only review in this field to be currently registered. The systematic review was granted ethical approval by the institutional ethics committee (ref: DF/08/09/2014/01).

Search Strategy

Eight databases were searched to effectively review the literature from an interdisciplinary perspective (i.e. *SPORTDiscus*, *CINAHL*, *AMED*, *MEDLINE*, *PsychINFO*, *SocIndex*, *PEDro*, ScienceDirect) using multiple keywords and Boolean phrases. The search terms were agreed *a priori* and informed by breaking down the research question, relevant MeSH terms, and by the biopsychosocial approaches used in the area.[2, 13] Extracted studies were included or excluded in a three step screening process studying each studies *title*, *abstract* and *full text.*[21] Systematic bibliographic searching was carried on the final full text studies reference lists using the same process.

Table 1 Search terms used for the systematic review

Electronic database	Search terms (including truncations)
EBSCO Host (including SPORTDiscus, CINAHL, AMED, SocIndex, PsychINFO, MEDLINE)	'Sport* inj*' OR 'athlet* inj*' (ab) AND Psychosocial OR psycholog* OR emotion* (ab) AND Rehabilitat* OR recover* OR outcome* OR return (ab) AND athlet* OR player* OR individual*OR patient*(ab)
ScienceDirect	'Sport* injur*' OR 'athlet* injur*' (title/abstract/key words) AND

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	Psychosocial OR psycholog* (title/abstract/key words)
PEDro	'Sport* inj*'OR 'athlet* inj' (title/abstract) AND Psycholog* OR psychosocial (title/abstract)

Eligibility Criteria

The eligibility criteria are presented in table 2. The criteria were agreed upon by the research team to avoid an unbiased evaluation of the literature. This resulted in no restriction on date of publication, gender, age, or level of performance. Each study had to conform to best practice definitions of *sports injury*[22, 23] and *competitive athlete*, containing discernible *psychosocial factors*[2, 13] influencing *sports injury rehabilitation outcomes.*[24, 25] Studies of non-musculoskeletal (MSK) injury such as concussion were excluded based on specific psychopathology directly effecting neurocognitive function. It is difficult to separate out the psychological consequences associated with the injury pathology from the more interpretive psychosocial responses of athletes.[26]

Table 2 Eligibility criteria applied to studies

Inclusion criteria	Exclusion criteria
Date unrestricted	**Non MSK pathology (e.g. traumatic brain injury, cardiac pathology, visceral damage, spinal cord injury)**
Sports injury – *any MSK pathology requiring the athlete to miss at least one training session or competition*	**Non English language**
Competitive athletes – *competes in sport at least once per week*	**Non peer reviewed**
Contain a discernible sports injury outcome	**Reviews (all), commentaries, editorials position statements, unpublished abstracts**
Contain a discernible psychosocial factor	**Intervention studies**
No gender, age or performance level restriction	**Inventory development studies**
No research design restriction	**Studies on prevention or risk**
Original empirical evidence	**Data gathered from coach or physiotherapist or athletic trainer**
Data gathered from the athlete	

Quality Appraisal

To assess the methodological quality of the literature the Mixed Methods Appraisal Tool (MMAT) was used.[20] Additional to generic criteria the MMAT has five sets of quality criteria relating to: (1) qualitative; (2) quantitative – randomised controlled studies; (3) quantitative – non-randomised controlled studies; (4) quantitative – observational descriptive studies and (5) mixed-methods studies. The overall quality score for each study was based on the methodological domain specific criteria using a percentage based calculation. Mixed methods studies were quality assessed within its own domain plus the domain/s used by its quantitative and qualitative components. According to the MMAT, for mixed methods studies the overall research quality cannot exceed the quality of its weakest component. The MMAT in this review was used to provide an informative description of overall quality and to assess the potential reporting of bias in the findings. Literature using the

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MMAT has found that the consistency of the global 'quality score' between reviewers (ICC) was between 0.72 and 0.94.[20]

Data synthesis

When the final studies had been identified each was read in full to enable the researchers to become immersed in the findings and inferences by *indwelling.*[27] The final studies were then placed into three tables for the review (1) demographic characteristics, (2) study summary, (3) study quality appraisal. A convergent thematic analysis followed to synthesise data from different empirical findings and the assessment of methodological quality.[28] A meta-aggregative approach was adopted. Meta-analysis of findings was not conducted due to the heterogeneity within the included studies research designs.

Establishing Rigour

To ensure rigour a peer review team was formed. The team comprised of the lead researcher (DF), a professor from the same institution (AS), and an academic from another University (AG). This team was created to minimise bias and human error. Established methods of peer debrief and use of '*devil's advocate'* were used to inform the reviews search strategy, records screening, and generation of final themes from the included studies.[27] The full text assessment of eligibility and quality appraisal was undertaken collaboratively in working meetings. These were chaired by the lead researcher with borderline cases or contentious issues resolved through group discussion until a consensus was reached. Eligibility of final studies was carried out using a voting system to determine the basis for study inclusion or exclusion. Decisions to include or exclude studies were based on majority voting. Where further clarification was deemed necessary, additional information was sought from study author(s) or referred to an appropriate University committee.

RESULTS

Literature identification

The electronic database search was undertaken on 1st June 2015 yielding a total of 368 records, with a further 92 later identified through systematic bibliographic searching. This gave a total number of 432 progressing to the screening process following removal of duplicate records (n=28). Following screening at title then abstract level 368 records were excluded leaving 64 full text articles. At this stage of the process 39 full text articles were excluded following research team scrutiny. One study [29] was referred by the team to the Chair of the Faculties Ethics Committee for advice and later included. This left 25 studies in the systematic review (Figure 1). Table three

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identifies the rating for each of the final studies as a marker of agreement for inclusion by the research team (e.g. for full agreement three stars were awarded).

[INSERT FIG.1]

Figure 1 Process overview of study identification, screening, eligibility, and inclusion (adapted from Moher[17])

Assessment of risk of bias

The methodological quality of the final studies was assessed using the MMAT and decisions agreed by the team. Fourteen studies were assessed against qualitative criteria, five studies against quantitative (non-randomised) criteria, four studies against quantitative (descriptive) criteria, and two against mixed methods criteria (table 3). The methodological quality of the 25 studies varied between 25-75% (mean 59%). Qualitative studies scored highest for quality (mean 64%, range 25-75%), compared to quantitative studies (mean 55.5%, range 25-75%) and mixed methods (mean 37.5%, range 25-50%). Although the MMAT does not state specific thresholds for quality level it was agreed by the team in line with previous published systematic reviews[14, 16, 30] that there was a moderate-high risk of reporting bias.

Table 3 Study quality appraisal

Study/rating	Screening questions	Qualitative (all)				Quantitative (non-randomised)				Quantitative (descriptive)				Mixed Methods				Quality Score(%)
1 Gordon & Lindgren[29] **	✓✓	✓	X	X	X													25
2 McDonald & Hardy[42] ***	✓✓									X	X	✓	✓					50
3 Johnson[34] ***	✓✓					✓	X	X	✓									50
4 Johnson[32] ***	✓✓					✓	X	✓	✓									75
5 Mainwaring[51] ***	✓✓	✓	✓	X	X													50
6 Quinn & Fallon[40] ***	✓✓									X	✓	X	X					25
7 Ford et al.[37] ***	✓✓									X	✓	✓	✓					75
8 Tracey[36] ***	✓✓	✓	✓	✓	X													75
9 Kvist et al.[41] **	✓✓					✓	✓	✓	X									75
10 Podlog & Eklund[44] ***	✓✓	✓	✓	✓	X													75
11 Thing[48] ***	✓✓	X	X	✓	X													25
12 Vergeer[49] ***	✓✓	✓	✓	.✓	X													75
13 Gallagher & Gardner[39] ***	✓✓									X	X	✓	X					25
14 Thatcher et	✓✓	✓	✓	✓	X													75

al.[70] **																		
15 Carson & Polman[38] ***	✓✓		✓	✓	✓	X					X	X	X	✓	✓	✓	X	25
16 Langford et al.[33] ***	✓✓						✓	✓	X	X								50
17 Mankad et al.[43] ***	✓✓		✓	✓	✓	X												75
18 Podlog & Eklund[35] ***	✓✓		✓	✓	✓	X												75
19 Carson& Polman[54] ***	✓✓		✓	✓	✓	X					X	X	✓	✓	✓	✓	X	50
20 Wadey et al.[53] ***	✓✓		✓	✓	✓	X												75
21 Ardern et al.[31] ***	✓✓						✓	✓	✓	X								75
22 Carson& Polman[47] ***	✓✓		✓	✓	✓	X												75
23 Podlog et al.[45] ***	✓✓		✓	✓	X	X												50
24 Clement et al.[46] ***	✓✓		✓	✓	✓	X												75
25 Podlog et al.[50] ***	✓✓		✓	✓	✓	X												75

✓ = denotes criteria met, X= denotes criteria not met, shaded=not applicable criteria

Demographic characteristics

The final 25 studies reported on 942 injured athletes across an age range between 15-37 years old (mean 23.7 years). From studies where there was clarity in gender ratio the total participant figure included 64% (n=552) male athletes and 36% (n=309) female injured athletes. The athletes included in this review were derived from team and individual sports, ranging from international levels of performance to regularly competing amateurs. The final studies covered the 25 year period from 1990 to 2015. The national affiliation of the study's lead author highlights the global interest in this topic (e.g. Australia 44%, United Kingdom 24%, North America 20%, and Scandinavia 12%).

Study Characteristics

The 25 studies were made up of 14 qualitative, nine quantitative, and two mixed methods (table 4). This highlights a potential limitation in previous reviews which did not recognise the important role of qualitative and mixed methods studies (e.g. [14]). Sports injury rehabilitation outcomes across the final studies focussed on perceived and actual markers of physical and psychological rehabilitation. For example, actual return to sport [31-33], perceived success and effectiveness[34-36], time loss from competition.[37] Quantitative studies were entirely correlation based utilising a wide range (n=22) of previously established inventories to measure psychosocial response, often with multiple inventories used simultaneously (e.g. [34, 38-40]). Only 32% (n=7) of the inventory measures used were specific to the sports injury domain.

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As found in previous literature (e.g. [14, 22]) there was a broad range of operational definitions of sports injury included across the studies. 70% of studies used a time lost based definition ranging from one day[37] to two months.[35] Time loss from ACL injury would clearly extend this range. Where mean actual time loss was explicitly stated this ranged from 18.5 days (moderate) – 9.4 months (major).[23] Return to competitive sport rates ranged from 51-78%. [31, 33] The injury characteristics revealed a bias towards serious knee injuries with eight studies solely focussing on ACL injury (32%) and eight where serious knee sprains dominated the range of pathologies (32%). Ten studies (40%) focussed on injuries requiring surgical intervention, with the remaining 15 studies (60%) including a mixture of injuries or information about whether surgical intervention was required or wasn't stated. It is noteworthy that none of the studies reported incidence of multiple pathologies, athletes being affected by existing co-morbidity, or misdiagnosis.

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Table 4 Demographic information from included studies

Study (date) inclusion rating	Operational definition of injury	Population studied	Injury type (s)	Sample number (*n*=)	Gender (M:F)	Age (mean years, SD, range)
1. Gordon & Lindgren [29]	Not explicitly stated	Elite cricket	Bilateral pars interarticularis defect requiring surgical intervention	1	1 male	Not stated
2.McDonald & Hardy [42]	Severe injury leading to time loss from sport of three weeks or more	NCAA Division 1 athletes from softball, basketball, track and field, tennis	Musculoskeletal injury including thigh strain, thigh contusion, metatarsal fracture, sprained ankle	5	3:2	Not stated
3.Johnson [34]	Injury occurring in training or competition and minimum time loss of 5 weeks	Highly competitive or elite athletes from team (80%) and individual (20%) sports	Musculoskeletal injury with most common knee, foot/ankle, and shoulder	81	64:17	22.9-25.2
4.Johnson[32]	Injury occurring in training or competition and minimum time loss of five weeks	Highly competitive or elite athletes from team (80%) and individual (20%) sports	Musculoskeletal injury with most common knee, foot/ankle, and shoulder	81	5:7	24.4
5.Mainwaring[51]	Sport related sprain or torsion injury to the knee severe enough to require at least diagnostic surgery	Competitive elite or club athletes from a variety of sports	Sport related ACL injuries	10	6:4	20-29 years
6.Quinn & Fallon[40]	Physical damage sustained as a result of sport participation with time loss of four week or more	Elite athletes from 25 different sports (73.5% team sports, 26.5% individual sports)	Musculoskeletal injury – predominantly ligamentous injury knee, injury to shoulder joint, stress fractures	136	118:18	24.6 ± 4.5
7.Ford et al. [37]	Medical problem sustained during practice or competition that prevented participation (training or playing) for at least one day beyond the date of occurrence.	Regularly competitive athletes from Australian football (41), basketball (20), cricket (14), field hockey (9), netball (26) and volleyball (11)	Not explicitly stated	121	65:56	22 ± 3.6
8.Tracey[36]	Injury that was moderate to severe and which kept them out of practice and/or competition for at least 7 consecutive days	NCAA Division 3 athletes competing in a variety of team and individual sports	Musculoskeletal injury including ACL sprain, sprained ankle, metatarsal fracture, meniscal tear, back strain, shoulder separation, foot contusion	10	Mixed	21.1 ± 0.9
9.Kvist et al.[41]	ACL injury, and undergone reconstruction performed at same hospital	Regularly competitive patient-athletes e.g. participating in soccer, handball. Ice hockey, floor ball, American football	ACL requiring surgical reconstruction (various grafts)	62	34:28	18-37
10.Podlog & Eklund[44]	Time loss of one month or more was the criteria used to denote injuries as serious	Competitive amateur and semi-professional athletes from a variety of individual and team sports	Serious musculoskeletal injury affecting knee, ankle, hip , shoulder, spine , hand	12	7:5	18-28
11.Thing[48]	Not explicitly stated	Elite and non-elite competitive female handball athletes	ACL injury	17	17 female	19-33 years
12.Vergeer[49]	Injury sustained during sport leading to time loss	Competitive rugby league athlete	Shoulder dislocation	1	1 male	28
13.Gallagher & Gardner[39]	Medically diagnosed and severity led to time loss of one week or longer	NCAA Division 1 athletes from nine different sports	Not explicitly stated	40	30:10	Not stated
14.Thatcher et al.[70]	Severe injury is classified as an injury that prevents an athlete from participating in practice/competition for more	Competitive university athletes (karate, judo, field hockey)	Severe musculoskeletal injury including shoulder dislocation, knee ligament sprain, fracture of fibula	3	1:2	Not stated

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	than 21 days					
15.Carson & Polman[38]	Injury occurred during match play leading to time loss	Professional rugby union athlete	ACL injury required surgical intervention	1	1 male	Not stated
16.Langford et al.[33]	Uncomplicated primary ACL reconstruction	Regularly competitive patient-athletes participating at least weekly prior to injury with intent to return to sport	ACL requiring surgical reconstruction (various grafts)	87	55:32	27.48±5.72
17.Mankad et al.[43]	Injury was absence from sport participation for a minimum of three months	State or national level athletes from variety of sports i.e., basketball, rugby league, gridiron, water polo, and BMX racing	Severe musculoskeletal injuries including knee sprain, shoulder dislocation	8	5:3	22.67 ± 3.74
18.Podlog & Eklund[35]	Athletes needed to have sustained an injury requiring a two months absence from sport-specific training and competition	High level amateur and semi-professional athletes returning to play post injury	Not explicitly stated	12	7:5	18-28
19.Carson& Polman[54]	Not stated	Professional rugby union athletes	ACL injury required surgical intervention	4	4 male	18-27
20.Wadey et al. [53]	Injury sustained during training or competition leading to time loss	Club to national level athletes from rugby union, soccer, basketball	All lower extremity musculoskeletal including: sprain, fracture, dislocation, tendinopathy , strain	10	10 male	21.7 ± 1.8
21.Ardern et al.[31]	ACL injury, and undergone reconstruction performed by the same surgeon	Regular competitive patient-athletes including: Australian football (29%), netball (19%), basketball (15%) and soccer (11%)	ACL requiring surgical reconstruction with hamstring graft	209	121:88	31.7 ± 9.7
22. Carson& Polman[47]	Not stated	Professional rugby union athletes	ACL injury required surgical intervention	5	5 male	Not stated
23.Podlog et al.[45]	Current musculoskeletal injury requiring a minimum one month absence from sport participation	Elite level adolescent athletes from a variety of sport i.e. Basketball, netball, soccer rowing, track and field	Musculoskeletal injury including sprain (ACL), dislocation (knee and shoulder), fractures (fibula, arm, lumbar spine), Achilles tendinopathy, bulging disc, Scheuermann's disease	11	3:8	15.3 ± 1.55
24 Clement et al.[46]	Injury that had restricted their sport participation for a minimum of six weeks over the past year	NCAA Division II University athletes from mix of sports including: acrobatics/ tumbling (n=4), football (n=3), baseball (n=1)	Musculoskeletal injury including: ACL injury (n=3), fractures (n=3), rotator cuff repair (n=1), chondrocyte removal from elbow (n=1)	8	4:4	18-22
25 Podlog et al.[50]	Injury was absence from sport participation for a minimum of two months	Mixed level (club-professional) athletes from rugby union (n=3), football (n=2), gymnastics (n=1), martial arts (n=1)	All lower extremity musculoskeletal injury including: fractures metatarsal/ankle (n=3), posterior cruciate ligament rupture (n=1), bruised bone (n=1), hamstring strain (n=1), Achilles tendon damage (n=1)	7	4:3	21.9 ±3.8

M:F, male:female; ACL, anterior cruciate ligament

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Psychosocial Factors

The thematic analysis uncovered three core themes across the studies: i) injury related emotion associated with rehabilitation outcomes ii) injury related cognitions associated with rehabilitation outcomes, and iii) injury related behaviours associated with rehabilitation outcomes (table 5). The rule of inclusion used to place the key findings into these core themes was influenced by the contemporary conceptual models reported in literature.[2, 13] The core themes arising from the included literature were discussed and agreed by the research team for 'best fit' and conceptual congruency. Mean methodological quality of the themes ranged from 56.3 -58.8%.

Table 5 thematic evaluation of the included studies (n=25)

Core Theme	Sub-sets	Studies*	MMAT Quality Rating (%)
Injury related emotion	Mood (TMD, TNM) Injury anxieties & fears Emotional integrity	2,3,4, 5, 6, 7, 8,9, 10, 11, 13,15,16, 17, 18, 21,22,23,24,25	58.8
Injury related cognition	Restoring the self Basic needs fulfilment Personal growth and development	1,3,4,5, 6, 7, 8, 10,11, 13, 14, 18, 19, 20, 22, 23,24,25	58.3
Injury related behaviour	Coping Social interaction	3,4, 6, 12,13,15,17,19,22,23,24,25	56.3

* where studies have multiple findings spanning a number of constructs these have been replicated across the core themes (e.g. qualitative papers that infer both emotion and cognition factors having an effect on sports rehabilitation outcomes)

Injury related emotion associated with sport injury rehabilitation outcomes

This theme was created to reflect the studies focussing on the role of emotion, mood, and affect factors on sports injury rehabilitation outcomes. Twenty of the final included studies were adjudged to have significant emotion related content. Specifically, the role of mood, anxiety and fear (re-injury and performance), and emotional integrity emerged.

A number of studies found that as rehabilitation progressed toward an actual return to sport total mood disruption (TMD) and total negative mood (TNM) decreased and more positive mood states developed.[36, 39, 40, 42] McDonald & Hardy[42] in a study of five Division 1 athletes found a significant negative relationship between TMD and the outcome of athlete perceived rehabilitation (r=0.69, p=<0.0001).

Despite returning to sport often being seen as a positive rehabilitation outcome, a number of studies reported heightened levels of anxiety and/or fear during the transition (e.g. [38, 43-46]). A frequently reported cause of anxieties and fear is that of re-injury (e.g. [31, 41, 43]). Performance related anxiety

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and fear seems prominent when returning to sport within the studies (e.g.[36, 44, 46, 47]). Podlog and Eklund[44] in a qualitative study of twelve athletes, all with severe injuries, found that successful rehabilitation was associated with effectively dealing with competition fears. Later work by the same author, on eleven injured elite adolescent athletes[45], highlighted the dual fears of pain and re-injury, together with the fear of falling behind others, missing out, and underperforming. This suggests that fear is experienced by both adult and younger athletes.

Three studies highlighted findings related to poor emotional integrity i.e. finding athletes being reluctant to discuss their emotions about being injured with their sporting peers and coaches. [36, 43, 48] Tracey[36] found that when some athletes returned to sport that their feelings of isolation/alienation remained. Mankad et al[43] suggested that the inability to 'emotionally disclose' within the team environment was related to an impeded long term psychological rehabilitation from sports injury.

Injury related cognitions associated with sport injury rehabilitation outcomes

This core theme was derived from findings related to the athlete's interpretations, appraisals, or beliefs about themselves or their rehabilitation.[13] Eighteen studies which reached conclusions related to restoration of the self (*self-confidence, self-esteem, self-identity*), injury related outlook, perceptions of basic psychological needs fulfilment, and perceptions of growth and development were included. Injury related cognitions appear to serve as 'precursors' to the resulting emotional responses (i.e. nervousness, anxiety, excitement) and are associated with personal and situational factors. [46] Personal factors such as gender, age, limited injury experience, lowered confidence, and perceptions of isolation were all significantly related to non-return to sport cognitions. [31-33, 41] Delayed surgical intervention was a noteworthy situational factor which was associated with negative risk appraisal and non-return to sport at 2-7 years post ACL surgery. [31]

Ten studies identified restoring the self as being important in the successful return to sport following injury.[29, 33, 37, 38, 40, 43, 44, 49, 50] According to the reviewed studies restoring the self appears to be i) an important motivating factor ii) a common concern when returning to sport following injury, and iii) predict time loss from sport due to injury.[37, 44, 46, 51]

Six studies identified that a successful return to sport was associated with feelings of sport related self-confidence.[29, 33, 38, 40, 47, 50] Within this context sport related confidence was relative to both injury and performance. Two studies by Carson and Polman[38, 47] found confidence building was important in the return to sport with this developed from injury specific and performance specific inputs e.g. from fitness testing, performing well during activity, and the injury site feeling '*strong*'. Podlog et al.[50] found confidence was a major attribute of psychological readiness to return to sport. Overall

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confidence in returning to sport was associated with the rehabilitation programme, the injured body part, and performance capability beliefs. 'Precursors' to developing confidence in returning to sport were noted as having trust in rehabilitation provider, satisfaction of social support needs, and achievement of physical standards / clinical outcomes. Langford et al[33] used the ACL-RSI on injured athletes finding significant difference between the group of returners to sport and those that had not returned at 6 months (p=0.005) and 12 months (p=0.001) suggesting that self-confidence may play an important role in the decision to return to sport.

A number of the final studies (n=6, 24%) inferred that fulfilling basic psychological needs was an important predictor of successful return to sport. Of these three studies were grounded in Basic Psychological Needs Theory[52] and were published by the same author.[35, 44, 45] The studies within this subset highlight the importance of addressing relatedness, competence, and autonomy during reintegration into sporting activities in order to reduce TNM and to experience a successful rehabilitation.[35, 39] Notably, fulfilment of competence, relatedness, and autonomy seems important in both elite adult and adolescent populations.[35, 44, 45]

Importantly, seven of the final studies (28%) suggested that perceiving injury as an opportunity for growth, and as a positive developmental experience was related to a successful rehabilitation (e.g.[36, 37, 44, 46, 53]).

Injury related behaviour associated with sport injury rehabilitation outcomes

This core theme was created to capture the impact of physical and psychosocial behaviours on sports injury outcomes. Any study that included content on athlete effort, actions, and activities were included in this theme.[13] Twelve studies (48%) contributed to this core theme relating to the effect of coping strategies, and social interactions on the athlete's rehabilitation outcomes.

Across the final studies there was ambiguity in findings over which type of coping mechanism was related to positive rehabilitation outcomes. Paradoxically, avoidance focussed coping strategies were suggested as being both facilitative[54] and also debilitative.[39, 43] A mixed method study [54] of elite professional rugby players found that behavioural and cognitive avoidance coping strategies enhanced perceptions of recovery. In contrast two studies credited using avoidance coping with less successful rehabilitation outcomes such as a delay in psychological rehabilitation[43], and associated increase in TNM.[39]

There was stronger agreement within the final studies about the positive association problem focussed coping strategies have on rehabilitation outcomes, such as actual reintegration back into training/competition (e.g.[38, 40, 47, 49]). Gallagher & Gardner[39] found that in the last phase of injury

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before a return to sport a significant negative relationship was found between approach focussed coping and TNM (r = –0.354, p = <0.05). Two studies by Carson and Polman[38, 47] identified problem focussed coping strategies enhanced the experience of returning to sport after an ACL injury

Although social interaction is a coping strategy in and of itself, seven studies highlighted its importance in affecting perceived and actual rehabilitation outcomes, and as such warrants its own sub-set. Studies on return to sport stressors and coping using seriously injured elite rugby players[38, 47] found perceptions of social support network provided by multiple agents (e.g. team mates, medical staff, coach, family, crowd) were particularly salient on returning to sport. Trust in the rehabilitation provider, feeling wanted by others, and satisfaction of social support needs were associated with psychological readiness to return to sport. [50] Importantly, insufficient social support appears to be associated with unsuccessful rehabilitation [32], and remains a common concern upon returning to sport.[36, 45]

DISCUSSION

The aim of this review was to understand the association between psychosocial factors and sports injury rehabilitation outcomes. This aim was underpinned by the research question: *which psychosocial factors are associated with sports injury rehabilitation outcomes in competitive athletes?* Twenty studies not previously reviewed were included for appraisal and synthesis. Our findings indicate that psychosocial factors (*emotion, cognition, and behavior related*) are associated with a variety of perceived and actual rehabilitation outcomes. It is thought that this process is cyclical in nature. [46] For example, cognitions impact upon injury related emotions and behaviours, and vice versa. The evidence presented in this review is consistent with previous reviews and theoretical perspectives.[2, 13, 16, 55] Wiese-Bjornstal[13] appears to provide a useful conceptual framework to understand this emerging topic.

What is not known is the extent psychosocial factors are related to rehabilitation outcomes; singularly or cumulatively, compared with biological factors. Compared with other domains of psychology the understanding of this topic is in its infancy.[24] The methodological quality of the final studies was agreed as poor-moderate (mean 59%) by the research team. Therefore, the findings of this review must be viewed as having a potential reporting bias.

Other domain related systematic reviews[14-16] highlight fear of re-injury as one of the most common emotional factors associated with rehabilitation outcomes after severe injury. Fear is seen as a unitary construct within quantitative research designs that dominate previous reviews. In contrast, the evidence from this review highlights injured athletes experience many anxieties and fears during

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rehabilitation. The articles included in this review found that the anxieties and fears athletes experience come in two forms i) re-injury related[31, 41, 43] and ii) performance related.[36, 47] This finding is an important one in helping to inform any intervention used during the rehabilitation of injured athletes.

Evidence from this review and the broader literature suggests an association between anxiety and fear of being re-injured and rehabilitation outcomes.[41, 56, 57] Little is known about which forms of anxiety and fear predominates, the interactional effects between different forms, and ultimately which is the most salient. The evidence in this review suggests that the athlete who can effectively manage anxiety and fear will experience more positive outcomes from rehabilitation.[44] Adern et al[58] highlighted the concept of '*psychological readiness*' as important in determining return to sport decisions post ACL injury. The construct of *'psychological readiness'* in terms of sports injury can be interpreted as being a combination of the athletes experiencing low levels of fear over re-injury and underperforming.[59]

Restoring self-confidence was a key sub set emerging from the studies (e.g. [33, 38, 40, 47]). Self-confidence is derived from two elements i) confidence in the injury site and ii) confidence in performance. Confidence may have a moderating effect on the emotion of fear as both seem determined by injury and performance related inputs. This review indicates that successful return to sport is underpinned by developing self-confidence cognitions, even though the mechanism of effect is not yet fully established.[29, 47] Confidence in returning to sport after injury appears to be a multidimensional factor. [50] Developing confidence in both the injured body part and ability to perform to a satisfactory standard may act as a '*buffer*' from injury related anxiety and fear. The implication of this is athletes would acquire the suitable *'psychological readiness'* to return.

Experiencing adversity has the potential to yield positive outcomes. Nonetheless, it is important to note that stress related growth isn't inevitable.[60] The articles reviewed found that an ability to perceive sport injury rehabilitation as an opportunity for development and growth was associated with more positive rehabilitation outcomes.[37, 53] A perspective from Wadey et al[61 (p 126)] is that growth through adversity may even lead to '*positive changes that propel them to a real or perceived higher level of functioning than that which existed prior to the negative circumstance'*. It seems that perceiving the experience related to injury as positive may facilitate returning to sport[44] , enable a more holistic recovery, and develop resilience in overcoming adversity.[53] Previous studies have shown the different forms of growth that can occur through injury include: personal, psychological, social, and physical.[61] This suggests practitioners should encourage athletes to reflect on the injury experience as an opportunity for growth to facilitate positive rehabilitation outcomes.

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From the articles reviewed emotional integrity emerged as an important sub set. Emotional integrity relates to the athletes conscious decision to either withhold or disclose false injury related emotions. Studies found this was a common practice compounding perceptions of isolation and impeding psychological rehabilitation outcomes (e.g. [36, 43, 48]). Findings support theoretical propositions of Wiese-Bjornstal[13] whereby emotional integrity (or emotional inhibition as phrased in the model) is identified as an emotion related factor associated with rehabilitation outcomes. The emotional integrity or lack of it in some injured athletes could have a profound effect on the ability to collect accurate data. If there is a high incidence of 'lack of emotional integrity' then this may challenge the validity of some studies already published and challenges researchers to develop methodologies to overcome this problem. Both researchers and practitioners should give injured athletes the opportunity to use nontraditional forms of communication e.g. blogs and diaries.

Current empirical limitations and future directions

The empirical literature relating to adult male athletes with severe knee injury (e.g. ACL) is well established. We conclude that this has created gender, age, and injury related biases in the literature, limiting generalisability of findings. Male and females exhibit sexual dimorphic and phenotypic differences in both the physical and psychological response to injury. This can lead to very different injury experiences and outcomes.[62, 63] It is has been previously been stated that age related differences is a neglected area in sport injury psychology.[64] The fact that only one of the final included studies included adolescent participants highlights this problem. Researchers and practitioners should be aware of dimorphic, phenotypic, and developmental differences across athletic populations to better facilitate positive rehabilitation outcomes.

Most studies reviewed adopted the perspective that actual return to sport is the major rehabilitation outcome, and cease their data collection at this point (e.g. [39, 49]). Return to play is often seen as the defining feature of recovery and has been criticised for skewing the evidence base.[65] It is naïve to assume that just because an athlete returns to sport post injury that they are fully recovered both physically and psychologically. It is plausible that the interpretation of a *successful rehabilitation* is associated with many perceived and actual complex biopsychosocial, technical, and tactical factors. Therefore, using return to pre-injury activity levels as the sole indicator is too simplistic.

Within the studies reviewed there was a lack of detail on co-morbidity, multiple pathologies, iatrogenic issues, or mis-diagnosis issues, despite these being potentially striking features of the injured athlete's experience.[2, 13] There appears to be little empirical literature on complicated, multi-

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pathological or unsuccessful rehabilitation. Studies using negative case analytical approaches could profoundly change our understanding of the area.

The overreliance of non-experimental, correlational designs within the literature restricts the ability to establish causal relationships between psychosocial factors and injury rehabilitation outcomes. Due to the nature of evidence reviewed a causal link between psychosocial factors and rehabilitation outcomes can't be reliably inferred. Additional to exploring experiences of injured athletes, future research also needs to explore causal patterns.

Strengths and limitations of this review

There are ontological and epistemological challenges in conducting a mixed studies systematic review.[19] The tendency for systematic reviews to exclude non experimental research has received criticism.[19, 66] Ferlie[67 (p 99)] emphasised the dangers of a reductionist approach:

> *'The world of evidence-based medicine can be characterised by an abstracted form of pure rationality, often of a meta-analytical nature…..the world of clinical (sports injury) practitioners, by contrast, may be much more local and experiential in nature.'*

There is a growing call for mixed study reviews within the healthcare sector in order to address the perceived divergence between research and practice.[19] This review is a positive response to this call and therefore offers an important contribution to the literature. The reviewed quantitative evidence provides associations between psychosocial factors and rehabilitation outcomes. Additionally, the qualitative and mixed methods evidence elucidates mechanisms behind these associations, and how psychosocial factors are modified throughout the rehabilitation process.

This review was focussed on competitive athletes. Therefore, this precludes any robust generalisability to other populations such as recreational and intramural athletes or non-athletic patient groups. All levels of competitive athlete were included. It is plausible that athletes with more time investment in sport or gaining financial benefit for participation may exhibit different types and/or intensity of psychosocial factors. [14] By not excluding dated studies and including six studies from the 1990's (e.g. [29, 32, 40]) may have led to timeframe based bias in the findings. That is, there is a danger of equating dated studies with more recent papers grounded in modern sport medicine. This review included all sports injury types to develop an understanding beyond simply ACL injury. It must be noted however, that the findings of this review are based on a sizeable percentage of post-operative ACL participants. Injury severity and type may be a confounding factor when examining sports injury rehabilitation outcomes.[14] An athlete with more severe injuries may exhibit more prolonged and severe negative psychosocial responses proliferating into the return to

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sport phase. Including studies with mixed time loss is ecologically valid, however, by aggregating studies together the ability differentiate injury experiences across specific populations is diminished. For example, whether analogous psychosocial factors are associated with injuries requiring surgical vs. non-surgical or conservative intervention could be debated.

To date this is the only systematic review to register with PROSPERO based on psychosocial factors associated with sport injury rehabilitation outcomes. The registration serves to endorse the rationale and rigour of this review. This will hopefully elevate the research area into one meriting value within the healthcare sector, and be a protagonist for further empirical investigation. If injury outcomes are associated with psychosocial factors as this and other reviews suggest, practitioners need to be empowered to recognise and address these factors or appropriately refer on.[68, 69]

CONCLUSION

This review identified, selected, appraised and synthesised all available empirical evidence irrespective of the research design or the theoretical framework adopted. As a result this review includes evidence not previously included in earlier systematic reviews. The evidence reviewed indicates that psychosocial factors are associated with a range of actual and perceived sports injury rehabilitation outcomes. Specifically, these psychosocial factors include an athlete's injury related cognitions, emotions and behaviours.

Contributions DF, AS, and MJ were responsible for the conception and design of this mixed studies systematic review. DF applied the search strategy, extracted data, completed PROSPERO registration, and obtained ethical approval. The peer review team (DF, AS, AG) applied the eligibility criteria at each stage, quality appraisal tool, and agreed on meta-aggregated themes. DF completed the final manuscript with critical revisions made by AS, MJ, AG.

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To be added as ancillary on-line material:

Table 6 Study research findings

Study	Study design	Psychosocial factor(s)	Sports Injury Rehabilitation Outcome	Findings
Gordon & Lindgren [29]	**Qualitative**: retrospective case study design	Interview data on experience of response, rehabilitation, and return to sport	Return to first class cricket post-surgery	Psychological adjustment on the part of the athlete (attributed to himself and own efforts) significant in recovery process Reported growth through rehabilitation with ability to meaningfully interact with seriously injured and handicapped people in the future Rationale thoughts and a self-responsible attitude led to more adaptive behaviours Return to sport experience mediated by confidence related to the injury, withstanding sporting demands, and performance
2.McDonald & Hardy [42]	**Quantitative**: prospective cohort design	Affect – POMS questionnaire	Athlete perceived rehabilitation progress and effectiveness	Significant negative correlation between total mood disturbance and perceived rehabilitation Significant negative correlation between affective measures of tension, depression, anger, fatigue, confusion and perceived rehabilitation
3.Johnson [34]	**Quantitative:** prospective cohort design	Psychological profile of multiply vs first time injured athletes (MACL, GCQ, KSP)	Perceptions of rehabilitation success (SIQ)	Significant difference between first time injured and multiply injured for perceptions of physical recovery, and awareness of rehabilitation guidelines Multiply injured athletes rated themselves significantly higher for mood variables of social orientation and activity than first time injured
4.Johnson[32]	**Quantitative**: longitudinal prospective cohort design (3-36months)	Psychosocial profile of injured athletes (MACL, GCQ, KSP)	Return to sport	Results suggested that being younger, being female, isolation from the team and athletic friends, and having had no previous experience with injury characterized the non-returning athlete
5.Mainwaring[51]	**Qualitative**: longitudinal and cross sectional design (over 12 months)	Domains of sports (physical, psychological, social)	Return to sport	Restoration of self comes from the motivation to overcome the disability (injury) This has a reciprocal mediating relationship with sport injury domains (psychological, social, physical) Each domain is influenced by person and situation factors
6.Quinn & Fallon[40]	**Quantitative**: repeated measures cohort design	Self-reporting of confidence (SSCI), injury appraisals, emotional response (POMS), self-efficacy, coping (COPE), motivation – self and rehabilitation focussed	Injury process to return to sport	Confidence in recovering on time and being successful upon return to sport followed inverted U shape through rehabilitation Rehabilitation motivation (adherence and intensity) increased in a linear fashion through the phases

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7.Ford et al.[37]	**Quantitative**: prospective correlational cohort design	Life stress (ALES) and moderating psychosocial variables SCAT-competitive trait anxiety, LOT-hardiness, SE-S-self-esteem, SSS-social support)	Time loss from sport	Use of active coping resources increased through the phases Hardiness and quality of social support were significantly related to decreased injury time-loss in athletes when positive life change increased Global self-esteem was significantly associated with decreased injury time-loss when both negative life change and total life change increased Dispositional optimism significantly associated with decreased time loss when positive life change increased
8.Tracey[36]	**Qualitative**: exploratory cohort design	Data on injury related affect, emotions, and cognitions	Perceived psychological adjustment and recovery	Cognitive appraisal of injury affected emotional and behavioural responses Return to practice associated with a reduction in negative emotions although feelings of alienation/isolation remained and comparison to non-injured peers served to increase emotional response Successful recovery associated with a sense of accomplishment and having gone through a learning experience Fear not a predominant theme on return to sport although feeling of hesitation /apprehension were apparent Reluctance to openly discuss injury related feeling with sport peers e.g. coaches
9.Kvist et al.[41]	**Quantitative**: prospective cohort design	Fear of re-injury/ movement (TSK)	Self-report function (KOOS) Sport participation (general questions)	3-4 years post-surgery only 53% athletes had returned to pre-injury activity level Negative significant correlation between TSK and knee related quality of life Athletes not returning to pre-injury activity level reported significantly higher fear of movement
10.Podlog & Eklund[44]	**Qualitative**: longitudinal cohort design	Psychosocial 'issues and processes' arising from interview data	Return to sport (pre-competition and competition)	Pre competition phase: Theme 1 Motives to return to sport e.g. restore identity Theme 2Return to competition appraisal and emotions (positive and negative) Theme 3 Decision making process (ambiguity & pressure to return) Competition phase: Theme 1 Dealing with competition fears Theme 2 Encounters with adversity Theme 3 Enjoyable aspects of return/ reflecting on positives of injury Suggested returning athletes experienced a number of autonomy, competence, and relatedness issues
11.Thing[48]	**Qualitative**: longitudinal ethnographic cohort design	Athlete perceptions of risk and health	Return to sport	Injury challenges social identity, bodily attitudes, and time management

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	(over one and a half years)			Return to sport characterised by ambivalence between desire vs. reason, and pleasure vs. safety All athletes seriously considered their sporting future Athletes often alone with problems of injury and chose not to discuss with sports peer
12.Vergeer[49]	**Qualitative**: prospective longitudinal case study design (over 20 weeks including three year follow up)	Mental representations of being an injured athlete	Restoration of function and return to sport	Dynamic flux in themes through recovery process At three years post injury athlete no longer competing despite functional restoration Theme 1: role of different types of injury awareness Theme 2:effective use of a mental itinerary Theme 3:complexity of mental model (state of injury and consequences associated) Theme 4: motivational role of reflecting of ideal or desired physical self Theme 5: involuntary and voluntary use of mental imagery
13.Gallagher & Gardner[39]	**Quantitative**: prospective correlational cohort design	Emotional response (POMS), coping (CRI-AF), cognitive schemas (YSQ-SF)	Phases of return to sport; phase one (within 72 hours onset), phase two (projected rehabilitation mid-point), phase three (discharge to return to sport activity)	TNM reduced throughout rehabilitation Avoidance focussed coping strategies positively related to TNM Approach focussed strategies negatively related to TNM Maladaptive schemas positively related to TNM Schema of *impaired autonomy* predicted more severe TNM
14.Thatcher et al.[70]	**Qualitative**: longitudinal exploratory case studies design	Motivational style (MSP) according to Reversal Theory, emotional response through rehabilitation (unstructured interview)	Return to training/competition	All athletes motivational style shifted throughout rehabilitation process Times during rehabilitation when motivational needs not being met leading to adverse emotional response Motivational flexibility important for successful rehabilitation
15.Carson & Polman[38]	**Mixed method**: longitudinal case study design	Interview, self –report diary, and questionnaire data on emotions and coping strategies (to give holistic view of cognitive appraisal processes through rehabilitation; ERAIQ, SIP, C-HIP, MOS-SSS, SCQ, ICQ)	Successful participation in rehabilitation and return to sport	Late limited participation and return to sport determined by influential emotional and coping strategies Late limited stage salient emotions (apprehension, encouragement, depression/frustration) and beneficial coping (goal setting, social support, use of both avoidance and problem focussed coping types) Return to sport stage salient emotions (confidence building, apprehension, relief) and beneficial coping (goal setting, social support, and use of problem focussed coping type)
16.Langford et al.[33]	**Quantitative**: prospective longitudinal cohort design (3,6, and 12 months)	Emotional response to injury (ERAIQ), psychological impact of returning to sport (ACL-RSI), physical recovery	Return to sport	At 12 months only 51% athletes had returned to competitive sport No differences in physical recovery or ERAIQ between groups, however

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		outcome measures		significant reduction across groups over rehabilitation period
17.Mankad et al.[43]	**Qualitative**: exploratory inductive design	Perceptions of emotional climate	Psychological rehabilitation from long term injury	Athletes that returned to competitive sport scored significantly higher on ACL-RSI (emotions, confidence in performance, risk appraisals) Theme 1: emotional trauma – athletes displayed fear of re-injury and identity concerns upon return to sport Themes 2: emotional climate – athletes felt the need to suppress/ inhibit genuine emotions in the team environment Theme 3: emotional acting – athletes learnt to disengage from genuine emotions through emotional control techniques within team environment Authors suggest these were emotionally destructive behaviours that could delay an athlete's long-term psychological rehabilitation
18.Podlog & Eklund[35]	**Qualitative**: longitudinal cohort design (6-8 month period)	Athletes perceptions of return to play arising from interview data	Perceived successful injury return	Successful rehabilitation influenced by perceptions of: Return to pre injury sport status Ability to stay on 'right path' Having realistic post injury expectations Feeling self-satisfied Absence of injury related concerns Effectively overcoming adversity Suggested successful injury return influenced by competence, relatedness, and autonomy aspects
19.Carson& Polman[54]	**Mixed method:** exploratory case studies design	Interview data, self –report diary, and C-HIP questionnaire data on coping strategies	Perceptions of psychological adjustment and recovery	Avoidance coping (behavioural and cognitive) may facilitate greater perceptions of control and help manage stressful situations High level of distraction coping strategies (physical and cognitive) Avoidance coping may facilitate personal develop through rehab and contribute towards fulfilment of basic needs
20.Wadey et al. [53]	**Qualitative**: retrospective exploratory cohort design	Psychological antecedent and mechanisms	Return to competitive sport	Possible for athletes to perceive benefits through injury rehabilitation which facilitates holistic recovery Reflecting back on the recovery of the injury athletes were able to get clearer sport related perspective and improve ability to deal with adversity By having contact with other distressed individuals, athletes believed they were less selfish, and had increased empathy for others
21.Ardern et al.[31]	**Quantitative**: cross sectional case series with follow up (2-7 years)	Fear of re-injury (self-report questionnaire)	Return to pre injury sport level	Significantly less fear of re-injury found in athletes who returned to sport at pre-injury level Significantly greater concern over sport environment conditions by females Significantly greater fear of re-injury in athletes with delay to surgical intervention (>3months)
22. Carson& Polman[47]	**Qualitative**: longitudinal	Interview and self-report diary data on	Return to competition	Return to play determined by influential emotions and the athletes coping

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	exploratory design (throughout transition into return to play)	injury cognitions, emotions, and coping strategies		strategies Pre competition salient themes included: influential emotions (confidence building, anticipation, anxiety) and coping (physical and mental preparation, social support) Post competition salient themes included: influential emotions (confidence building, positive performance emotions, performance anxieties) coping (problem focussed coping, social support, dealing with fear) Successful return to play influenced by gaining confidence in the injured tissue with this perceived to be improved through testing
23.Podlog et al.[45]	**Qualitative**: longitudinal cohort design (11 month period)	**Data on the athletes psychosocial experience**	**Process of return to sport**	Experience of process of return to sport influenced by: Theme 1-heightened injury stress (pain, falling behind others, missing out, fear of re-injury, underperforming) Theme 2 – coping (lack of directed strategies, use of avoidance coping, and problem focussed coping) Theme 3 – importance of social support Theme 4 – recovery outcomes (positive influenced by satisfaction in performance and success in achieving goals, negative influenced by underperformance relative to pre injury), reflecting on personal growth through being injury
24. Clement et al.[46]	**Qualitative**: retrospective cohort design	**Interview data on psychosocial responses to rehabilitation**	**Return to sport**	Rehabilitation from sports injury influenced by cycles of cognitive appraisals, emotional responses, and behavioural response When returning to sport athletes reflected on lessons learnt, with these appraisals serving as precursors to emotional response (feelings of excitement and anxiety) and behavioural reponse (being cautious when returning to play)
25. Podlog et al.[50]	Qualitative: **retrospective cohort design**	**Focus group and interview data based on psychological experience and precursors of returning to sport**	**Psychological readiness to return to sport**	Psychological readiness determined by three components: Component 1 – confidence in returning to sport (precursor: trust in rehabilitation provider, social support, achievement of standards/ outcomes) Component 2 – realistic expectations of one's sporting capabilities (precursor: patience, acceptance, effective goal setting) Component 3 – motivation to regain previous performance standards (precursor: effective goal setting, boredom of injury, feeling wanted, social support)

ALES (Athlete Life Experiences Survey), **SCAT** (Sport Competition Anxiety Test), **LOT** (Life Orientation Test), **SE-S** (Self-esteem Scale), **SSS** (Social Support Scale), **POMS** (Profile of Mood States), **CRI-AF** (Coping Response Inventory – Adult Form), **YSQ-SF**(Young Schema Questionnaire – Short Form), **ERAIQ** (Emotional Response of Athletes to Injury Questionnaire) , **SIQ** (Sports Injury Questionnaire), **MACL** (Mood Adjective Checklist), **GCQ** (General Coping Questionnaire), **KSP** (Karolinska Scales of Personality), **TSK** (Tampa Scale of Kinesiophobia), **KOOS** (Knee Injury and Osteoarthritis Outcome Score) , **ACL-RSI** (ACL - Return to Sport

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After Injury Scale), **C-HIP** (Coping with Health, Injuries, and Problems Inventory) , **SSCI** (State Sport Confidence Inventory), **TNM** (Total Negative Mood), **MOS-SSS** (MOS-Social Support Survey), **SCQ** (Sports Climate Questionnaire), **ICQ** (Injury Climate Questionnaire), **SIP** (Sports Inventory for Pain)

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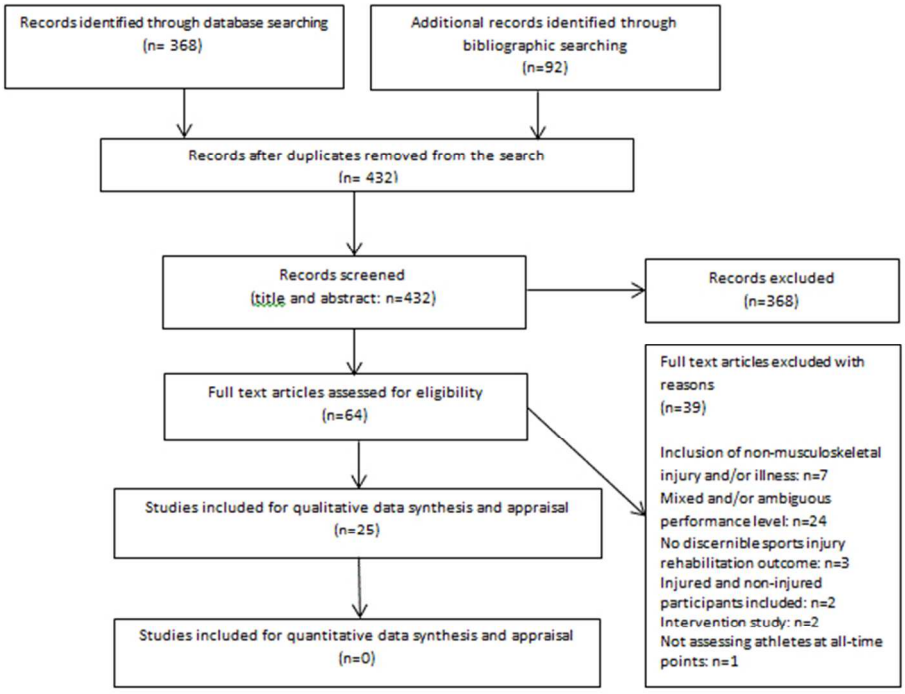

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Table 6 Study research findings

Study	Study design	Psychosocial factor(s)	Sports Injury Rehabilitation Outcome	Findings
Gordon & Lindgren [29]	**Qualitative**: retrospective case study design	Interview data on experience of response, rehabilitation, and return to sport	Return to first class cricket post-surgery	Psychological adjustment on the part of the athlete (attributed to himself and own efforts) significant in recovery process Reported growth through rehabilitation with ability to meaningfully interact with seriously injured and handicapped people in the future Rationale thoughts and a self-responsible attitude led to more adaptive behaviours Return to sport experience mediated by confidence related to the injury, withstanding sporting demands, and performance
2.McDonald & Hardy [42]	**Quantitative**: prospective cohort design	Affect – POMS questionnaire	Athlete perceived rehabilitation progress and effectiveness	Significant negative correlation between total mood disturbance and perceived rehabilitation Significant negative correlation between affective measures of tension, depression, anger, fatigue, confusion and perceived rehabilitation
3.Johnson [34]	**Quantitative:** prospective cohort design	Psychological profile of multiply vs first time injured athletes (MACL, GCQ, KSP)	Perceptions of rehabilitation success (SIQ)	Significant difference between first time injured and multiply injured for perceptions of physical recovery, and awareness of rehabilitation guidelines Multiply injured athletes rated themselves significantly higher for mood variables of social orientation and activity than first time injured
4.Johnson[32]	**Quantitative**: longitudinal prospective cohort design (3-36months)	Psychosocial profile of injured athletes (MACL, GCQ, KSP)	Return to sport	Results suggested that being younger, being female, isolation from the team and athletic friends, and having had no previous experience with injury characterized the non-returning athlete
5.Mainwaring[49]	**Qualitative**: longitudinal and cross sectional design (over 12 months)	Domains of sports (physical, psychological, social)	Return to sport	Restoration of self comes from the motivation to overcome the disability (injury) This has a reciprocal mediating relationship with sport injury domains (psychological, social, physical) Each domain is influenced by person and situation factors
6.Quinn & Fallon[40]	**Quantitative**: repeated measures cohort design	Self-reporting of confidence (SSCI), injury appraisals, emotional response (POMS), self-efficacy, coping (COPE), motivation – self and rehabilitation focussed	Injury process to return to sport	Confidence in recovering on time and being successful upon return to sport followed inverted U shape through rehabilitation Rehabilitation motivation (adherence and intensity) increased in a linear fashion through the phases Use of active coping resources increased through the phases
7.Ford et al.[37]	**Quantitative**: prospective correlational cohort design	Life stress (ALES) and moderating psychosocial variables SCAT-competitive trait anxiety, LOT-	Time loss from sport	Hardiness and quality of social support were significantly related to decreased injury time-loss in athletes when positive life change increased

		hardiness, SE-S-self-esteem, SSS-social support)		Global self-esteem was significantly associated with decreased injury time-loss when both negative life change and total life change increased Dispositional optimism significantly associated with decreased time loss when positive life change increased
8.Tracey[47]	**Qualitative**: exploratory cohort design	Data on injury related affect, emotions, and cognitions	Perceived psychological adjustment and recovery	Cognitive appraisal of injury affected emotional and behavioural responses Return to practice associated with a reduction in negative emotions although feelings of alienation/isolation remained and comparison to non-injured peers served to increase emotional response Successful recovery associated with a sense of accomplishment and having gone through a learning experience Fear not a predominant theme on return to sport although feeling of hesitation /apprehension were apparent Reluctance to openly discuss injury related feeling with sport peers e.g. coaches
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10.Podlog & Eklund[44]	**Qualitative**: longitudinal cohort design	Psychosocial 'issues and processes' arising from interview data	Return to sport (pre-competition and competition)	Pre competition phase: Theme 1 Motives to return to sport e.g. restore identity Theme 2Return to competition appraisal and emotions (positive and negative) Theme 3 Decision making process (ambiguity & pressure to return) Competition phase: Theme 1 Dealing with competition fears Theme 2 Encounters with adversity Theme 3 Enjoyable aspects of return/ reflecting on positives of injury Suggested returning athletes experienced a number of autonomy, competence, and relatedness issues
11.Thing[47]	**Qualitative**: longitudinal ethnographic cohort design (over one and a half years)	Athlete perceptions of risk and health	Return to sport	Injury challenges social identity, bodily attitudes, and time management Return to sport characterised by ambivalence between desire vs. reason, and pleasure vs. safety All athletes seriously considered their sporting future

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12.Vergeer[48]	**Qualitative**: prospective longitudinal case study design (over 20 weeks including three year follow up)	Mental representations of being an injured athlete	Restoration of function and return to sport	Athletes often alone with problems of injury and chose not to discuss with sports peer Dynamic flux in themes through recovery process At three years post injury athlete no longer competing despite functional restoration Theme 1: role of different types of injury awareness Theme 2:effective use of a mental itinerary Theme 3:complexity of mental model (state of injury and consequences associated) Theme 4: motivational role of reflecting of ideal or desired physical self Theme 5: involuntary and voluntary use of mental imagery
13.Gallagher & Gardner[39]	**Quantitative**: prospective correlational cohort design	Emotional response (POMS), coping (CRI-AF), cognitive schemas (YSQ-SF)	Phases of return to sport; phase one (within 72 hours onset), phase two (projected rehabilitation mid-point), phase three (discharge to return to sport activity)	TNM reduced throughout rehabilitation Avoidance focussed coping strategies positively related to TNM Approach focussed strategies negatively related to TNM Maladaptive schemas positively related to TNM Schema of *impaired autonomy* predicted more severe TNM
14.Thatcher et al.[68]	**Qualitative**: longitudinal exploratory case studies design	Motivational style (MSP) according to Reversal Theory, emotional response through rehabilitation (unstructured interview)	Return to training/competition	All athletes motivational style shifted throughout rehabilitation process Times during rehabilitation when motivational needs not being met leading to adverse emotional response Motivational flexibility important for successful rehabilitation
15.Carson & Polman[38]	**Mixed method**: longitudinal case study design	Interview, self –report diary, and questionnaire data on emotions and coping strategies (to give holistic view of cognitive appraisal processes through rehabilitation; ERAIQ, SIP, C-HIP, MOS-SSS, SCQ, ICQ)	Successful participation in rehabilitation and return to sport	Late limited participation and return to sport determined by influential emotional and coping strategies Late limited stage salient emotions (apprehension, encouragement, depression/frustration) and beneficial coping (goal setting, social support, use of both avoidance and problem focussed coping types) Return to sport stage salient emotions (confidence building, apprehension, relief) and beneficial coping (goal setting, social support, and use of problem focussed coping type)
16.Langford et al.[33]	**Quantitative**: prospective longitudinal cohort design (3,6, and 12 months)	Emotional response to injury (ERAIQ), psychological impact of returning to sport (ACL-RSI), physical recovery outcome measures	Return to sport	At 12 months only 51% athletes had returned to competitive sport No differences in physical recovery or ERAIQ between groups, however significant reduction across groups over rehabilitation period Athletes that returned to competitive sport scored significantly higher on ACL-RSI (emotions, confidence in performance, risk appraisals)

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17.Mankad et al.[43]	**Qualitative**: exploratory inductive design	Perceptions of emotional climate	Psychological rehabilitation from long term injury	Theme 1: emotional trauma – athletes displayed fear of re-injury and identity concerns upon return to sport Themes 2: emotional climate – athletes felt the need to suppress/ inhibit genuine emotions in the team environment Theme 3: emotional acting – athletes learnt to disengage from genuine emotions through emotional control techniques within team environment Authors suggest these were emotionally destructive behaviours that could delay an athlete's long-term psychological rehabilitation
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19.Carson& Polman[52]	**Mixed method:** exploratory case studies design	Interview data, self –report diary, and C-HIP questionnaire data on coping strategies	Perceptions of psychological adjustment and recovery	Avoidance coping (behavioural and cognitive) may facilitate greater perceptions of control and help manage stressful situations High level of distraction coping strategies (physical and cognitive) Avoidance coping may facilitate personal develop through rehab and contribute towards fulfilment of basic needs
20.Wadey et al. [51]	**Qualitative**: retrospective exploratory cohort deign	Psychological antecedent and mechanisms	Return to competitive sport	Possible for athletes to perceive benefits through injury rehabilitation which facilitates holistic recovery Reflecting back on the recovery of the injury athletes were able to get clearer sport related perspective and improve ability to deal with adversity By having contact with other distressed individuals, athletes believed they were less selfish, and had increased empathy for others
21.Ardern et al.[31]	**Quantitative**: cross sectional case series with follow up (2-7 years)	Fear of re-injury (self-report questionnaire)	Return to pre injury sport level	Significantly less fear of re-injury found in athletes who returned to sport at pre-injury level Significantly greater concern over sport environment conditions by females Significantly greater fear of re-injury in athletes with delay to surgical intervention (>3months)
22. Carson& Polman[46]	**Qualitative**: longitudinal exploratory design (throughout transition into return to play)	Interview and self-report diary data on injury cognitions, emotions, and coping strategies	Return to competition	Return to play determined by influential emotions and the athletes coping strategies Pre competition salient themes included: influential emotions (confidence building, anticipation, anxiety) and coping (physical and mental

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				preparation, social support) Post competition salient themes included: influential emotions (confidence building, positive performance emotions, performance anxieties) coping (problem focussed coping, social support, dealing with fear) Successful return to play influenced by gaining confidence in the injured tissue with this perceived to be improved through testing
23.Podlog et al.[45]	**Qualitative**: longitudinal cohort design (11 month period)	**Data on the athletes psychosocial experience**	**Process of return to sport**	Experience of process of return to sport influenced by: Theme 1-heightened injury stress (pain, falling behind others, missing out, fear of re-injury, underperforming) Theme 2 – coping (lack of directed strategies, use of avoidance coping, and problem focussed coping) Theme 3 – importance of social support Theme 4 – recovery outcomes (positive influenced by satisfaction in performance and success in achieving goals, negative influenced by underperformance relative to pre injury), reflecting on personal growth through being injury
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25. Podlog et al.[50]	**Qualitative: retrospective cohort design**	**Focus group and interview data based on psychological experience and precursors of returning to sport**	**Psychological readiness to return to sport**	Psychological readiness determined by three components: Component 1 – confidence in returning to sport (precursor: trust in rehabilitation provider, social support, achievement of standards/ outcomes) Component 2 – realistic expectations of one's sporting capabilities (precursor: patience, acceptance, effective goal setting) Component 3 – motivation to regain previous performance standards (precursor: effective goal setting, boredom of injury, feeling wanted, social support)

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Reviewers Comments and Author Responses

We would like to thank both reviewers for their excellent feedback on our revised manuscript. We discussed and responded to the reviewer comment as a research team and feel this has further improved the review. We believe we have addressed all the comments comprehensively and logically within the space constraints. The table below summarises our response, and where we have amended the manuscript. This relates to the uploaded file named 'Marked Copy'.

Comment	Response	Location
R1.1 I found a few remaining instances of the use of causal language and one grammatical error: p. 14, l. 18 "impacted upon" p. 15, l. 1 "determined by" p. 15, l. 27 "improved" p. 15, l. 30-31 "impact…have on" p. 16, l. 7-8 it should be "perceptions…were"	 This has now been replaced with **'***associated with personal and situational factors.'* This has now been replaced with **'***associated with the rehabilitation programme…….'* This has now been replaced with *'enhanced perceptions of recovery.'* This has now been replaced with *'….final studies about the positive association problem focussed coping strategies have on rehabilitation outcomes.'* This grammatical error has been amended.	 Page 16 line 9.
R2.1 There are a number of areas that require proofreading, where sentences are incomplete or punctuation is needed (eg. Page 4 line 6 – comma after people; page 6 line 3 – agreed "upon"; Page 9 line 12 – "recognising" should be "recognise"; Page 13 line 24-25; Page 16 lines 19-20 and a few others)	Apologies for these minor errors and we have now amended these so not to detract from the quality of the work. Evidence of these amendments is found on the Marked Copy.	On the marked copy where highlighted in reviewer comments.
R2.2 The question driving your aim asks "are psychosocial factors…" but your study is a little more nuanced. Maybe it would be more accurate to state "which psychosocial factors…" since you are discussing types and categories of factors?	Based on reviewer comments the review RQ has now been amended to read: '*which psychosocial factors are associated with sports injury rehabilitation outcomes in competitive athletes?*'	Page 2 line 6 (abstract). Page 5 lines 9-11. Page 16 line 15-16.

R2.3 Page 5, line 4 – consider striking the term "thick"	The term 'thick' has now been deleted from the manuscript.	Page 5 line 4.
R2.4 Page 14 lines 19-22 – These demographic factors don't seem to fit in this category as "stand alone" factors. If they were related to certain specific cognitions that influenced return to sport, then I could see them being more relevant here. The inclusion of lowered mood state and fear here also does not make sense as those are "injury related emotions" described in the previous section. I think these may have been moved here from the section on RTS outcomes that was previously deleted, but they need better integration into this theme to be relevant here. The same with delayed surgical intervention – how does this relate to cognition? These may be important factors related to RTS, but their relationship with cognition - or any other psychosocial theme - is not clear.	Thank you for this group of comments and how the personal and situational factors link to the cognition theme. We have made amendments based upon this. Page 14 line 19-20 we have removed any reference to emotions of mood state and fear so the theme content is more coherent. These are integrated within the emotion theme. Page 14 line 18-22 we have linked the personal factors with return to sport cognitions to better contextualise the content. The following sentence on delayed surgical intervention is then, therefore better contextualised. This should now take the reader through a finding that cognitions are affected by certain demographic (personal and situational) factors, and these factors have an association with return to sport cognitions and behaviour. This sits well with theoretical propositions of Wiese-Bjornstal et al (1998) and Lazarus and Folkman (1984).	Page 14 line 19-20. Page 14 line 18-22.
ED1 The manuscript is quite long (understandable given the complexities of the results section), but I think you may be able to streamline some of the discussion to shorten the paper a bit. Please do a careful read and ensure you are being as succinct as possible. For example, the final paragraph of the discussion could be removed (or at the very least moderated and shortened), and the final 2 sentences of the conclusion (lines 23-26) can also be removed - they are not conclusions based on the data.	We have read through the discussion section as a team in order to streamline key points and reduced word count to a point where meaning has not been adversely affected. The final two sentences of the conclusion have been removed based upon your comment. In all we have reduced the word count by 180 words without losing important content.	Throughout the discussion section Page 20 line 28-31.

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