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1 Psychosocial factors associated with outcomes of sports injury rehabilitation in
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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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3 1 What are the new findings?
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- 5 2 • Psychosocial factors including how an athlete *thinks, feels, and acts* are associated with the
6 3 outcomes of their rehabilitation.
7 4
8 5 • An athlete’s *psychological readiness* to return to play appears to be a product of fear,
9 6 anxiety, confidence in performing well, and remaining uninjured.
10 7
11 8 • Being female, young, having a limited experience of injury, negative emotion, and
12 9 perceptions of isolation are factors related to less successful outcomes of rehabilitation.
13 10
14 11 • Our current interpretation of a successful rehabilitation is overly simplistic and associated
15 12 with many biopsychosocial, technical, and tactical factors.
16 13
17 14 • This research topic has age, injury, and gender related bias that future research should
18 15 address.
19 16

20 17 How might it impact on clinical practice in the near future?
21

- 22 18 • Practitioners need to be aware that injured athletes are emotionally vulnerable, and that
23 19 their emotional integrity may be questionable during rehabilitation process.
24 20
25 21 • Practitioners need to ensure injured athletes are physically, psychologically, socially,
26 22 tactically, and technically ready to return to sport.
27 23
28 24 • Practitioners shouldn’t assume that physical and psychosocial recovery from injury occurs
29 25 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 impact¹⁸ 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 control¹⁵; autonomy, relatedness, competence¹⁴; 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

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 guidelines¹⁷ 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 |

| | |
|-------|---|
| | 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

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 study²⁹ 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

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 Moher¹⁷)

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 |

[illegible]

✓ = 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 sport³¹⁻³³, perceived success and effectiveness³⁴⁻³⁶, 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.

1 As found in previous literature (e.g. ^{14, 22}) there was a broad range of operational definitions of sports
2 injury included across the studies. 70% of studies used a time lost based definition ranging from one
3 day³⁷ to two months.³⁵ Time loss from ACL injury would clearly extend this range. Where mean
4 actual time loss was explicitly stated this ranged from 18.5 days (moderate) – 9.4 months (major).²³
5 Return to competitive sport rates ranged from 51-78%. ^{31, 33} The injury characteristics revealed a bias
6 towards serious knee injuries with eight studies solely focussing on ACL injury (32%) and eight where
7 serious knee sprains dominated the range of pathologies (32%). Ten studies (40%) focussed on
8 injuries requiring surgical intervention, with the remaining 15 studies (60%) including a mixture of
9 injuries or information about whether surgical intervention was required or wasn't stated. It is
10 noteworthy that none of the studies reported incidence of multiple pathologies, athletes being
11 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 |

| | | | | | | |
|-----------------------------------|---|--|---|-----|---------|--------------|
| 15. Carson & Polman ³⁸ | than 21 days 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

1 **Psychosocial Factors**

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

9 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 |

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

12
13 **Injury related emotion associated with sport injury rehabilitation outcomes**

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

18 A number of studies found that as rehabilitation progressed toward an actual return to sport total
19 mood disruption (TMD) and total negative mood (TNM) decreased and more positive mood states
20 developed.^{36, 39, 40, 42} McDonald & Hardy⁴² in a study of five Division 1 athletes found a significant
21 negative relationship between TMD and the outcome of athlete perceived rehabilitation ($r=0.69$,
22 $p<0.0001$).

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

and fear seems prominent when returning to sport within the studies (e.g.^{36, 44, 46, 47}). Podlog and Eklund⁴⁴ 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 athletes⁴⁵, 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}

Tracey³⁶ found that when some athletes returned to sport that their feelings of isolation/alienation remained. Mankad et al⁴³ 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 al³³ 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 Theory⁵² 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 facilitative⁵⁴ and also debilitating.^{39, 43} A mixed method study⁵⁴ 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 rehabilitation⁴³, 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 & Gardner³⁹ found that in the last phase of injury

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

4 Although social interaction is a coping strategy in and of itself, seven studies highlighted its
5 importance in affecting perceived and actual rehabilitation outcomes, and as such warrants its own
6 sub-set. Studies on return to sport stressors and coping using seriously injured elite rugby players^{38,}
7 ⁴⁷ found perceptions of social support network provided by multiple agents (e.g. team mates,
8 medical staff, coach, family, crowd) were particularly salient on returning to sport. Trust in the
9 rehabilitation provider, feeling wanted by others, and satisfaction of social support needs were
10 associated with psychological readiness to return to sport.⁵⁰ Importantly, insufficient social support
11 appears to be associated with unsuccessful rehabilitation³², and remains a common concern upon
12 returning to sport.^{36, 45}

13 DISCUSSION

14 The aim of this review was to understand the association between psychosocial factors and sports
15 injury rehabilitation outcomes. This aim was underpinned by the research question: *which*
16 *psychosocial factors are associated with sports injury rehabilitation outcomes in competitive*
17 *athletes?* Twenty studies not previously reviewed were included for appraisal and synthesis. Our
18 findings indicate that psychosocial factors (*emotion, cognition, and behavior related*) are associated
19 with a variety of perceived and actual rehabilitation outcomes. It is thought that this process is
20 cyclical in nature.⁴⁶ For example, cognitions impact upon injury related emotions and behaviours,
21 and vice versa. The evidence presented in this review is consistent with previous reviews and
22 theoretical perspectives.^{2, 13, 16, 55} Wiese-Bjornstal¹³ appears to provide a useful conceptual
23 framework to understand this emerging topic.

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

29 Other domain related systematic reviews¹⁴⁻¹⁶ highlight fear of re-injury as one of the most common
30 emotional factors associated with rehabilitation outcomes after severe injury. Fear is seen as a
31 unitary construct within quantitative research designs that dominate previous reviews. In contrast,
32 the evidence from this review highlights injured athletes experience many anxieties and fears during

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

5 Evidence from this review and the broader literature suggests an association between anxiety and
6 fear of being re-injured and rehabilitation outcomes.^{41, 56, 57} Little is known about which forms of
7 anxiety and fear predominates, the interactional effects between different forms, and ultimately
8 which is the most salient. The evidence in this review suggests that the athlete who can effectively
9 manage anxiety and fear will experience more positive outcomes from rehabilitation.⁴⁴ Adern et al⁵⁸
10 highlighted the concept of '*psychological readiness*' as important in determining return to sport
11 decisions post ACL injury. The construct of '*psychological readiness*' in terms of sports injury can be
12 interpreted as being a combination of the athletes experiencing low levels of fear over re-injury and
13 underperforming.⁵⁹

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

23 Experiencing adversity has the potential to yield positive outcomes. Nonetheless, it is important to
24 note that stress related growth isn't inevitable.⁶⁰ The articles reviewed found that an ability to
25 perceive sport injury rehabilitation as an opportunity for development and growth was associated
26 with more positive rehabilitation outcomes.^{37, 53} A perspective from Wadey et al^{61 (p 126)} is that
27 growth through adversity may even lead to '*positive changes that propel them to a real or perceived*
28 '*higher level of functioning than that which existed prior to the negative circumstance*'. It seems that
29 perceiving the experience related to injury as positive may facilitate returning to sport⁴⁴ , enable a
30 more holistic recovery, and develop resilience in overcoming adversity.⁵³ Previous studies have
31 shown the different forms of growth that can occur through injury include: personal, psychological,
32 social, and physical.⁶¹ This suggests practitioners should encourage athletes to reflect on the injury
33 experience as an opportunity for growth to facilitate positive rehabilitation outcomes.

1 From the articles reviewed emotional integrity emerged as an important sub set. Emotional integrity
2 relates to the athletes conscious decision to either withhold or disclose false injury related emotions.
3 Studies found this was a common practice compounding perceptions of isolation and impeding
4 psychological rehabilitation outcomes (e.g. ^{36, 43, 48}). Findings support theoretical propositions of
5 Wiese-Bjornstal¹³ whereby emotional integrity (or emotional inhibition as phrased in the model) is
6 identified as an emotion related factor associated with rehabilitation outcomes. The emotional
7 integrity or lack of it in some injured athletes could have a profound effect on the ability to collect
8 accurate data. If there is a high incidence of 'lack of emotional integrity' then this may challenge the
9 validity of some studies already published and challenges researchers to develop methodologies to
10 overcome this problem. Both researchers and practitioners should give injured athletes the
11 opportunity to use nontraditional forms of communication e.g. blogs and diaries.

12 **Current empirical limitations and future directions**

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

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

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

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

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

8 **Strengths and limitations of this review**

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

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

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

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

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

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

11 CONCLUSION

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

18 **Contributions** DF, AS, and MJ were responsible for the conception and design of this mixed studies
19 systematic review. DF applied the search strategy, extracted data, completed PROSPERO
20 registration, and obtained ethical approval. The peer review team (DF, AS, AG) applied the eligibility
21 criteria at each stage, quality appraisal tool, and agreed on meta-aggregated themes. DF completed
22 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 & Lindgren²⁹ | 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 |
| 2.McDonald & Hardy⁴² | Quantitative: prospective cohort design | Affect – POMS questionnaire | Athlete perceived rehabilitation progress and effectiveness | Return to sport experience mediated by confidence related to the injury, withstanding sporting demands, and performance Significant negative correlation between total mood disturbance and perceived rehabilitation |
| 3.Johnson³⁴ | Quantitative: prospective cohort design | Psychological profile of multiply vs first time injured athletes (MACL, GCQ, KSP) | Perceptions of rehabilitation success (SIQ) | Significant negative correlation between affective measures of tension, depression, anger, fatigue, confusion and perceived rehabilitation Significant difference between first time injured and multiply injured for perceptions of physical recovery, and awareness of rehabilitation guidelines |
| 4.Johnson³² | Quantitative: longitudinal prospective cohort design (3-36months) | Psychosocial profile of injured athletes (MACL, GCQ, KSP) | Return to sport | Multiply injured athletes rated themselves significantly higher for mood variables of social orientation and activity than first time injured 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.Mainwaring⁵¹ | 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) |
| 6.Quinn & Fallon⁴⁰ | 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 | Each domain is influenced by person and situation factors 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 |
| 8.Tracey ³⁶ | Qualitative: exploratory cohort design | Data on injury related affect, emotions, and cognitions | Perceived psychological adjustment and recovery | Dispositional optimism significantly associated with decreased time loss when positive life change increased 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 |
| 9.Kvist et al. ⁴¹ | Quantitative: prospective cohort design | Fear of re-injury/ movement (TSK) | Self-report function (KOOS) Sport participation (general questions) | Reluctance to openly discuss injury related feeling with sport peers e.g. coaches 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 |
| 10.Podlog & Eklund ⁴⁴ | Qualitative: longitudinal cohort design | Psychosocial 'issues and processes' arising from interview data | Return to sport (pre-competition and competition) | Athletes not returning to pre-injury activity level reported significantly higher fear of movement 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 |
| 11.Thing ⁴⁸ | Qualitative: longitudinal ethnographic cohort design | Athlete perceptions of risk and health | Return to sport | Suggested returning athletes experienced a number of autonomy, competence, and relatedness issues 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 |
| | | | | 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 |
| | | | | TNM reduced throughout rehabilitation |
| 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 | |
| 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) | Avoidance focussed coping strategies positively related to TNM |
| | | | | Approach focussed strategies negatively related to TNM |
| | | | | Maladaptive schemas positively related to 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 | Schema of <i>impaired autonomy</i> predicted more severe TNM |
| | | | | All athletes motivational style shifted throughout rehabilitation process |
| | | | | Times during rehabilitation when motivational needs not being met leading to adverse emotional response |
| 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 | Motivational flexibility important for successful rehabilitation |
| | | | | 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 |
| 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 | Authors suggest these were emotionally destructive behaviours that could delay an athlete’s long-term psychological rehabilitation 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 |
| 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 | Suggested successful injury return influenced by competence, relatedness, and autonomy aspects 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) |
| 20.Wadey et al. ⁵³ | Qualitative: retrospective exploratory cohort design | Psychological antecedent and mechanisms | Return to competitive sport | Avoidance coping may facilitate personal develop through rehab and contribute towards fulfilment of basic needs 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 |
| 21.Arden 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 | By having contact with other distressed individuals, athletes believed they were less selfish, and had increased empathy for others 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 |
| 22. Carson& Polman ⁴⁷ | Qualitative: longitudinal | Interview and self-report diary data on | Return to competition | Significantly greater fear of re-injury in athletes with delay to surgical intervention (>3months) Return to play determined by influential emotions and the athletes coping |

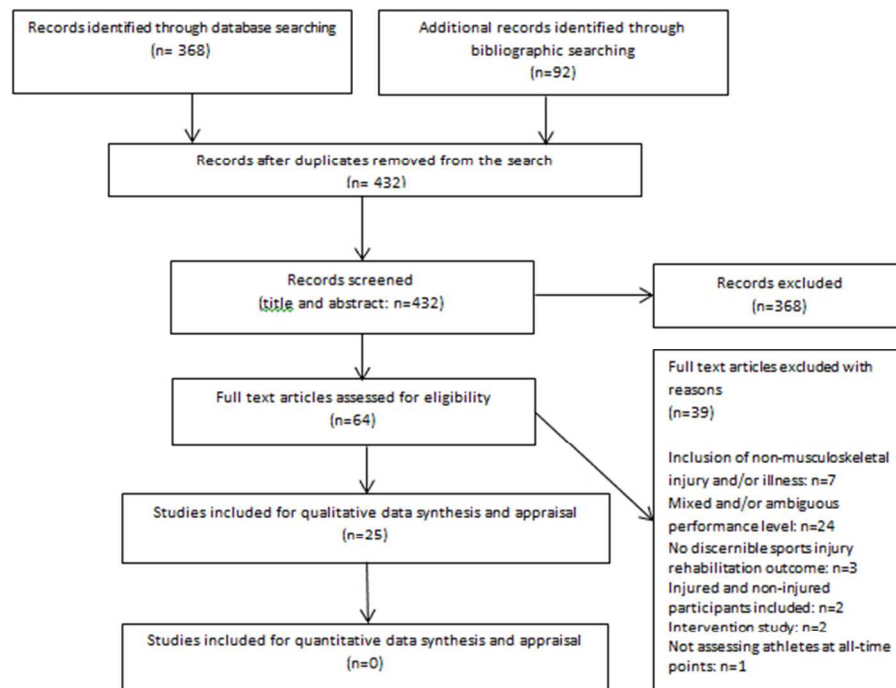
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| | exploratory design (throughout transition into return to play) | injury cognitions, emotions, and coping strategies | | <p>strategies</p> <p>Pre competition salient themes included: influential emotions (confidence building, anticipation, anxiety)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

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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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 Significant negative correlation between total mood disturbance and perceived rehabilitation |
| 2.McDonald & Hardy ⁴² | Quantitative: prospective cohort design | Affect – POMS questionnaire | Athlete perceived rehabilitation progress and effectiveness | Significant negative correlation between affective measures of tension, depression, anger, fatigue, confusion and perceived rehabilitation Significant difference between first time injured and multiply injured for perceptions of physical recovery, and awareness of rehabilitation guidelines |
| 3.Johnson ³⁴ | Quantitative: prospective cohort design | Psychological profile of multiply vs first time injured athletes (MACL, GCQ, KSP) | Perceptions of rehabilitation success (SIQ) | Multiply injured athletes rated themselves significantly higher for mood variables of social orientation and activity than first time injured 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 Restoration of self comes from the motivation to overcome the disability (injury) |
| 4.Johnson ³² | Quantitative: longitudinal prospective cohort design (3-36months) | Psychosocial profile of injured athletes (MACL, GCQ, KSP) | Return to sport | This has a reciprocal mediating relationship with sport injury domains (psychological, social, physical) |
| 5.Mainwaring ⁴⁹ | Qualitative: longitudinal and cross sectional design (over 12 months) | Domains of sports (physical, psychological, social) | Return to sport | Each domain is influenced by person and situation factors 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 |
| 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 | 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 |
| 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 | |

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| | 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 |
| 8.Tracey ⁴⁷ | Qualitative: exploratory cohort design | Data on injury related affect, emotions, and cognitions | Perceived psychological adjustment and recovery |
| 9.Kvist et al. ⁴¹ | Quantitative: prospective cohort design | Fear of re-injury/ movement (TSK) | Self-report function (KOOS) Sport participation (general questions) |
| 10.Podlog & Eklund ⁴⁴ | Qualitative: longitudinal cohort design | Psychosocial 'issues and processes' arising from interview data | Return to sport (pre-competition and competition) |
| 11.Thing ⁴⁷ | Qualitative: longitudinal ethnographic cohort design (over one and a half years) | Athlete perceptions of risk and health | Return to sport |

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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 | <p>Athletes often alone with problems of injury and chose not to discuss with sports peer</p> <p>Dynamic flux in themes through recovery process</p> <p>At three years post injury athlete no longer competing despite functional restoration</p> <p>Theme 1: role of different types of injury awareness</p> <p>Theme 2:effective use of a mental itinerary</p> <p>Theme 3:complexity of mental model (state of injury and consequences associated)</p> <p>Theme 4: motivational role of reflecting of ideal or desired physical self</p> <p>Theme 5: involuntary and voluntary use of mental imagery</p> <p>TNM reduced throughout rehabilitation</p> |
| 13.Gallagher & Gardner ³³ | 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) | <p>Avoidance focussed coping strategies positively related to TNM</p> <p>Approach focussed strategies negatively related to TNM</p> <p>Maladaptive schemas positively related to TNM</p> |
| 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 | <p>Schema of <i>impaired autonomy</i> predicted more severe TNM</p> <p>All athletes motivational style shifted throughout rehabilitation process</p> <p>Times during rehabilitation when motivational needs not being met leading to adverse emotional response</p> |
| 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 | <p>Motivational flexibility important for successful rehabilitation</p> <p>Late limited participation and return to sport determined by influential emotional and coping strategies</p> <p>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)</p> |
| 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 | <p>Return to sport stage salient emotions (confidence building, apprehension, relief) and beneficial coping (goal setting, social support, and use of problem focussed coping type)</p> <p>At 12 months only 51% athletes had returned to competitive sport</p> <p>No differences in physical recovery or ERAIQ between groups, however significant reduction across groups over rehabilitation period</p> <p>Athletes that returned to competitive sport scored significantly higher on ACL-RSI (emotions, confidence in performance, risk appraisals)</p> |

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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 |
| 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 | Authors suggest these were emotionally destructive behaviours that could delay an athlete's long-term psychological rehabilitation 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 |
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| 21. Arden 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 | By having contact with other distressed individuals, athletes believed they were less selfish, and had increased empathy for others 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 |
| 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 | Significantly greater fear of re-injury in athletes with delay to surgical intervention (>3months) 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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| 23.Podlog et al. ⁴⁵ | Qualitative: longitudinal cohort design (11 month period) | Data on the athletes psychosocial experience | Process of return to sport | 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 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) |
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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) |

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 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)

Confidential: For Review Only

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|---|--|---|
| 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. | <p>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.</p> <p>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.</p> <p>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).</p> | <p>Page 14 line 19-20.</p> <p>Page 14 line 18-22.</p> |
| 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. | <p>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.</p> <p>The final two sentences of the conclusion have been removed based upon your comment.</p> <p>In all we have reduced the word count by 180 words without losing important content.</p> | <p>Throughout the discussion section</p> <p>Page 20 line 28-31.</p> |