BMJ Open

# Investigating correlates of athletic identity and sport-related injury outcomes: a scoping review.



| | |
|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2020-044199 |
| Article Type: | Original research |
| Date Submitted by the Author: | 26-Aug-2020 |



| | |
|---|---|
| Complete List of Authors: | Renton, Tian; University of Toronto Faculty of Medicine, Rehabilitation Sciences Institute; St Michael's Hospital, Centre for Depression & Suicide Studies<br>Petersen, Brian; University of Toronto, Faculty of Kinesiology & Physical Education<br>Kennedy, Sidney; University of Toronto Faculty of Medicine, Department of Psychiatry; St Michael's Hospital, Centre for Depression & Suicide Studies |



| | |
|---|---|
| Keywords: | SPORTS MEDICINE, REHABILITATION MEDICINE, Orthopaedic sports trauma < ORTHOPAEDIC & TRAUMA SURGERY |


SCHOLARONE™
Manuscripts

*I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.*

*The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.*

*Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.*

**Title**: Investigating correlates of athletic identity and sport-related injury outcomes: a scoping review.

**Authors**: Tian Renton*, MSc [1,2], Brian Petersen[3], Sidney H. Kennedy, MD [2,4]

**Affiliations**:
1. Rehabilitation Sciences Institute, University of Toronto, Toronto, Ontario, Canada
2. Centre for Depression & Suicide Studies, St. Michael's Hospital, Toronto, Ontario, Canada
3. Faculty of Kinesiology & Physical Education, University of Toronto, Toronto, Ontario, Canada
4. Department of Psychiatry, University of Toronto, Toronto, Ontario Canada

**Contact Information**:
Tian Renton
The University of Toronto
Rehabilitation Sciences Institute
500 University Avenue, Suite 160
Toronto, Ontario
M5G 1V7
Phone: (416) 864-6060 ext. 7848
Email: tian.renton@mail.utoronto.ca
**Corresponding Author*

Brian Petersen
The University of Toronto
Faculty of Kinesiology & Physical Education
55 Harbord Street
Toronto, Ontario
M5S 2W6
Email: brian.petersen@mail.utoronto.ca

Dr. Sidney H. Kennedy
Professor of Psychiatry, University of Toronto
Centre for Depression and Suicide Studies, St. Michael's Hospital
193 Yonge Street, Suite 6-001A
Toronto, Ontario
M5B 1M8
Phone: 416-864-6099
Email: sidney.kennedy@uhn.ca

**Word Count**: 4843

**ABSTRACT**

**Objectives***:* To conduct a scoping review that i) describes what is known about the relationship between athletic identity and sport-related injury outcomes and ii) describes the impact that an injury has on athletic identity in athletes.

**Design***:* Scoping review.

**Setting***:* N/A

**Participants***:* n= 1852 athletes from various sport backgrounds and levels of competition.

**Interventions***:* N/A

**Primary & Secondary Outcome Measures***:* The primary measure used was the Athletic Identity Measurement Scale. Secondary outcome measures assessed demographic, psychological, behavioural, physical function and pain-related constructs.

**Results***:* Twenty-two studies were identified for inclusion. Samples were dominated by male, Caucasian athletes. Most studies captured musculoskeletal injuries, with only three studies included sport-related concussion. Athletic identity was significantly and positively associated with depressive symptom severity, sport performance traits (e.g., ego and mastery), social network size, physical self-worth, motivation, rehabilitation over adherence, mental toughness and playing through pain, injury severity and functional recovery outcomes. Findings pertaining to the impact that injury had on athletic identity were inconsistent.

**Conclusions***:* Athletic identity was most frequently associated with psychological, behavioural and injury-specific functional outcomes. Future research should seek to include more diverse athlete samples (e.g., females, athletes with various ethnic backgrounds, para-athletes) and should consider using theoretical injury models to inform study methodologies used.

**Keywords**: athlete, athletic identity, sport, injury, rehabilitation

**Article Summary**

Strengths and limitations of this study

- The search strategy was constructed in consultation with a University of Toronto librarian.
- Citation management (EndNote) and systematic review citation screening software (Covidence) were used to allow reviewers to screen citations and extract data, independently.
- Data extraction variables thoroughly described the study sample, injuries sustained, theoretical models referenced, athletic identity scores and timeline of administration, significant key findings as well as study strengths and limitations.
- A quality assessment was not conducted and level of evidence ratings were not assigned to studies.

**Author Contributions:** TR was responsible for establishing the research questions, developing and conducting the literature search, performing the title, abstract and article screening process, extracting data from eligible articles, drafting the manuscript and submitting the manuscript for publication. BP was responsible for performing the title, abstract and article screening process, extracting data from eligible articles and contributing to results and discussion sections of the manuscript draft. SK was responsible for helping establish the research questions, advising on data extraction elements and editing/revising the manuscript draft prior to submission for publication.

**Acknowledgements**: Authors would like to thank Mrs. Erica Nekolaichuk (University of Toronto Librarian) for helping construct the search strategy used within this review. Authors would also like to thank Dr. Nick Reed, Dr. Sakina Rizvi, and Dr. John Cairney for their critical review of and feedback provided on the original review protocol.

**Funding:** This work was supported by a Canadian Institutes of Health Research Frederick Banting and Charles Best Canada Graduate Scholarship (fund # 505508)

**Conflicts of Interest:** None declared.

**INTRODUCTION**

Sports and recreation are a cherished past time for individuals of all ages, genders and sexes, ethnicities, cultures and physical abilities. Sport is for any and every body. Broadly speaking, sport participants (subsequently referred to as athletes) represent a different group of individuals than those who are merely physically active (e.g., exercisers, weekend warriors, gym-goers), with the key distinguishing feature being the element of competition (e.g., games, matches, goals, points, etc.). Therefore, it could be argued that athletes represent a sub-culture of physically active individuals. Members of a sub-culture are said to adhere to a distinct set of values and ideals (e.g., fitness and competitive performance), personal style and aesthetic (e.g., athletic gear), cultural preferences, lingual expressions (e.g., colloquial terms or slang), as well as bodily practices and behaviours (e.g., cardiovascular conditioning and strength training) (1). Existing literature also suggests that athletes are anthropometrically (e.g., body shape and composition) (2), habitually (e.g., sleep, nutrition, training, doping) (3), and conceptually (e.g., self-concept, personality) different from non-athletes (4).

With respect to psychological profiles, athletes demonstrate higher levels of extraversion compared to non-athletes, with greater extraversion identified in team sport athletes (e.g., soccer, hockey) compared to individual sport athletes (e.g., swimming, golf) (5). Traits such as mental toughness (6), perseverance (6, 7) and positive self-esteem (7-9) have also been associated with sport participation. Despite differences in personality traits observed, it has been proposed that the relationship between sport participation and personality is bi-directional (i.e., sport influences the expression of personality and personality influences participation in sport) (10, 11). However, not all athletes are created equal, nor are their respective sports.

Sport is inherently inclusive and caters to individuals of all skill levels and physical abilities. Some athletes view sport as a fun pastime activity (e.g., recreational athletes) while others view sport as an occupation (e.g., Olympians, professional athletes). Regardless of sport level, each athlete is thought to embody an athletic identity (AI). Initially defined by Brewer and colleagues in 1993, AI is defined as "the exclusivity and strength with which an individual identifies with the athlete role, and looks to others for confirmation of that role" (12). To some extent, an athlete's self-perception of their AI can provide an important measure of their longevity in sport (13). Stronger AIs have been associated with positive health outcomes, increased sport engagement, enhanced athletic performance, improved global self-esteem and confidence, as well as improved social relationships (12, 14-17). Conversely, following a sport-related injury, stronger AIs have been associated with depressive symptoms (18). It has also been suggested that athletes who hold a stronger AI may neglect other identities and role responsibilities in order to maintain the athlete role (12). Therefore, a strong AI may be helpful in some cases and harmful in others.

Research pertaining to AI is growing steadily, with many investigations seeking to examine and describe singular correlates of AI. The extent of the influence that AI exerts on the other facets of self are unclear. Findings likely have important implications for athletes, as there is some indication that a strong, singular identity (i.e., an individual who identifies only as an athlete) can be harmful, especially following a sport-related injury (18). Therefore, a scoping review is necessary to understand the breadth of the existing literature as well as the strengths and limitations. Results from this review can be used to develop a subsequent systematic review, inform the design of and methodologies used in future studies and may also have implications for clinical practice.

**Research Questions:**

1. What is known about the association between athlete self-reported AI and response to a sport-related injury? Response to injury is operationally defined as any outcome observed following injury (e.g., psychological, behavioral, functional, cognitive, or performance).

2. What is known about the impact of a sport-related injury on athlete self-reported AI?

## METHOD

### Search Strategy & Study Identification

Search strategies and terms were developed in consultation with a University of Toronto Health Science Librarian (E.N.; 01/20/2020; see Appendix A, Table 1). The following databases were searched in March and April 2020 by one reviewer (TR): MEDLINE, EMBASE, SPORTDiscus, CINAHL, APA PsycInfo, and Sport Medicine & Education Index (Proquest). Number of citations identified were recorded in Table 1 (see Appendix A). Search results were exported to EndNote (19) and duplicates were discarded (n=334). Thereafter, article titles and abstracts (n=1122) were exported to the systematic review software program, Covidence (20). Covidence collates each reviewer's decision to accept or reject a citation and identifies screening conflicts for resolution. The program also populates a PRISMA flow chart to reflect the number of citations included or excluded at each screening stage (see Appendix B, Figure 1). Reasons for exclusion were cited at the full-text screening stage only. Studies identified for inclusion at full-text screening also had their reference lists reviewed for additional studies. ClinicalTrials.gov was also searched using the following terms: athlete, identity, injury and sport, but did not identify any additional studies. TR and BP independently performed each stage of the screening process (titles, abstracts and full-text screening) as well as full-text data extraction. After completing each stage, reviewers met virtually (via Zoom) to discuss and resolve conflicts. Progression to the next screening stage occurred only after 100% agreement was achieved. The same process was applied during the data extraction phase. For the purposes of quality assurance, this scoping review was structured according to the PRISMA-ScR checklist (see Appendix C).

**Study Inclusion Criteria:**

1) AI was assessed using a self-report quantitative measure.

2) study sample consisted of at least one group with a sport-related injury which prevented them from engaging in sport.

3) injuries were real or hypothetical (i.e., imaginary).

4) athletes of any age and playing status (e.g., amateur or professional, retired or active). Studies that included athletes with disabilities (e.g., para-athletes) were permissible however, the injury must have been secondary to the existing disability (i.e., study must pertain to a sport-related injury).

5) an objective measure was used to assess the injury or post-rehabilitation status or post-injury AI.

**Study Exclusion Criteria:**

1) Article not available in the English language.

2) Full text article could not be located following direct request to author(s) if not available online.

3) Injury was not specified or assessed for severity.

4) AI was not self-reported (i.e., was reported by a coach, team mate or parent).

5) Conference proceedings or abstracts.

6) Qualitative studies.

7) Systematic, scoping or narrative reviews.

8) Thesis or dissertations.

9) Consensus statements.

**Data Extraction**

The following data were extracted from each of the included studies (see Table 2 & Table 3).

1) Description of sample: country of origin, sample size, sex, ethnicity, age, recruitment source, sport background, level of sport and history of sport involvement (e.g., frequency and years of participation).

2) Injury descriptors: definition of injury used, type and severity of injury, time removed from sport, rehabilitation protocol administered, and surgical details.

3) Study methodology: study design, primary and secondary objectives.

4) Theoretical support: author and model or theory used.

6) Outcome measures: AI measured used, timeline of administration, AI score, and additional outcome measures used.

7) Key findings: findings related to AI and other measured variables.

8) Study strengths & limitations.

Findings are presented in a narrative summary, and where possible presented as a tally (i.e., number of studies that reported on a given finding) to denote trends in the literature. In keeping with the purpose of scoping review methodology which is "…to identify knowledge gaps, scope a body of literature, clarify concepts or to investigate research conduct" (21) as well as "… to identify strengths [and] weaknesses … in the research" (22), studies will not undergo quality review (e.g., assessment of bias) or be assigned a level of evidence rating.

**Patient and Public Involvement**

No patient(s) involved.

**RESULTS**

The search strategy identified 1456 records for consideration (see Appendix A, Table 1 for databases searched, search terms used, and number of records identified). Two additional articles were identified via hand searching of the included article reference lists. One additional article was previously known to others, but not identified in the searches. Two articles contained multiple studies. A total of 20 publications reporting on 22 studies were eligible for inclusion. Studies utilized cross-section observational (n=8), prospective longitudinal (n=13) and mixed-methods (n=1) designs.

**Sample Descriptors**

Studies originated from Australia (n=1), Canada (n=1), Israel (n=1), Slovenia (n=1), and the United States (n=18). Most studies included both sex groups, except for three studies which included all-male samples (23-25) and one which included an all-female sample (26). A total of n=1852 athletes were included in the 22 studies; individual study samples ranged from a minimum of n=6 (27) to a maximum n=316 (25). Participants were a minimum of 13 (25) to a maximum of 70 years old (28). Participants were recruited from several clinical and non-clinical settings, with one study failing to specify a recruitment source (27). See Table 2.

*Table 2. Sample Description, Injury Details, Study Design and Model Use*

| **Citation; Author (Year)** | **Sample Descriptors**<br><br>**1) Country of Origin**<br>**2) n= (Sex %)**<br>**3) Ethnicity (%)**<br>**4) Age M ± SD; Range**<br>**5) Recruitment Source**<br>**6) Sport (%)**<br>**7) Level of Sport**<br>**8) History of Sport Engagement (Frequency / Years)** | **Injury Description**<br><br>**1) Definition of Injury (Yes/No: Definition)**<br>**2) Sport Injury/Severity**<br>**3) Time out of Sport M (SD)**<br>**4) Rehabilitation Protocol & Surgery Details** | **Study Design & Objectives**<br><br>**1) Study Design**<br>**2) Primary Objective**<br>**3) Secondary Objective** | **Model or Theory Referenced**<br><br>**1) Authors (Year)**<br>**2) Model Name** |
|---|---|---|---|---|
| [32]; Padaki et al. (2018) | 1) US<br>2) n=24 (50% Male)<br>3) -<br>4) 14.5 ± 2.7<br>5) Tertiary care centre<br>6) Single sport (29.2%); Multi sport (58.3%)<br>7) -<br>8) - | 1) Yes: "ACL rupture requiring surgery"<br>2) ACL tear; 41.7% reporting concomitant meniscal injury<br>3) -<br>4) - | 1) Cross-sectional<br>2) To examine the psychological trauma, including potential PTSD symptomatology, following ACL rupture among young athletes. | 1) -<br>2) - |
| [38]; Hilliard et al. (2017) | 1) US<br>2) n=79 (64.6% Male)<br>3) 70% Caucasian<br>4) 19.96 ± 1.56<br>5) Athletic training clinics in colleges or universities in Midwestern US<br>6) Football (35%); Soccer (18%); Basketball (11%); Track (10%); Baseball (6%); Volleyball (6%); Gymnastics/Dance (6%); Swimming (4%); | 1) Yes: "experiencing a MSK injury considered moderate in severity that results in at least 7 days of missed practice or competition and receiving physiotherapy for the injury"<br>2) ACL tear (13.9%); sprains (12.6%); fractures (6.3%); | 1) Cross-sectional convergent parallel mixed methods<br>2) To explore what aspects of AI might predict over adherence to rehabilitation.<br>3) To get a better understanding of participants' views of their athletic participation and | 1) Wiese-Bjornstal et al. (1998)<br>2) Integrated Model of Response to Sport Injury |

| | | | | |
|---|---|---|---|---|
| | Cross-Country (3%); Field Hockey (3%); Lacrosse (1%); Wrestling (1%); Not Specified (2%)<br>7) Division I (26%); Division II (15%); Division III (40%); and NAIA (19%)<br>8) 14.19 ± 9.40 hours spent training/week prior to injury; 10.45 ± 4.46 years involved in sport | undefined injury, only general area reported [e.g., right knee, lower back, etc.]( 67%)<br>3) As per definition, "…at least 7 days of missed practice or competition…"; median of 4 weeks reported since time of injury (range 1 to 63 weeks)<br>4) 42% of injuries required surgery, not otherwise specified | rehabilitation adherence. | |
| [37]; O'Rourke et al. (2017) | 1) US<br>2) n=51 (52.9% Male)<br>3) -<br>4) 14.53 ± 1.85<br>5) Athletes presenting to a local hospital or university affiliated outpatient concussion clinic<br>6) Soccer (24%); Lacrosse (10%); Football (8%); Other (58%; skiing, volleyball, hockey, swimming, Ultimate Frisbee, cheerleading and wrestling)<br>7) -<br>8) - | 1) Yes: suffered a concussion in the past 14 days; unknown diagnostic criteria<br>2) Concussion<br>3) -<br>4) - | 1) Prospective longitudinal<br>2) To assess the role of psychological factors on self-reported post-concussion recovery in youth athletes within an existing theoretical and empirically supported framework.<br>3) To assess non-psychosocial variables previously shown to influence concussion symptomatology (e.g., age, gender, number of days post-concussion, and number of previous concussions). | 1) Wiese-Bjornstal et al. (1998)<br>2) Integrated Model of Response to Sport Injury |
| [35]; Baranoff et al. (2015) | 1) Australia<br>2) Time 1: n=44 (61.4% Male)<br>Time 2: n=26 (46.1% Male)<br>3) -<br>4) 27 ± 9.4<br>5) Physiotherapy clinics | 1) Yes: ACL tear<br>2) ACL tear<br>3) Mean time between injury and surgery: 7 weeks, 6 days (SD=9 weeks, 4 days) | 1) Prospective longitudinal<br>2) To assess the roles of catastrophizing and acceptance in relation to depression, pain intensity, and | 1) -<br>2) - |

| | | | | |
|---|---|---|---|---|
| | 6) Australian Rules Football (29.5%); Netball (18.2%); Basketball (13.6%)<br>7) -<br>8) - | 4) ALCR Rehabilitation Protocol; ACL allograft reconstruction (11.4%); ACL autograft reconstruction (89%) | substance use to cope with an injury 2 weeks post-ACL reconstructive surgery (Time 1) and 5 months of ALCR rehabilitation (Time 2). | |
| [27]; Samuel et al. (2015) | 1) Israel<br>2) n=6 (% Unknown)<br>3) -<br>4) 21.83 ± 2.93<br>5) Sports medicine centres<br>6) Basketball (33.3%); Judo (33.3%); Track and Field (16.7%); Gymnastics (16.7%)<br>7) Internationally ranked (83.3%); Nationally ranked (16.7%)<br>8) 11.17 ± 3.41 years involved in sport | 1) Yes: ACL tear<br>2) ACL tear<br>3) Range: 7 to 12 months<br>4) - | 1) Prospective longitudinal<br>2) To examine competitive athletes' experience of severe injuries. | 1) Samuel et al. (2011)<br>2) Scheme of Change for Sport Psychology Practice (SCSPP) |
| [24]; Kroshus et al. (2014) | 1) US<br>2) n=146 (baseline); n=116 (post-season) (100% Male)<br>3) -<br>4) -<br>5) Collegiate teams<br>6) Ice Hockey<br>7) Division I (NCCA)<br>8) - | 1) Yes: NCCA definition of concussion<br>2) Concussion<br>3) -<br>4) - | 1) Prospective cohort<br>2) To assess the association between pre-season individual characteristics and post-season recall of within-season concussion symptom-reporting behaviours. | 1) Cialdini & Trost (1998)<br>2) Social Influence: Social Norms, Conformity and Compliance |
| [26]; Madrigal et al. (2014) | 1) US<br>2) n=4 (100% Female)<br>3) -<br>4) Only range was provided: 20-21 years old<br>5) NCAA Division I school teams; by referral via team athletic trainer<br>6) Softball; Women's Soccer<br>7) NCAA Division I | 1) Yes: "sport injury that is expected to prevent/limit his/her sport participation for at least 4 days"<br>2) Meniscus tear, leg injury (not otherwise specified), broken bone in hand, labrum tear in shoulder<br>3) Range: 5 weeks to 8 months | 1) Prospective longitudinal<br>2) To examine an athlete's psychological strengths (i.e., mental toughness, hardiness, and optimism) and emotional response to sport injury and rehabilitation and coping resources. | 1a) Weise-Bjornstal et al. (1998)<br>2a) Integrated Model of Response to Sport Injury<br><br>1b) Lazarus & Folkman (1984)<br>2b) Stress Appraisal & Coping |

| | | | | |
|---|---|---|---|---|
| | 8) - | 4) 50% required surgery | 3) To examine individual differences and changes over time from injury to being cleared to play. | |
| [42]; Masten et al. (2014) | 1) Slovenia<br>2) n=68 (69.1% Male)<br>3) -<br>4) M=23.4; Range: 16 to 40 years old<br>5) Orthopedic clinic in Ljubljana, Slovenia<br>6) Handball (20.6%); Football (20.6%); Basketball (19.1%); Volleyball (6%); Alpine Skiing (<3%); Ice Hockey (<3%); Judo (<3%); Snowboarding (<3%); Tennis (<3%); Running (<3%); Gymnastics (<3%); Rugby (<3%); Standing/Acrobatic Skiing (<3%)<br>7) World-class and internationally ranking (41.2%); National Ranking or uncategorized (58.8%)<br>8) - | 1) Yes: according to a previously proposed injury rating scale; individuals categorized to be in *group 4* (i.e., rehab time expected to be up to one month) or *group 5* (i.e., rehab time expected to be over one month and up to 6 months).<br>2) Meniscus tear; ACL/PCL; patella injury; unreported (% not reported); Group 4 (8.8%), Group 5 (76.5%)<br>3) As per inclusion criteria, removed from sport for at least 1 month<br>4) Standard rehabilitation protocol, not otherwise specified; "knee surgery", not otherwise specified | 1) Cross-sectional<br>2) To examine if athletes differ from each other in depression, general irritability, and inhibition of behaviour regarding injury severity.<br>3) To examine the psychological response to injury on the basis of specific dispositional characteristics to identify those personality and dispositional traits that make athletes more prone to injury. | 1) -<br>2) - |
| [23]; Petrie et al. (2014) | 1) US<br>2) n=26 (100% Male)<br>3) 52.2% Black<br>4) 20.08 ± 1.46<br>5) Football teams from the Southwestern US<br>6) Football<br>7) NCAA Division I<br>8) - | 1) Yes: "[an injury] defined as having occurred as a result of participation in an organized intercollegiate practice or game, requiring medical attention by a team athletic trainer or physician, and having resulted in the inability to participate for one | 1) Prospective longitudinal<br>2) To determine the direct effects of life stress, different sources of social support, AI and mental toughness on athletic injury over the course of a competitive season.<br>3) To examine the potential moderating effects social | 1) Andersen & Williams (1988)<br>2) A Model of Stress and Athletic Injury |

| | | | | |
|---|---|---|---|---|
| | | or more days beyond the day of injury"<br>2) Lower extremity not otherwise specified (69%); upper extremity (31%)<br>3) 11.88 days ± 27.71<br>4) - | support, AI, and mental toughness on the life stress-injury relationship. | |
| [33]; Brewer et al. (2013) | 1) US<br>2) n=91 (63.7% Male)<br>3) 92% Caucasian<br>4) 29.73 ± 10.24; range 14 to 54 years old<br>5) Physical therapy clinics<br>6) -<br>7) Competitive (43%); Recreational (54%)<br>8) - | 1) Yes: ACL tear<br>2) ACL tear<br>3) At least 6 weeks<br>4) Accelerated ACL rehabilitation protocol as developed by Shelbourne et al.; emphasis placed on early attainment of ROM, quadriceps strength, and normal gait. Exercises tailored to and considered safe for the patients' stage of recovery, patients may be encouraged to exceed the prescribed number of sets to hasten their recovery | 1) Prospective longitudinal<br>2) To identify predictors of adherence to a post-operative ACL home rehabilitation program. | 1a) Lazarus & Folkman (1984)<br>2a) Stress, Appraisal and Coping<br><br>1b) Wiese-Bjornstal et al. (1998)<br>2b) Integrated Model of Response to Sport Injury |
| [25]; McKay et al. (2013) | 1) Canada<br>2) n=316 (100% Male)<br>3) -<br>4) Median= 15; range 13 to 17 years old<br>5) Elite ice hockey teams in Calgary, Alberta<br>6) Ice Hockey<br>7) AAA, AA, A<br>8) Bantam age group: mean of 8.06 years of organized hockey; midget age group: mean of 9.57 years of organized hockey | 1) Yes: "any injury that required medical attention, resulted in the inability to complete the current session of activity, and/or required the cessation of sporting activity for at least 24 hours"<br>Subsequent injury: "any injury that occurred during the season, after the first reported injury, regardless of | 1) Prospective cohort<br>2) To determine the risk of injury associated with AI, attitudes towards body checking, competitive state anxiety, and re-injury fear in elite youth ice hockey players.<br>3) To determine if there is an elevated risk of subsequent injury associated with return-to-play | 1) -<br>2) - |

| | | | | |
|---|---|---|---|---|
| | | anatomical position or injury type"<br>2) n=143 injures reported: concussion (22.4%); muscle Strain (14.7%); joint/ligament sprain (14.7%)<br>3) As per definition<br>4) - | before medical clearance. | |
| [39]; Podlog et al. (2013) | *Study 1:*<br>1) US<br>2) n=118 (51.7% Male)<br>3) -<br>4) 15.97 ± 1.41<br>5) Teams in Texas<br>6) Football (36%); Basketball (24%); Soccer (11%); Volleyball (8%); Track and Field (5%); Baseball (4%); Softball (4%); Cheerleading (3%); Tennis (1.7%); Dance (0.8%); Swimming (0.8%)<br>7) School teams, local clubs or community leagues<br>8) 14.18 ± 8.93 hours per week spent training prior to injury; 6.69 ± 2.80 years involved in current sport (range: 1 to 14 years)<br><br>*Study 2:*<br>1) US<br>2) n=105 (59% Male)<br>3) -<br>4) -<br>5) NCAA teams across the US<br>6) Football (21%); Basketball (15%); Soccer (11%); Volleyball (9%); Track and Field (4%); Baseball (16%); Softball (3%); | *Study 1:*<br>1) Yes: "were currently experiencing an injury requiring a minimum 2-week absence from sport training and competition, and currently receiving physiotherapy for their injury"<br>2) ACL tear (34.7%); medial malleolus/fibula/distal tibia fracture (22.9%); shoulder dislocation (7.6%); Carpel Tunnel Syndrome (<1%)<br>3) M=2.7 months (SD=2.01); range: 0.5 to 7 months<br>4) 57.6% required surgery, not otherwise specified<br><br>*Study 2:*<br>1) Same as above<br>2) ACL (17.1%); fractured humerus/femur/clavicle (14.3%); shoulder dislocation (8.6%); sprain (7.6%)<br>3) M=2.49 months (SD=2.10); range: 0.5 to 7 months | *Study 1:*<br>1) Cross-sectional<br>2) To provide initial validation of a novel injury-rehabilitation over adherence measure.<br><br>*Study 2:*<br>1) Cross-sectional<br>2) To examine correlates of over adherence and premature return to sport. | *Study 1 & Study 2:*<br>1) Wiese-Bjornstal et al. (1998)<br>2) Integrated Model of Response to Sport Injury |

| | | | | |
|---|---|---|---|---|
| | Cheerleading/Gymnastics (9%); Tennis (5%); Golf (0.9%); Rugby (0.9%); Swimming (2%); Lacrosse (2%); Snowboarding (2%); Missing (0.9%)<br>7) NCAA Division I, II, III<br>8) 14.06 ± 6.14 hours per week spent training prior to injury; 9.74 ± 4.60 involved in current sport (range: 1 to 20 years) | 4) 50.5% required surgery, not otherwise specified | | |
| [40]; Weinberg et al. (2013) | 1) US<br>2) n=130 (52.3%)<br>3) -<br>4)20.03 ± 1.60; range: 18 to 24 years old<br>5) Intramural teams at a midsized university in the Midwestern US<br>6) Basketball (100%)<br>7) Recreational<br>8) 6.64 ± 3.98 years involved in sport | 1) Yes: "playing through injury was defined in the current study as participating while still feeling pain so that a) the pain/injury needs some sort of mental attention during participation, b) involves some sort of loss of or change in function that would directly affect performance capabilities, therefore indicating a threat to wellbeing, and c) a decision process was necessary as to whether participation should and/or would be initiated and continued during the experience of pain/injury"<br>2) -<br>3) -<br>4) - | 1) Cross-sectional<br>2) To determine whether athletes' attitudes and behavioural intentions regarding playing through pain and injury differ as a function of their level of AI and their gender. | 1) -<br>2) - |

| | | | | |
|---|---|---|---|---|
| [31]; Brewer et al. (2010) | 1) US<br>2) n=108 (66.7% Male)<br>3) 90% Caucasian<br>4) 29.38 ± 9.93; range: 14 to 54 years old<br>5) Physical therapy clinics<br>6) -<br>7) Competitive 47%; Recreational 49%; Non-Athletes 4%<br>8) - | 1) Yes: ACL tear<br>2) ACL tear<br>3) -<br>4) - | 1) Prospective longitudinal<br>2/3) To test the following predictions in a sample of physically active people who tore their ACL and underwent reconstructive surgery and rehabilitation: (i) decreasing one's athletic identity after ACL surgery could help to preserve self-esteem in the face of formidable threat to short- and potentially long-term sport participation, and ii) greater decrements in athletic identity are expected for those individuals who are experiencing slow postoperative recovery. | 1) -<br>2) - |
| [30]; Brewer et al. (2007) | 1) US<br>2) n=91 (63.7% Male)<br>3) 29.73 ± 10.24; range: 14 to 54 years old<br>4) Physical therapy clinics<br>5) -<br>6) Competitive 43%; Recreational 54% | 1) Yes: ACL tear<br>2) ACL<br>3) -<br>4) ACLR Rehabilitation | 1) Prospective longitudinal<br>2) To examine predictors of daily pain and negative mood over the first 6 weeks of rehabilitation following ACL reconstruction. | 1) Wiese-Bjornstal et al. (1998)<br>2) Integrated Model of Response to Sport Injury |
| [29]; Brewer et al. (2003) | 1) US<br>2) n=61<br>3) 92% Caucasian<br>4) 26.03 ± 7.99; range: 14 to 47 years old<br>5) Physical therapy clinic<br>6) -<br>7) Competitive 57%; Recreational 41% | 1) Yes: ACL tear<br>2) ACL<br>3) -<br>4) ACL reconstruction; Accelerated Rehabilitation Protocol | 1) Prospective longitudinal<br>2) To investigate whether prospective associations among psychological factors and rehabilitation adherence differ as a function of age | 1a) Wiese-Bjornstal et al. (1998)<br>2a) Integrated Model of Response to Sport Injury |

| | | | | |
|---|---|---|---|---|
| | 8) - | | through re-analysis of data from a previously published report. | 1b) Brewer et al. (1994)<br>2b) Cognitive Appraisal Models of Adjustment |
| [36]; Manuel et al. (2002) | 1) US<br>2) Time 1 (baseline): n=48 (58.3% Female); Time 2 (3 Weeks) n=44; Time 3 (6 Weeks) n=40; Time 4 (12 Weeks) n=34<br>3) 85% Caucasian<br>4) Range: 15 to 18 years old<br>5) MSK Outpatient Physical Therapy Department at Wakeforest University<br>6) Football (56%); Baseball (11%); Wrestling (11%); Soccer (25%); Basketball (21%); Track (14%); Volleyball (7%);<br>7) -<br>8) - | 1) Yes: "athletes who would be out of sports for at least 3 weeks."<br>2) Most common injury was ACL (no % provided); Injury Severity Scale as completed by the attending orthopedic surgeon. Scores range from 1 to 4, with a lower score indicating a less severe injury; M=2.50 (SD=1.26).<br>3) As per definition, out of sport for at least 3 weeks<br>4) - | 1) Prospective longitudinal<br>2) To explore patterns of psychological distress in adolescents experiencing sport injuries. | 1) -<br>2) - |
| [28]; Green et al. (2001) | 1) US<br>2) n=30 (60% Male)<br>3) 93.3% Caucasian<br>4) M=30.8 (SD=missing); range: 19 to 70 years old<br>5) Sport medicine clinics, physical therapy clinics and orthopedic centers<br>6) -<br>7) -<br>8) Minimum of 30 minutes of sport or physical activity /week. | 1) Yes: "discontinuance of regular physical activity/sport that was operationally defined as 30 minutes of physical activity a week, for a period of at least 6 weeks."<br>2) 50% knee injury; 26.7% other (three foot injuries, one broken tibia/fibula, one herniated disc, one broken arm); 10% shoulder injury; 6.7% hip injury; 3% ankle injury<br>3) As per definition "at least 6 weeks", | 1) Cross-sectional<br>2) To examine coping skills and social support to better understand those individuals most vulnerable to injury. | 1a) Kubler-Ross et al. (1969)<br>2a) Stage Models of Grief<br><br>1b) Brewer et al. (1994)<br>2b) Cognitive Appraisal Models of Adjustment<br><br>1c) Lazarus & Folkman (1984)<br>2c) Cognitive Appraisal Models of Adjustment<br><br>1d) Andersen & Williams (1988)<br>2d) A Model of Stress and Athletic Injury |

| | | | | |
|---|---|---|---|---|
| | | no additional data provided<br>4) - | | 1e) Weise-Bjornstal et al. (1998)<br>2e) Integrated Model of Response to Sport Injury |
| [34]; Brewer et al. (2000) | 1) US<br>2) n=95 (70.5% Male)<br>3) 88% Caucasian<br>4) 26.92 ± 8.23<br>5) Physical therapy clinic<br>6) -<br>7) Competitive (52%); Recreational (43%); Non-Athletes (3%); Missing (2%)<br>8) - | 1) Yes: ACL tear<br>2) ACL tear<br>3) -<br>4) Accelerated ACL rehabilitation protocol as developed by Shelbourne et al.; emphasis on early attainment of ROM, quadriceps strength and normal gait | 1) Prospective longitudinal<br>2) To examine the relationships among psychological factors, rehabilitation adherence, and rehabilitation outcomes after ACL reconstruction. | 1a) Brewer et al. (1994)<br>2a) Cognitive Appraisal Models of Adjustment<br><br>1b) Wiese-Bjornstal et al. (1998)<br>2b) Integrated Model of Response to Sport Injury<br><br>1c) Self-developed by authors<br>2c) Adapted model based on above referenced models (see article) |
| [18]; Brewer et al. (1993) | *Study 1*<br>1) US<br>2) n=121 (M: 66.9%)<br>3) -<br>4) -<br>5) Sport medicine clinics in Phoenix, Arizona<br>6) -<br>7) -<br>8) -<br><br>*Study 2*<br>1) US<br>2) n=90 (Injured: 16.7%); 100% Male<br>3) -<br>4) - | *Study 1*<br>1) No<br>2) Physician-rated injury severity on a 3-point scale (1=mild, 2=moderate, 3=severe); M=2.10<br>3) Injury status at time of enrollment on a 7-point scale (1=acutely injured, 7=completely recovered) M= 3.53<br>4) -<br><br>*Study 2*<br>1) No | *For Both Studies*<br>1) Cross Section Observational<br>2) To test the prediction that individuals who maintain strong, exclusive identification with the athlete role are more likely to become depressed following an athletic injury than individuals without such an identification. | 1) Bandura et al. (1977)<br>2) Self-Determination Theory |

| | | | | |
|---|---|---|---|---|
| | 5) University of California Varsity Football Team<br>6) -<br>7) -<br>8) - | 2) -<br>3) -<br>4) - | *Study 1*<br>3) To assess the extent to which AI was related to depressed mood in a sample of athletes who were already injured.<br><br>*Study 2*<br>3) To investigate the relationship between AI and depressed mood in a sample of both injured and uninjured athletes. | |

*Legend*: - = missing data point; ACL = anterior cruciate ligament; ALCR = Anterior Cruciate Ligament Reconstruction; AI = athletic identity; AIMS = Athletic Identity Measurement Scale; NAIA = National Association of Intercollegiate Athletics; NCAA = National Collegiate Athletics Association; PCL = posterior cruciate ligament; ROM = range of motion



**Sports & Athlete Descriptors**

Athletes were involved in a range of team and individual sports, however several studies did not specify sport background (18, 28-34). Furthermore, two studies included a small proportion (3% (31) and 4% (34)) of self-defined “non-athletes”. Authors of this review chose to include these studies due to small number of non-athletes (n = 7 total) included in analyses. Samples consisted of recreational (e.g., house league) and competitive athletes (e.g., elite, NCAA) however, several studies did not report on this metric (18, 28, 32, 35-37). Sport involvement (e.g., frequency of and years involved in sport) was heterogeneous and reported within six studies (25, 27, 28, 38-40); sport participation ranged from 30 minutes (28) to 14.19 (SD= 9.40) hours per week (38) and years of sport involvement ranged from 6.64 years (SD=3.98) (40) to 11.17 years (SD= 4.31) (27). See Table 2.

**Injury Descriptors**

Musculoskeletal (MSK) injuries were the most common injuries cited. Nine studies reported exclusively on anterior cruciate ligament (ACL) surgical outcomes, while two (24, 37) exclusively examined concussion. The remaining 11 studies captured various MSK injuries. In one, the authors did not specify an exact injury but indicated injury to lower or upper extremities (23) and one captured both MSK injuries and concussion (25). Two studies did not define the injuries sustained (18, 36). Of these two, one indicated injury severity on a scale ranging from 1 (mild) to 3 (severe) (18) while the other stated that the majority of injuries were ACL tears, but did not specify the exact proportion (36). Time away from sport due to injury varied, ranging from 24 hours (23, 25) to 63 weeks (38). Ten studies did not specify a length of absence. Three studies (23, 25, 40) reported on athletes who sustained multiple injuries during data collection period while the remaining 19 captured a first (i.e., initial) injury only. See Table 2.

**Definitions & Theoretical Models**

Operational definitions of injury were specified in each study except one (18). Those that captured ACL and concussions exclusively, indicated a diagnosed ACL tear or diagnosed or self-reported concussion in lieu of an operational definition. Eleven studies referenced injury models as a means of justification for study methodologies used. The most frequently cited model was the *Integrated Model of Response to Sport Injury* (41). Several other theories, unrelated to sport injury were also referenced. See Table 2.

Weise-Bjornstal's injury model (41) (see Appendix D, Figure 2) suggests an athlete's cognitive appraisal (e.g., rate of perceived recovery, cognitive coping, etc.) of the injury is a primary driver of outcome (i.e., physical, behavioural and emotional). Seven studies explicitly measured cognitive appraisal via subjective rehabilitation progress (31), coping skills and strategies used (26-28, 36), psychological response to injury (26), readiness to return to sport (39) and rehabilitation beliefs (42). Most of the outcome measures used typified athlete personal factors. A small proportion of studies (n=6) used measures that isolated situational factors (e.g., sport, social and environmental) (23, 28, 29, 34, 37, 42), but only assessed social support (e.g., availability, quality, source).

**Outcome Measures**

The Athletic Identity Measurement Scale (AIMS) (43), 7 or 10-item version, was used exclusively to quantify the strength of AI (see Table 3). The AIMS consists of three sub-scales: social identity (i.e., the extent to which the individual views themselves as occupying the athlete role), exclusivity (i.e., the extent to which the individual defines their self-worth based on the athlete role), and negative affectivity (i.e., the extent to which the individual experiences negative emotions from undesired outcomes associated with the athlete role) (43). Findings summarized were specific to AI. Analyses that did not consider AI were excluded from the summary. Findings were grouped into the following categories: demographic, psychosocial, behavioural, injury-specific and pain. Several studies also investigated the impact that injury had on AI. These findings are presented at the end of this section.

*Table 3. Study Outcome Measures, Key Findings and Limitations*

| **Citation; Author (Year)** | **Outcomes Measures**<br><br>**1) AIMS: 7 or 10 items**<br>**2) Timeline of Administration**<br>**3) Group; Score (M±SD)** | **Key Findings Pertaining to AI** | **Strengths & Limitations** |
|---|---|---|---|

| | 4) Names of Additional Measure Used | | |
|---|---|---|---|
| [32]; Padaki et al. (2018) | 1) 10 items<br>2) Baseline: pre-operation<br>3) Sex: Male = 53.4 vs. Female = 56.6<br><br>Sport Involvement: Single sport = 57.5 vs. Multi-sport = 52.8<br><br>Age: ≤ 14 years old = 54.5 vs. 15-21 years old = 54.1<br><br>SDs not provided<br><br>4) Level of Sports Specialization; IES-R | - single sport athletes had significantly higher AIMS scores than multi-sport athletes<br>- no significant difference in AIMS scores by age group ( ≤ 14 years old vs. 15 – 21 years old)<br>- no significance difference on IES-R between high (AIMS score: >50) and low AI groups (AIMS score: ≤ 49) | *Strengths:*<br>- only study to group athletes by sport specialization (as per the American Orthopedic Society for Sports Medicine definition; i.e., single vs. multi-sport athletes) and compare AIMS scores between groups<br>- only study to examine psychological trauma associated with a sport injury<br><br>*Limitations:*<br>- small sample size<br>- unknown how long athletes were removed from sport<br>- figures are provided, but exact values are not referenced<br>- does not appear that tests of statistical significance were conducted to compare *high* & *low* AI groups<br>- no pre-injury data available<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [38]; Hilliard et al. (2017) | 1) 7 items<br>2) Baseline: post-injury<br>3) 5.78 ± 0.72 ⊗<br>4) ROAQ | - positive moderate and significant association between AIMS score and over adherence to rehabilitation protocols<br>- positive moderate and significant association between AIMS score and attempts to expedite rehabilitation process<br>- positive moderate but non-significant association between AIMS score and willingness to ignore practitioner recommendations pertaining to rehabilitation<br>- AIMS negative affectivity sub-scale independently predicted likelihood that athlete would: i) | *Strengths:*<br>- sample is described clearly and thoroughly (e.g., clear definition of injury, sport, level of play, frequency of sport involvement, type of sport injury, time removed from sport)<br>- range of sports and levels of play captured increase the generalizability of findings<br>- study design used does not prioritize one aspect of the research over the other (i.e., quantitative vs. qualitative)<br>- regression models have sufficient power |

| | | | |
|---|---|---|---|
| | | ignore practitioner recommendations and ii) attempt to expedite the rehabilitation process | -captured a range of MSK injuries<br>-clear operational definition of injuries eligible for inclusion<br><br>*Limitations:*<br>- only one additional outcome measure administrated<br>- ROAQ assesses athlete *beliefs*, not *actual* behaviours<br>- sample is predominantly male<br>- statistical tests comparing AIMS scores to subscale scores, increases likelihood of multicollinearity<br>- large variation in "time since injury": 1 week [acute] vs. 63 weeks [chronic]<br>- no pre-injury data available |
| [37]; O'Rourke et al. (2017) | 1) 7 items<br>2) Time 2: ~14-21 days post-concussion<br>3) 38.25 ± 6.23<br>4) SCAT-2; AGS-YS; MCS-YS; PIMCQ-2; SMS; SAS-2; SNS | -moderate positive and significant association with AIMS score: mastery orientation, ego, parent ego climate, intrinsic and extrinsic motivation, social network size, post-concussion symptoms at Time 2 & 3<br>-small negative and significant association between AIMS score and social network satisfaction<br>-stronger AI significantly predicted more severe post-concussion symptoms at Time 3 (~21-28 days post-concussion) | *Strengths:*<br>- only study to capture and compare AI to presence of post-concussion symptoms at multiple time points in the acute recovery phase<br>- similar number of male and female athletes captured in sample<br>- thorough evaluation of athlete motivation captured via measures administered<br><br>Limitations:<br>- poorly described sample with respect to level of and frequency of sport involvement<br>- Bonferroni correction was not applied for tests of multiple comparison (e.g., correlations)<br>- using a hospital-based clinic as a recruitment source may have biased the sample to have captured athletes with more severe concussion symptoms<br>- follow-up measures administered very close together (Time 1: ~1-14 days post- |

| | | | |
|---|---|---|---|
| | | | concussion; Time 2: ~14-21 days post-concussion; Time 3: ~21-28 days post-concussion)<br>- diagnostic criteria for concussion not stated<br>- no pre-injury data available |
| [35]; Baranoff et al. (2015) | 1) 7 items<br>2) Baseline: 0-2 weeks post-operation<br>3) 31.0 ± 9.0<br>4) AAQ; PCS; DASS 21 | -strong positive and significant association between AIMS score and depressive symptom severity | *Strengths*:<br>-equal representation of males and females in sample<br>- t-tests conducted to determine if there was a significant difference between athletes who submitted questionnaires at both time points vs. at Time 1 only; no significant difference between groups on measures of depression<br>-measure mean/SD provided for both groups (i.e., athletes who completed questionnaires at both time points vs. Time 1 only)<br><br>*Limitations*:<br>-small sample size<br>-only three sports captured<br>-frequency and years of sport involvement not provided for sample<br>-~ 8 weeks between occurrence of injury and questionnaire completion<br>-no pre-injury data on AI<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [27]; Samuel et al. (2015) | 1) 7 items<br>2) Multiple: Time 1: 2.25 months from date of initial injury; Time 2: 6.58 months from date of initial injury; Time 3: 10.08 months from date of initial injury<br>3) Time 1 = 45.17 ± 1.83 Time 2 = 43.33 ± 3.83 Time 3 = 44.55 ± 3.50<br>4) CEI; BCope | - no significant difference between AIMS scores as assessed at different time points | *Strengths:*<br>-years of sport involvement provided<br>-AI was assessed at multiple time points, with sufficient time between follow-up<br><br>*Limitations:*<br>-small sample size<br>-participant raw data provided; means/SDs not calculated<br>-sex distribution of sample not provided |

| | | | |
|---|---|---|---|
| | | | -recruitment source not provided<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [24]; Kroshus et al. (2014) | 1) 7 items<br>2) Baseline: pre-season, pre-injury<br>3) 39.79 ± 4.73<br>4) Concussion History; CKI; CAI; HIQ | - significant interaction identified between perceived concussion reporting norms and AIMS score with respect to predicting non-reporting behaviours; stronger AI was associated with non-report<br>-AIMS score alone did not significantly predict non-reporting behaviours | *Strengths:*<br>-only study to look exclusively at concussion reporting behaviours<br>-homogenous sport sample captured; all participants were NCAA Division I ice hockey players<br>-large sample size<br><br>*Limitations:*<br>-all male sample; not generalizable to females<br>-reporting behaviours subject to recall bias; follow-up questionnaires were administered at the end of hockey season<br>-reporting behaviours based on presence of post-impact concussion symptoms rather than incidence of unreported suspected concussions |
| [26]; Madrigal et al. (2014) | 1) 10 items<br>2) Multiple: Time 1: preseason; Time 4: Cleared-To-Play<br>3) Time 1 = 54.25 ± 7.80<br>Time 4 = 53.67 ± 8.74<br>4) MTS; PPI-A; LOT-R; BCope; PRSII; RAQ; DRS | - no significant difference identified between AIMS score as measured at preseason and return-to-play following injury | *Strengths*:<br>-equal representation of males and females in sample<br>-assessed AI prior to sport injury<br>-captured a range of MSK injuries<br><br>*Limitations*:<br>-frequency and years of sport involvement not provided<br>-small sample size<br>-measure means/SDs not calculated for sample; participant raw data provided<br>-results were presented for each athlete, rather than summary for the entire sample<br>-narrow age range captured (20 to 21 years old) |

| | | | |
|---|---|---|---|
| [42]; Masten et al. (2014) | 1) 7 items<br>2) Baseline: Pre-operation<br>3) -<br>4) FPI; STAI-X1; SIP 15; SIRBS; 6-item self-developed scale assessing social support provided by family, coach and sport colleagues, and athlete's motivation for rehabilitation | - AIMS scores independently predicted an athlete's motivation to engage in rehabilitation as well as their subjective value of rehabilitation; athletes with stronger AI were significantly more likely to have greater motivation and positive views towards rehabilitation | *Strengths*:<br>-only study to exclusively capture high-ranking athletes (e.g., world class, international and national)<br>-compared athletes by injury severity (more severely injured [expected rehab time > 1 month but ≤ 6 months] vs. less severely injured [expected rehab time ≤ 1 month])<br>-diverse group of athletes captured<br>-wide age range captured (16 to 40 years old)<br><br>*Limitations*:<br>-AIMS mean/SD not provided or compared between more severely injured vs. less severely injured athletes<br>-level of sport involvement was not provided for majority of sample<br>-questionnaires only administered at one time point; unable to make any conclusions about changes to AI as a result of sport injury |
| [23]; Petrie et al. (2014) | 1) 6 items; one item removed due to lack of variability<br>2) Baseline: pre-season (i.e., pre-injury)<br>3) 32.23 ± 5.71<br>4) LESCA; MSPSS; SMTQ | - no significant associations between AIMS score: i) life stress, ii) injury outcome, iii) social support or iv) mental toughness were identified<br>- AIMS score was not a significant predictor of "time lost" (i.e., number of days removed from sport due to injury); AIMS score interaction terms with i) positive and ii) negative life stress were also non-significant | *Strengths:*<br>-homogenous sport sample captured; all participants were NCAA Division I football players<br>-sample was ethnically diverse<br>-assessed AI prior to sport injury<br>-clear operational definition of injuries eligible for inclusion<br><br>*Limitations:*<br>-small sample size<br>-frequency and years of sport involvement not provided<br>-findings not generalizable to females<br>-no post-injury assessment of AI |

| | | | |
|---|---|---|---|
| | | | -no comparison between injured and un-injured athletes with respect to AIMS baseline scores |
| [33]; Brewer et al. (2013) | 1) 7 items<br>2) Once: pre-operation<br>3) 30.07 ± 9.73<br>4) NEO-FFI-Neuroticism; LOT-R; POMS-B; Subjective Pain Rating; Subjective Daily Stress Rating | - AIMS score did not significantly predict home exercise completion ratio (i.e., number of sets of home exercises completed compared to what was prescribed)<br>- significant interaction identified between AIMS score and daily stress as predictors of home exercise completion ratio; when daily stress was high, individuals with stronger AI were more likely to complete their prescribed exercises | *Strengths:*<br>-similar distribution of competitive vs. recreational athletes<br>-one of three studies that assessed *actual* rehabilitation behaviours (e.g., home exercise completion, cryotherapy)<br><br>*Limitations:*<br>-sample was predominantly Caucasian; findings may not be generalizable to other ethnic groups<br>-sample was predominantly male<br>-sample was poorly described; frequency and years of sport involvement and sports captured were not provided<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [25]; McKay et al. (2013) | 1) 10 items<br>2) Baseline: within 3 weeks of hockey season start, pre-injury<br>3) 55.72 ± 7.54<br>4) CSAI-2R; BCQ; FRQ; MPQ-SF | -athletes with AIMS score below the 25th percentile were at greater risk for incurring an injury; this finding was significant<br><br>* findings omitted due to publishing authors' error; discrepancy between findings communicated in text of results section and tables* | *Strengths:*<br>-large sample size<br>-athletes grouped by age for analysis<br>-only study to examine AI in relation to injury risk<br>-injuries were reported by an external source<br>-homogenous sport sample captured; all participants were elite male ice hockey players<br>-only study to capture concussion and MSK injuries<br>-clear operational definition of injuries eligible for inclusion<br><br>*Limitations:*<br>-direct discrepancy in findings pertaining to AI; authors were contacted for clarification but no response was provided<br>-no post-injury assessment of AI |

| | | | |
|---|---|---|---|
| | | | -findings not generalizable to females<br>-narrow age range captured (13 to 17 years old) |
| [39]; Podlog et al. (2013) | *Study 1:*<br>1) 7 items<br>2) Baseline: post-injury<br>3) 5.67 ± 0.90 ⊗<br>4) SPSQ ⊗; ROAQ ⊗; I-PRRS ⊗<br><br>*Study 2:*<br>1) 7 items<br>2) Baseline: post-injury<br>3) 5.63 ± 0.96 ⊗<br>4) SPSQ ⊗; ROAQ ⊗; I-PRRS ⊗ | *Study 1 Only:*<br>- AIMS scores significantly predicted attempts to expedite the rehabilitation process; athletes with a stronger AI were significantly more likely to think and behave in a way that would expedite rehabilitation<br><br>*Study 1 & 2:*<br>- small positive and significant association between AIMS score and tendency to ignore practitioner rehabilitation recommendations<br>- AIMS scores significantly predicted rehabilitation tendencies;<br>athletes with a stronger AI were significantly more likely to ignore practitioner recommendations | *Strengths (Study 1 & 2):*<br>-samples captured were thoroughly described<br>-wide range of sports and levels of involvement captured<br>-large sample size<br>-similar number of males and females captured<br>-captured a range of MSK injuries<br>-clear operational definition of injuries eligible for inclusion<br><br>*Limitations:*<br>-no post-injury assessment of AI (both studies)<br>-large variation in time lost (i.e., number of days removed from sport) due to sport injury (both studies)<br>-sample age (mean/SD) not provided in study 2 |
| [40]; Weinberg et al. (2013) | 1) 10 items<br>2) Baseline: post-injury<br>3) 4.15 ± 1.21⊗<br>4) RPIQ ⊗; PIB ⊗ | -males scored significantly higher on each AIMS subscale compared to females<br>-AI significantly predicted athlete attitudes towards sport risk, pain and playing through pain; athletes scoring ≥ $75^{th}$ percentile on the AIMS were more likely to have positive attitudes and behavioural tendencies to play through pain and injury compared to the moderate (between $25^{th}$ and $75^{th}$ percentile) and low AI groups ≤ 25 percentile)<br>-AIMS exclusivity and negative affect subscales significantly predicted RPIQ toughness [in regards to risk, pain and injury in sport], social role choice [willingness to accept risk, pain and injury in sport], and pressed | *Strengths:*<br>-large sample size<br>-equal representation of males and females<br><br>*Limitations:*<br>-homogenous sample of intramural basketball players; findings not generalizable to other sports<br>-few details provided about injury<br>-reporting behaviours subject to recall bias; questionnaires administered at an unknown time point following injury<br>-did not assess *actual* behaviours following injury; operational definition (i.e., "playing through injury as defined…" applied as an inclusion criteria only |

| | | | |
|---|---|---|---|
| | | [perceptions of pressure exerted by others to playing with pain and injury] subscale scores; athletes scoring higher on the exclusivity and negative affect AIMS subscales were more likely to endorse toughness (i.e., risk, pain and injury)<br>-AIMS negative affect subscale scores significantly predicted athlete behavioural intentions to play through an injury; athletes with stronger AIs were more likely to play through an injury | -narrow age range captured (18 to 24 years old) |
| [31]; Brewer et al. (2010) | 1) 7 items<br>2) Multiple: Time 1: pre-operation; Time 2: 6-months post-operation; Time 3: 12-months post-operation; Time 4: 24-months post-operation.<br>3) Time 1 = 32.14 ± 8.83<br>Time 2 = 31.62 ± 8.23<br>Time 3 = 29.07 ± 8.47<br>Time 4 = 28.45 ± 8.09<br>4) Subjective rating of rehabilitation progress (%) | -Time 1 and Time 2, Time 3 and Time 4 AIMS scores were not significantly different; all other time point comparisons were significantly different and adjusted for age and gender<br>-subjective ratings of rehabilitation progress significantly predicted AIMS score differences between Time 2 and 3 after adjusting for Time 1 AIMS score, gender and age; athletes who experienced a slower recovery were more likely to experience greater decreases to their AI | Strengths:<br>- sufficient time between follow-up points<br>- long-term follow-up; only study to gather information 2-years post-injury<br>-Bonferroni correction applied to tests of multiple comparisons<br>-equal distribution of competitive and recreational level athletes<br>-wide age range captured (14 to 54 years old)<br><br>Limitations:<br>-details about sports captured not provided<br>-frequency and years of sport involvement not provided<br>-details about sport injury not provided<br>-males and Caucasians were over represented in sample; findings not generalizable to females and other ethnicities<br>-small number of cases included in the data set for analysis (53.7% of total sample); no indication if tests of significance were conducted between included/excluded cases |

| | | | |
|---|---|---|---|
| | | | -limited number of covariates included in regression models<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [30]; Brewer et al. (2007) | 1) 7 items<br>2) Baseline: pre-operation<br>3) 30.36 ± 9.71<br>4) NEO-FFI – Neuroticism Subscale; LOT-R; PDS; number of physical therapy appointments per/day; HOMEX [frequency of exercise completion with and without videocassette use]; HOMEXRAT [division of HOMEX by number of sets of home rehabilitation exercises prescribed for a given day]; EXERCISE [number of minutes spent "on vigorous physical activity other than their rehabilitation exercises"]; NRS; POMS-B | -AIMS score did not significantly and independently predict average daily pain<br>-AIMS score did not significantly and independently predict negative mood<br>-significant interaction between AIMS score and number of days since surgery with respect to predicting negative mood; athletes with stronger AIs experienced greater decreases in negative mood as number of days since surgery increased | Strengths:<br>-similar representation of recreational and competitive level athletes<br>-one of three studies that assessed *actual* rehabilitation behaviours (e.g., home exercise completion, cryotherapy)<br>-wide age range captured (14 to 54 years old)<br><br>Limitations:<br>-details about sports captured not provided<br>-frequency and years of sport involvement not provided<br>-details about sport injury not provided<br>-males and Caucasians were over represented in sample; findings not generalizable to females and other ethnicities<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [29]; Brewer et al. (2003) | 1) 10 items<br>2) Baseline: ~ 10 days pre-operation<br>3) 44.16 ± 9.98<br>4) SMI; SSI; BSI; SIRAS ×; ratio of appointments attended to scheduled; Home Rehabilitation Adherence – Exercise Completion; Home Rehabilitation Adherence – Cryotherapy | -significant interaction between age and AIMS score with respect to predicting: i) home exercise adherence and ii) cryotherapy use; younger athletes with stronger AIs were more likely to complete their at home exercises and to utilize cryotherapy | *Strengths:*<br>-one of three studies that assessed *actual* rehabilitation behaviours (e.g., home exercise completion, cryotherapy)<br>-wide age range captured (14 to 47 years old)<br><br>*Limitations:*<br>-competitive athletes were over represented in sample<br>-males and Caucasians were over represented in sample; findings not generalizable to females and other ethnicities<br>-details about sports captured not provided |

| | | | |
|---|---|---|---|
| | | | -frequency and years of sport involvement not provided<br>-AIMS only assessed at one time point<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [36]; Manuel et al. (2002) | 1) 10 items<br>2) Baseline: post-injury<br>3) 47.20 ± 9.78<br>4) ISS $^{\times}$; APES; PRQ-R-S; ACS; BDI | -AIMS score significantly predicted depression scores; athletes with stronger AIs were more likely to experience more severe depressive symptoms | *Strengths:*<br>-range of sports captured<br>-one of two studies to assess injury severity (based on physician rating)<br><br>*Limitations:*<br>-frequency and years of sport involvement not provided<br>-few details provided with respect to injuries captured<br>-small sample size<br>-Caucasians were over-represented in sample; findings may not be generalizable to other ethnicities<br>-AIMS only assessed at one time point<br>-narrow age range captured (15 to 18 years old) |
| [28]; Green et al. (2001) | 1) 10 items (note: 5-point Likert response scale used)<br>2) Baseline: post-injury<br>3) 43.10 ± 11.51<br>4) ACSI; POMS; PSPP; SSQ | -negative but non-significant association between AIMS score and depressive mood<br>-moderate positive and significant association between AIMS score and physical conditioning<br>-AIMS score did not significantly predict depressive symptom severity | *Strengths:*<br>-captured a range of MSK injuries<br>-wide age range captured (19 to 70 years old)<br>-clear operational definition of injuries eligible for inclusion<br><br>*Limitations:*<br>-information about sports and levels of athlete sport involvement not provided<br>-Caucasians were over-represented in sample; findings may not be generalizable to other ethnicities<br>-small sample size<br>-AIMS only assessed at one time point |

| | | | |
|---|---|---|---|
| [34]; Brewer et al. (2000) | 1) 10 items<br>2) Baseline: ~ 10 days pre-operation<br>3) 41.65 ± 12.16<br>4) SMI; SSI; BSI; SIRAS × ; ratio of appointments attended to scheduled; Home Rehabilitation Adherence – Exercise Completion; Home Rehabilitation Adherence – Cryotherapy; KT 1000 (Joint Laxity); One Leg Hop Distance; LKSS | -small positive and significant association between AIMS score and motivation<br>-moderate positive and significant association between AIMS score and joint laxity as measured 6 months following ACL reconstructive surgery<br>-small positive and significant association between AIMS score and i) one leg hop distance and ii) knee function as measured 6 months following ACL reconstructive surgery<br>-AIMS score significantly predicted joint laxity as measured 6 months following ACL reconstructive surgery; athletes with stronger AI were more likely to have similar knee joint stability between the affected and unaffected leg | *Strengths:*<br>-large sample size<br>-only study to measure functional injury outcomes (e.g., joint laxity, one leg hop distance, pain) using objective measures<br><br>*Limitations:*<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries<br>-frequency and years of sport involvement not provided<br>-males and Caucasians were over-represented in sample; findings may not be generalizable to females and other ethnicities<br>-AIMS only assessed at one time point<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [18]; Brewer et al. (1993) | *Study 1*<br>1) 10 items<br>2) Baseline: ~2 weeks following injury<br>3) 47.93 ± 9.98<br>4) PSPP-G; SARRS; POMS-D; BDI<br><br>*Study 2*<br>1) 10 items<br>2) Baseline: pre-season<br>3) Injured = 48.47 ± 9.09<br>Non-Injured = 51.60 ± 9.09<br>4) PSPP-G; SARRS; POMS-D; BDI | *Study 1:*<br>-AIMS score was not significantly associated with depressive symptom severity<br>-AIMS score was a significant independent predictor of depressive symptom severity; athletes with stronger AIs were more likely to experience more severe symptoms of depression<br>-small positive and significant association between AIMS scores and physician-rated injury severity<br><br>*Study 2:*<br>-significant interaction between AIMS score and physician-rated injury severity in regards to predicting depressive symptom severity; athletes with a stronger AI and more severe injury were more likely to | *Strengths (Study 1):*<br>-one of two studies to assess injury severity (based on physician rating)<br>-large sample size<br><br>*Limitations (Study 1)*:<br>-males were overrepresented in sample; findings may not be generalizable to females<br><br>*Strengths (Study 2):*<br>-only study to compare AIMS scores between injured and uninjured group of athletes<br><br>*Limitations (Study 2):*<br>-exclusively captured male football players; findings may not be generalizable to females and other sports<br>-very small proportion of injured athletes captured (20% of total sample) |

| | | | |
|---|---|---|---|
| | | experience depressive symptoms of a greater severity<br>-no significant difference in AIMS score between injured and uninjured groups | *Strengths (Both Studies):*<br>-cross validated depressive symptom severity using two measures of depression<br><br>*Limitations (Both Studies):*<br>-details about sport injury not provided<br>-frequency and years of sport involvement not provided<br>-AIMS only assessed at one time point<br>-no operational definition of sport injury provided |

*Legend*: - = missing data point, × = clinician reported data; ⊗ = item mean score; AAQ = Acceptance and Action Questionnaire; ACL = anterior cruciate ligament; ACS = Adolescent Cope Scale; ACSI – Adolescent Coping Skills Inventory; AER = Attempt an Expedited Rehabilitation; AGS-YS = Achievement Goal Scale for Youth Sports; AI = athletic identity; BC = Brief Cope; BCope = Brief COPE; BCQ = Body Checking Questionnaire; BDI = Beck Depression Inventory ;BSI = Brief Symptom Inventory; CAI = Rosenbaum and Arnett's Concussion Attitudes Index; CEI = Change-Event Inventory; CKI = Concussion Knowledge Index; CSAI-2R = Competitive State Anxiety Inventory 2-R; DASS 21 = Depression, Anxiety and Stress Scale; DRS = Dispositional Resiliency Scale; FPI = Freiburger Persönlichnkeitsinventar – Personality; FRQ = Fear of Reinjury Questionnaire; HOMEX = home exercise completion with and without videocassette; IES-R = Horowitz Impact of Event Scale – Revised ; IPR = Ignore Practitioner Recommendations; ISS = Injury Severity Scale ; LESCA = Life Events Survey for Collegiate Athletes; LKSS = Lysholm Knee Scoring Scale; LOT-R = Life Orientation Test – Revised; MCS-YS = Motivational Climate Scale for Youth Sports; MPQ-SF = McGill Pain Questionnaire-Short Form; MSK = musculoskeletal; MSPSS = Multidimensional Scale of Perceived Social Support; MTS = Mental Toughness Scale; NEO-FFI – Neuroticism Subscale = NEO Five Factor Inventory = Neuroticism Subscale; NRS = Numerical Rating Scale; PCS = Pain Catastrophizing Scale; PDS = Perceived Daily Stress; PIB = Perceived Injury Behaviour; PIMCQ-2 = Parent-Initiated Motivational Climate Questionnaire-2; PPI-A = Psychological Performance Inventory-A; POMS = Profile of Mood States; POMS-B = Profile of Mood States – B (Abbreviated Version); POMS-D = Profile of Mood States – Depression; PRSII = Psychological Response to Sport Injury Inventory ; PSPP = Physical Self-Perception Profile; PSPP-G = Physical Self-Perception Profile – Global Physical Self-Worth Subscale; RAQ = Rehabilitation Adherence Questionnaire; ROAQ = Rehabilitation Over Adherence Questionnaire; RPIQ = Risk of Pain and Injury Questionnaire; RPQ-R-S = Personal Resource Questionnaire-Revised-Social Support; SARRS = Social and Athletic Readjustment Scale; SAS-2 = Sport-Anxiety Scale-2; SIP 15 = Sports Inventory for Pain; SIRAS = Sport Injury Rehabilitation Adherence Scale; SIRBS = Sport Injury Rehabilitation Belief Scale; SMI = Self-Motivation Inventory; SMS = Sport Motivation Scale; SMTQ = Sports Mental Toughness Questionnaire; SNS = Social Network Scale; SPSQ = Self Presentation in Sport Questionnaire; SSI = Social Support Inventory; STAI X1 = State Anxiety



## Demographics

Findings pertaining to AI and sex were presented in two studies but were inconsistent. One study found that sex significantly predicted AIMS sub-scales scores, with males having significantly higher scores on each subscale (e.g., social, exclusivity and negative affect) than females (40). Padaki and colleagues also compared AIMS scores by sex (M=56.6 vs. 53.4 for females and males, respectively), but this difference was not significant (p=0.092). They also examined AIMS scores by sport involvement (single vs. multi-sport athletes) and was the only study to have done so. Interestingly, single sport athletes reported a significantly stronger AI (M=57.7) compared to multi-sport athletes (M=52.8, p=0.043). Two studies investigated AI and age (24, 32), with both identifying a negative non-significant association (i.e., as age increases, AI decreases). See Table 3.

**Psychosocial**

Depressive symptoms were measured in six studies, but only five presented findings in relation to AIMS scores. Correlational analyses were conducted in two of the studies (28, 35) while regression models were constructed in the other three (18, 30, 36). Correlational analysis identified a large positive significant association between AI and depression scores (35), while findings from the other study identified a small negative but non-significant association (28). Beta coefficients generated from regression models illustrated a similar positive relationship between AI and depressive symptom severity, while also adjusting for several covariates. Two studies included AIMS scores in their models as an interaction term, one with injury severity (18) and one with number of days since surgery (30). Although both models indicated that interaction terms explained a greater variance in depression scores compared to when AIMS scores were entered alone, only one interaction coefficient was significant (30). Despite evidence suggesting that athletes with stronger AIs were more likely to experience depressive symptoms following a sport-related injury, findings also indicated that they experienced greater improvements in their mood throughout the post-surgical follow-up period (30). Four studies assessed anxiety, but only one study compared anxiety symptoms (e.g., sport-related performance, somatic, concentration disruption and worry) to AI (37). Despite anxiety symptoms being positively related to AI, findings were not significant. Another study assessed athletes for symptoms of post-traumatic stress disorder (PTSD; e.g., hyperarousal, avoidance, and intruding thoughts) (32) and compared PTSD scores between "high" and "low" AI groups prior to ACL reconstructive surgery, however group differences were not significant.

AI was significantly associated with several other, albeit more abstract, psychosocial constructs including sport performance traits, physical self-worth, motivation, and social network size. Traits associated with sport performance such as ego (i.e., being the best athlete one can be) and mastery (i.e., performing to the best of one's abilities) were significantly associated with AI as represented by the moderate effect sizes observed (37). One study compared physical self-worth (i.e., perceived sport competence, perceived muscular and physical strength and conditioning) to AI and identified a positive moderate and significant association among athletes shortly after they began a rehabilitation program (28). One study also identified a small significant association between AI and generalized motivation (34). Similarly, a moderate positive significant association was also identified between motivational climate in sport (as facilitated by parental figures) and AI. Athletes with stronger AIs also maintained greater intrinsic and extrinsic motivation towards sport (37). Although social support was assessed in seven studies, only two presented findings in relation to AI. Findings indicated that maintenance of larger social networks was moderately positively and significantly associated with stronger AIs (37). Petrie and colleagues also examined the relationship between AI and social support but with respect to family, friends and significant others. Small positive but non-significant associations were identified between support provided by family, friends and AI but a negative association for significant others. See Table 3.

**Behavioural**

Several studies investigated the relationship between AI and rehabilitation over adherence, motivation, completion of exercises and accompanying treatments (e.g., cryotherapy). One study identified a small significant positive association between AI and beliefs pertaining to rehabilitation over adherence (38) and another found that stronger AIs significantly and independently predicted over adherence (i.e., ignoring practitioner recommendations and attempting to expedite the rehabilitation process) (39). Contrariwise, another study found athletes with AIs > $75^{th}$ percentile were *less* likely attempt to return-to-sport prior to medical clearance (25).

Exercise completion was assessed in three studies (29, 33, 34) but findings were inconsistent. In one study, correlational analyses identified a small positive but non-significant association between AI and exercise completion (34). Authors also entered AI as an interaction term in regression models. When entered with subjective stress (33) a small positive significant interaction was found, however when entered with age, a negative significant association was identified (29). Researchers also found that younger athletes were significantly more likely to complete their exercises and cryotherapy treatments compared to older athletes. Interestingly the opposite relationship was observed in an earlier study but findings weren't significant (34).

In alignment with the findings discussed above, athletes with stronger AIs were significantly more likely to place a greater value on and maintain greater motivation towards the rehabilitation process (42). Similarly, beliefs and attitudes regarding rehabilitation were also examined (40). Authors allocated athletes into sub-groups based on their AIMS score (low = < 25th percentile; moderate = between 25 and 75th percentile; high = > 75th percentile). Athletes in the *high* sub-group reported significantly greater positive attitudes and tendencies to play through pain and injury than athletes in the *low* and *moderate* groups. When entered into a hierarchical regression model, AIMS exclusivity and negative affect subscales significantly predicted attitudes pertaining to toughness (regarding risk, pain and injury in sport), social role choice (willingness to accept risk, pain and injury in sport as a part of the athlete role) and "pressed" (the perception of pressure felt from others to play with pain and injury) across each sub-group. However, only the AIMS negative affect sub-scale was found to be a significant independent predictor of perceived injury behaviours (i.e., intention to play through injury) (40). A similar finding was identified by Kroshus and colleagues in their investigation of concussion reporting behaviours. They found that athletes with stronger AIs were slightly and significantly more likely to engage in non-reporting behaviours than athletes with weaker AIs (24). Interestingly, additional variance was explained when perceived concussion reporting norms were added to the model. See Table 3.

**Injury-Specific Outcomes**

Injury severity, risk and functional outcomes were examined in several studies. Significant small effect sizes were identified between AI and physician-rated injury severity (18). Similarly, another study indicated that stronger AIs were moderately positively and significantly associated with concussion symptom severity at follow-up time points (~14-21 and ~21-28 days post-concussion). When entered into a hierarchical regression model, AI significantly predicted post-concussion symptom severity ~21-28 days following injury (37). With respect to injury risk, one study found that athletes with AIMS scores < 25th percentile faced a greater risk compared to those > 25th percentile, but this difference was not significant (25). Interestingly, athletes with AIMS scores > 75th percentile were significantly more likely to have incurred a subsequent injury during the data collection period.

Only one study assessed functional recovery outcomes. Measured 6 months following ACL reconstructive surgery, AI was moderately positively and significantly associated with improved joint stability (i.e., less anterior and posterior laxity in the knee joint, improved one leg hoping scores, and improved subjective knee function [i.e., limping, locking, instability, support, swelling, stairclimbing, and squatting]) (34). Findings were replicated in regression models which indicated that AI was a significant and positive independent predictor of joint stability, meanwhile psychological distress was identified as a significant negative independent predictor. See Table 3.

**Pain**

Measures assessing subjective ratings of pain were administered in six studies, however only two analyzed pain ratings in relation to AIMS scores (30, 35). Both studies identified small negative non-significant associations between AI and post-surgical pain ratings. See Table 3.

**Impact of Injury on AI**

Of the four studies assessing AI at multiple time points (25-27, 31), only two (25, 26) assessed AI prior to and following injury. One study found that AIMS scores decreased significantly over time (pre-surgery compared to 6, 12 and 24 months post-surgery) after adjusting for age, sex and rehabilitation progress (31). Scores did not change significantly between pre-op and 6-months nor between 12 and 24-month follow up, but all other comparisons were significant. Madrigal et al., also assessed AIMS at two time points: pre-season and return-to-sport (26). Minor decrements in AI were observed but were non-significant. Readers should note that despite measuring AI at multiple time points, two studies did not conduct tests of statistical significance (25, 27). See Table 3.

**DISCUSSION**

Literature describing the relationship between AI and sport-related injury outcomes has grown steadily over the past 25 years. Importantly, 18 of 22 studies identified for inclusion in this review originated from the United States. This is important to consider when interpreting the findings presented herein given the cultural importance that different countries and ethnic groups may place on certain sports and the athlete role (44-46). Athletes were representative of many different sports and were involved at varying levels of competition, thus enhancing the external validity of findings to the general athlete population. Several studies referenced a theoretical model to inform study design and methodologies used. However, seminal work on Identity Theory (47, 48), Social Identity Theory (49), and conceptualizations of ego (50) were absent in the interpretation and discussion of results across all studies. This indicates a large disconnect between the theoretical understanding of identity maintenance and formation with respect to how it relates to AI and sport injury.

Injury outcomes were grouped into five categories. Psychosocial, behavioural and injury-related outcomes dominated the literature, with relatively few studies reporting results within demographic, and pain-related categories. Several studies identified moderate to strong positive relationships between AI and depressive symptoms following injury. This is supported by several previous studies having identified the occurrence of injury as a risk factor for depression in athletes (51-54), and reinforces the notion that physical function and engagement in sport is integral to upholding the AI standard set forth by "high identifiers". When an identity standard goes unmet or un-verified, as is the case when an athlete sustains an injury and is unable to engage in sport, depressive symptoms ensue due to *ego dissonance* (i.e., an incongruence between who an individual believes themselves to be and the actions or behaviours they engage in). Further support for this argument is provided by several studies which identified a significant positive relationship between AI and physical self-worth (28) as well as general motivation (34) and motivation towards both sport (37) and rehabilitation (42).

Behaviourally, evidence suggested that athletes with stronger identities were more likely to over adhere to prescribed rehabilitative protocols (38, 39). It is postulated that this behaviour occurs due to an athlete's attempt to remain in an *ego syntonic* state. The athlete seeks congruence between who they think they are (i.e., an athlete) and their associated role responsibilities (e.g., engaging in competition, training with team mates), therefore they engage in behaviours to expedite their recovery. Interestingly, pain appears to be negatively associated (non-significant) with AI. This might suggest that an element of mental toughness or grit accompanies stronger AIs (i.e., the ability to play through and downplay pain). It may also be the case that athletes with stronger AIs develop better coping skills to deal with pain and are better equipped to push through it. It may also be possible that athletes with stronger identities choose to and are able to ignore minor indicators of injury (i.e., pain) up to a certain pain threshold, which is supported by study findings (30, 35). Further support for this explanation is provided by studies that identified positive significant associations between AI and injury severity (18, 37). Most studies did not assess AI prior to and following injury. Of those that did, limited but inconsistent evidence suggesting that AI decreases due to injury (26, 31).

**Limitations**

Being that most studies were conducted in the United States, findings represent athletes who embody Western cultural values and attitudes towards sports and athletics. Subsequent studies should seek to include athletes from various countries and ethnic backgrounds to better understand the impact of cultural diversity on the development of AI. Future studies should also seek to include athletes who identify as having a disability (i.e., para-athletes), as these individuals were not captured within any study sample. Females were underrepresented in most studies which limits the applicability of these findings to the greater female athlete population. Studies captured many different MSK injuries, but few investigated sport-related concussions in relation to AI. Therefore, findings may not be applicable to concussed athletes. Overall, sport involvement (e.g., frequency and years of involvement) as well as injury severity was poorly described. This oversight makes it difficult to gauge the dose-response relationship that exists between AI and the injury outcomes observed, and highlights the need for its consideration in future research. Finally, scoping reviews do not conduct quality assessments or assign level of evidence ratings (55). These objectives are better suited to a systematic review, which should be conducted prior to delineating implications for clinical care or conducting an intervention that seeks to alter AI to improve post-injury outcomes.

**CONCLUSIONS**

Findings from this review highlighted several significant and positive associations between AI and psychological (e.g., depressive symptoms, performance traits, physical self-worth, motivation), behavioural (e.g., rehabilitation over adherence, playing through pain and suspected injury) and injury-related (e.g., function and injury severity) outcomes. Assessing AI prior to the start of a rehabilitation protocol may give both the athlete and treating clinician a road map of what to expect with respect to mindset, behaviours and recovery outcomes. Importantly, readers should consider the floor and ceiling effects of AI with respect to the relationships identified. A somewhat limited variability in mean AIMS scores does not allow for definitive conclusions to be made with respect to the dose-response relationship that exists between AI and injury outcomes. Therefore, future studies should aim to capture athletes with a wider range of AIMS scores (i.e., AI of varying strengths) as well as non-athletes who have also experienced an injury. Readers should also consider the over representation of Caucasian male, able-bodied athletes and MSK injuries identified in this review. Homogeneity in these domains limits the external validity of findings to other ethnic groups, females, and sport-related concussion populations. Furthermore, subsequent studies should also seek to include para-athletes (i.e., athletes with physical or cognitive disabilities) as no study included in this review considered this population.

This review also highlights a large gap in knowledge with respect to the impact that injury has on AI. Studies must utilize prospective longitudinal designs that assess AI prior to and following the occurrence of injury. Additional consideration should be given to including multiple long-term follow-up observations. As per Wiese-Bjornstals' injury model, an athlete's cognitive appraisal of the injury event acts as a central driving force for the outcomes observed.

Despite its importance, few studies directly assessed this construct. Therefore, researchers may wish to inform the selection of their study methodologies while referencing a theoretical model to facilitate a more holistic understanding of the outcomes observed.

**REFERENCES**

1. Andrews DL. The performance of sporting subcultures. 2016. Available from: www.umdknes.com/knes287resources/Lectures/09/L091.pdf. Accessed October 2019.
2. Radu L-E, Popovici I-M, Puni A-R. Comparison of anthropometric characteristics between athletes and non-athletes. *Procedia - Social and Behavioral Sciences*2015;191:495-9.
3. University Ohio. Training habits of elite athletes. Available from: http://onlinemasters.ohio.edu/blog/training-habits-of-elite-athletes/. Accessed October 2019.
4. Aries E, McCarthy D, Salovey P, et al. A comparison of athletes and non-athletes at highly selective colleges: academic performance and personal development. *Res High Educ J*2004;45(6):577-602.
5. Allen MS, Greenlees I, Jones M. Personality in sport: a comprehensive review. *International Review of Sport and Exercise Psychology*2013;6(1):184-208.
6. Guillén F, Laborde S. Higher-order structure of mental toughness and the analysis of latent mean differences between athletes from 34 disciplines and non-athletes. *Pers Individ Dif* 2014;60:30-5.
7. Laborde S, Guillén F, Mosley E. Positive personality-trait-like individual differences in athletes from individual- and team sports and in non-athletes. *Psychol Sport Exerc*2016;26:9-13.
8. Kipp LE. Psychosocial aspects of youth physical activity. *Pediatr Exerc Sci*2017;29(1):35-8.
9. Slutzky CB, Simpkins SD. The link between children's sport participation and self-esteem: exploring the mediating role of sport self-concept. *Psychol Sport Exerc*2009;10(3):381-9.
10. Allen MS, Laborde S. The role of personality in sport and physical activity. *Curr Dir Psychol Sci*2014;23(6):460-5.
11. Allen MS, Vella SA, Laborde S. Sport participation, screen time, and personality trait development during childhood. *Br J Dev Psychol*2015;33(3):375-90.
12. Brewer BW, Van Raalte J, Linder DE. Athletic identity: hercules' muscle or achilles heel? *Int J Sport Psychol*1993;24(2):237-54.
13. Chen S, Snyder S, Magner M. The effects of sport participation on student-athletes' and non-athelte students' social life and identity. *Journal of Issues in Intercollegiate Athletics* 2010;3:176-93.
14. Horton R, Mack D. Athletic identity in marathon runners: functional focus on dysfunctional commitment. *J Sport Behav*2000;23(2):101-19.
15. Marsh HW, Perry C, Horsely C, et al. Multidimensional self-concepts of elite athletes: how do they differ from the general population. *J Sport Exerc Psychol*1995;17(1):70-83.
16. Petitpas A. Identity foreclosure: a unique challenge. *Personnel and Guidance Journal*1978;56(9):558.
17. Porat Y, Lufi D, Tenenbaum G. Psychological components contribute to select young female gymnasts. *Int J Sport Psychol*1989;20(4):279-86.

18. Brewer BW. Self-identity and specific vulnerability to depressed mood. *Journal of Personality*1993;61(3):343-64.
19. Clarivate Analytics: EndNote (Version 7.7.1). Philadelphia, USA. Available from: https://endnote.com
20. Innovation VH: Covidence Systematic Review Software. Melborne, Australia. Available from: https://www.covidence.org
21. Munn Z, Peters MDJ, Stern C, et al. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med Res Methodol*2018;18(1):143-7.
22. Caron JG, Bloom GA, Falcão WR, et al. An examination of concussion education programmes: a scoping review methodology. *Injury Prevention*2015;21(5):301-8.
23. Petrie TA, Deiters J, Harmison RJ. Mental toughness, social support, and athletic identity: moderators of the life stress-injury relationship in collegiate football players. *Sport Exerc Perform Psychol*2014;3(1):13-27.
24. Kroshus E, Kubzansky LD, Goldman RE, et al. Norms, athletic identity, and concussion symptom under-reporting among male collegiate ice hockey players: a prospective cohort study. *Ann Behav Med*2015;49(1):95-103.
25. McKay C, Campbell T, Meeuwisse W, et al. The role of psychosocial risk factors for injury in elite youth cce hockey. *Clin J Sport Med*2013;23(3):216-21.
26. Madrigal L, Gill DL. Psychological responses of division I female athletes throughout injury recovery: a case study approach. *J Clin Sport Psychol*2014;8(3):276-98.
27. Samuel RD, Tenenbaum G, Mangel E, et al. Athletes' experiences of severe injuries as a career-change event. *J Sport Psychol Action*2015;6(2):99-120.
28. Green SL, Weinberg RS. Relationships among athletic identity, coping skills, social support, and the psychological impact of injury in recreational participants. *J Appl Sport Psychol*2001;13(1):40-59.
29. Brewer BW, Cornelius AE, Van Raalte JL, et al. Age-related differences in predictors of adherence to rehabilitation after anterior cruciate ligament reconstruction. *J Athl Train*2003;38(2):158-62.
30. Brewer BW, Cornelius AE, Sklar JH, et al. Pain and negative mood during rehabilitation after anterior cruciate ligament reconstruction: a daily process analysis. *Scand J Med Sci Sports*2007;17(5):520-9.
31. Brewer BW, Cornelius AE, Stephan Y, et al. Self-protective changes in athletic identity following anterior cruciate ligament reconstruction. *Psychol Sport Exerc*2010;11(1):1-5.
32. Padaki AS, Noticewala MS, Levine WN, et al. Prevalence of posttraumatic stress disorder symptoms among young athletes after anterior cruciate ligament rupture. *Orthopaedic Journal of Sports Medicine*2018;6(7):2325967118787159.
33. Brewer BW, Cornelius AE, Van Raalte JL, et al. Predictors of adherence to home rehabilitation exercises following anterior cruciate ligament reconstruction. *Rehabil Psychol*2013;58(1):64-72.
34. Brewer BW, Raalte JLV, Cornelius AE, et al. Psychological factors, rehabilitation adherence, and rehabilitation outcome after anterior cruciate ligament reconstruction. *Rehabil Psychol*2000;45(1):20-37.

35. Baranoff J, Hanrahan SJ, Connor JP. The roles of acceptance and catastrophizing in rehabilitation following anterior cruciate ligament reconstruction. *J Sci Med Sport*2015;18(3):250-4.
36. Manuel JC, Shilt JS, Curl WW, et al. Coping with sports injuries: an examination of the adolescent athlete. *J Adolesc Health*2002;31(5):391-3.
37. O'Rourke DJ, Smith RE, Punt S, et al. Psychosocial correlates of young athletes' self-reported concussion symptoms during the course of recovery. *Sports, Exercise & Performance Psychology*2017;6(3):1-.
38. Hilliard RC, Blom L, Hankemeier D, et al. Exploring the relationship between athletic identity and beliefs about rehabilitation overadherence in college athletes. J *Sport Rehabil*2017;26(3):208-20.
39. Podlog L, Gao Z, Kenow L, et al. Injury rehabilitation overadherence: preliminary scale validation and relationships with athletic identity and self-presentation concerns. *J Athl Train*2013;48(3):372-81.
40. Weinberg R, Vernau D, Horn T. Playing through pain and injury: psychosocial considerations. *J Clin Sport Psychol*2013;7(1):41-59.
41. Wiese-Bjornstal DM, Smith AM, Shaffer SM, et al. An integrated model of response to sport injury: psychological and sociological dynamics. *J Appl Sport Psychol*1998;10(1):46-69.
42. Masten R, Stražar K, Žilavec I, et al. Psychological response of athletes to injury. *Kinesiology*2014;46(1):127-34.
43. Brewer BW, Cornelius AE. Norms and factorial invariance of the Athletic Identity Measurement Scale. *Academic Athletic Journal*2001;15:103-13.
44. Bradshaw L. Why do certain countries excel at certain sports? 2017. Available from: https://theculturetrip.com/middle-east/articles/why-do-certain-countries-excel-at-certain-sports/. Accessed August 2020.
45. Pot N, Van Hilvoorde I. Generalizing the effects of school sports: comparing the cultural contexts of school sports in the Netherlands and the USA. *Sport in Society*2013;16(9):1164-75.
46. Andreff W. The correlation between economic underdevelopment and sport. *European Sport Management Quarterly*2001;1(4):251-79.
47.Erikson E. Identity: Youth And Crisis. New York:Norton & Company 1968.
48. Marcia JE. Identity in Adolscence: Handbook Of Adolescent Psychology. New York: Wiley 1980.
49. Tajfel H, Turner J. Chapter 3 An integrative theory of intergroup conflict. In: Austin WG, Worchel S, eds. The Social Psychology Of Intergroup Relations. Monterey, CA: Brooks/Cole Pub. Co 1979: 33-47.
50. Frued S. The Ego and the Id, Standard Edition. London: Hogarth 1923.
51. Appaneal RN, Levine BR, Perna FM, et al. Measuring postinjury depression among male and female competitive athletes. *J Sport Exerc Psychol*2009;31(1):60-76.
52. Cox CE, Ross-Stewart L, Foltz BD. Investigating the prevalence and risk factors of depression symptoms among NCAA division I collegiate athletes. *Journal of Sports Science*2017;5:14-28.
53.Mainwaring LM, Hutchison M, Bisschop SM, et al. Emotional response to sport concussion compared to ACL injury. *Brain Inj*2010;24(4):589-97.
54. Smith AM, Scott SG, O'Fallon WM, et al. Emotional responses of athletes to injury. *Mayo Clin Proc*1990;65(1):38-50.

55. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol*2005;8(1):19-32.

Appendix A

Table 1. Search Strategies – By Database

| Database | Search Strategy/Terms | Search Date | Number of Articles Returned |
|---|---|---|---|
| MEDLINE (OVID)<br><br>1946 – Present | 1. Athletes/<br>2. (Paralympian or Olympian or athlet*).tw,kf.<br>3. sports/ or baseball/ or basketball/ or bicycling/ or boxing/ or cricket sport/ or football/ or golf/ or gymnastics/ or hockey/ or martial arts/ or mountaineering/ or racquet sports/ or running/ or skating/ or snow sports/ or soccer/ or sports for persons with disabilities/ or "track and field"/ or volleyball/ or walking/ or water sports/ or weight lifting/ or wrestling/<br>4. (archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running).tw,kf.<br>5. 1 or 2 or 3 or 4<br>6. exp Self Concept/<br>7.((identity or esteem or efficacy or schema) adj 3 self).tw,kf.<br>8. ((identity or esteem or efficacy or schema) adj 3 athlet*).tw,kf.<br>9. ((identity or esteem or efficacy or schema) adj 3 himself).tw,kf.<br>10. ((identity or esteem or efficacy or schema) adj 3 herself).tw,kf.<br>11. ((identity or esteem or efficacy or schema) adj 3 themselves).tw,kf.<br>12. 7 or 8 or 9 or 10 or 11<br>13. ((coherence or self) adj 3 sense of).tw,kf.<br>14. 6 or 12 or 13<br>15. 5 and 14<br>16. exp "wounds and injuries"/ | March 31/2020 | n=250 |

Appendix A

| | | | |
|---|---|---|---|
| | 17. (tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur*).tw,kf.<br>18. 16 or 17<br>19. 5 and 14 and 18<br>20. Athletic Injuries/<br>21. 14 and 20<br>22. 19 or 21 | | |
| EMBASE CLASSIC + EMBASE (OVID)<br><br>1947 – March 30 2020 | 1. Athletes/<br>2. (Paralympian or Olympian or athlet*).tw,kf.<br>3. sports/ or baseball/ or basketball/ or bicycling/ or boxing/ or cricket sport/ or football/ or golf/ or gymnastics/ or hockey/ or martial arts/ or mountaineering/ or racquet sports/ or running/ or skating/ or snow sports/ or soccer/ or sports for persons with disabilities/ or “track and field”/ or volleyball/ or walking/ or water sports/ or weight lifting/ or wrestling/<br>4. (archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running).tw,kf.<br>5. 1 or 2 or 3 or 4<br>6. exp Self Concept/<br>7.((identity or esteem or efficacy or schema) adj 3 self).tw,kf.<br>8. ((identity or esteem or efficacy or schema) adj 3 athlet*).tw,kf.<br>9. ((identity or esteem or efficacy or schema) adj 3 himself).tw,kf.<br>10. ((identity or esteem or efficacy or schema) adj 3 herself).tw,kf.<br>11. ((identity or esteem or efficacy or schema) adj 3 themselves).tw,kf.<br>12. 7 or 8 or 9 or 10 or 11<br>13. ((coherence or self) adj 3 sense of).tw,kf.<br>14. 6 or 12 or 13 | March 31/2020 | N=357 |

Appendix A

| | | | |
|---|---|---|---|
| | 15. 5 and 14<br>16. exp "wounds and injuries"/<br>17. (tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur*).tw,kf.<br>18. 16 or 17<br>19. 5 and 14 and 18<br>20. Athletic Injuries/<br>21. 14 and 20<br>22. 19 or 21 | | |
| SPORTDiscus (EBSCO)<br><br>1800 – Present | S1. DE "ATHLETES" OR DE "AFRICAN athletes" OR DE "AMATEUR athletes" OR DE "ARAB athletes" OR DE "ARCHERS" OR DE "ASIAN athletes" OR DE "ATHLETES with disabilities" OR DE "BADMINTON players" OR DE "BASEBALL players" OR DE "BASKETBALL players" OR DE "BLACK athletes" OR DE "BOBSLEDDERS" OR DE "BODYBUILDERS" OR DE "BOWLERS" OR DE "BOXERS (Sports)" OR DE "BULLFIGHTERS" OR DE "CANADIAN athletes" OR DE "CANOEISTS" OR DE "CELEBRITY athletes" OR DE "CHILD athletes" OR DE "CHILDREN of athletes" OR DE "CHRISTIAN athletes" OR DE "COLLEGE athletes" OR DE "CRICKET players" OR DE "CROQUET players" OR DE "CURLERS (Athletes)" OR DE "CYCLISTS" OR DE "DEFENSIVE players" OR DE "DIABETIC athletes" OR DE "ELITE athletes" OR DE "ENDURANCE athletes" OR DE "EUROPEAN athletes" OR DE "FENCERS" OR DE "FOOTBALL players" OR DE "GAY athletes" OR DE "GLADIATORS" OR DE "GOLFERS" OR DE "GYMNASTS" OR DE "HANDBALL players" OR DE "HIGH school athletes" OR DE "HOCKEY players" OR DE "INTERSEX athletes" OR DE "JAI alai players" OR DE "JEWISH athletes" OR DE "JUNIOR high school athletes" OR DE "KABADDI players" OR DE "LACROSSE players" OR DE "LAWN bowlers" OR DE "LGBTQ athletes" OR DE "LONG-term athlete development" OR DE "MALE athletes" OR DE "MARTIAL artists" OR DE "MEXICAN athletes" OR DE "MIDDLE school athletes" OR DE "MOUNTAINEERS" OR DE "MUSLIM athletes" OR DE "NATIVE American athletes" OR DE "NETBALL players" OR DE "OFFENSIVE players" OR DE "OLDER athletes" OR DE "OLYMPIC athletes" OR DE "ORIENTEERS" OR DE "PACIFIC Islander athletes" OR DE "PROFESSIONAL athletes" OR DE "ROWERS" OR DE "RUGBY football players" OR DE "RUNNERS (Sports)" OR DE "SKATERS" OR DE "SKIERS" OR DE "SKYDIVERS" OR DE "SNOWBOARDERS" OR DE "SOCCER players" OR DE "SOFTBALL players" OR DE "SQUASH players" OR DE "STARTING players" OR DE | April 2/2020 | N=433 |

Appendix A

| | | | |
|---|---|---|---|
| | "SUBSTITUTE players" OR DE "SURFERS" OR DE "SWIMMERS" OR DE "TABLE tennis players" OR DE "TEAM handball players" OR DE "TENNIS players" OR DE "TRACK & field athletes" OR DE "TRIATHLETES" OR DE "VOLLEYBALL players" OR DE "WATER polo players" OR DE "WEIGHT lifters" OR DE "WINDSURFERS (Persons)" OR DE "WOMEN athletes" OR DE "WRESTLERS"<br><br>S2. AB ( Paralympian or Olympian or athlet* ) OR TI ( Paralympian or Olympian or athlet* ) OR SU (Paralympian or Olympian or athlet* ) OR KW (Paralympian or Olympian or athlet* )<br><br>S3. DE "RECREATION" OR DE "AMATEUR sports" OR DE "AQUATIC sports" OR DE "BALL games" OR DE "BASEBALL" OR DE "COLLEGE sports" OR DE "CONTACT sports" OR DE "ENDURANCE sports" OR DE "EXTREME sports" OR DE "GYMNASTICS" OR DE "HOCKEY" OR DE "INDIVIDUAL sports" OR DE "MILITARY sports" OR DE "OLYMPIC Games" OR DE "PROFESSIONAL sports" OR DE "RECREATIONAL sports" OR DE "SCHOOL sports" OR DE "SOFTBALL" OR DE "SPORTS competitions" OR DE "SPORTS for children" OR DE "SPORTS for girls" OR DE "SPORTS for people with disabilities" OR DE "SPORTS for youth" OR DE "SPORTS teams" OR DE "TARGETS (Sports)" OR DE "TEAM sports" OR DE "WINTER sports" OR DE "WOMEN'S sports"<br><br>S4. TI ( archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running ) OR AB (archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or | | |

Appendix A

| | | | |
|---|---|---|---|
| | taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running ) OR SU (archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running ) OR KW (archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running )<br><br>S5. S1 OR S2 OR S3 OR S4<br><br>S6. DE "SELF-perception" OR DE "BODY image" OR DE "SELF-esteem"<br><br>S7. DE "ATHLETIC identity (Psychology)" OR DE "IDENTITY (Psychology)" OR DE "ATHLETIC identity (Psychology)" OR DE "PHYSICALLY active people -- Identity" OR DE "PSYCHOLOGY of athletes" OR DE "ATHLETIC identity (Psychology)"<br><br>S8. TI ( (identity or esteem or efficacy or schema) N3 self ) OR AB ( (identity or esteem or efficacy or schema) N3 self ) OR SU ( (identity or esteem or efficacy or schema) N3 self ) OR KW ( (identity or esteem or efficacy or schema) N3 self ) | | |

Appendix A

| | | | |
|---|---|---|---|
| | S9. TI ( (identity or esteem or efficacy or schema) N3 athlet* ) OR AB ( (identity or esteem or efficacy or schema) N3 athlet* ) or SU ( (identity or esteem or efficacy or schema) N3 athlet* ) or KW ( (identity or esteem or efficacy or schema) N3 athlet* )<br><br>S10. TI ( (identity or esteem or efficacy or schema) N3 himself ) OR AB ( (identity or esteem or efficacy or schema) N3 himself ) OR SU ( (identity or esteem or efficacy or schema) N3 himself ) or KW ( (identity or esteem or efficacy or schema) N3 himself )<br><br>S11. TI ( (identity or esteem or efficacy or schema) N3 herself ) OR AB ( (identity or esteem or efficacy or schema) N3 herself ) OR SU ( (identity or esteem or efficacy or schema) N3 herself ) OR KW ( (identity or esteem or efficacy or schema) N3 herself )<br><br>S12. TI ( (identity or esteem or efficacy or schema) N3 themselves ) OR AB ( (identity or esteem or efficacy or schema) N3 themselves ) OR SU ( (identity or esteem or efficacy or schema) N3 themselves ) OR KW ( (identity or esteem or efficacy or schema) N3 themselves)<br><br>S13. S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12<br><br>S14. TI ( (coherence or self) N3 sense of ) OR AB ( (coherence or self) N3 sense of ) OR SU (coherence or self) N3 sense of ) OR KW ( (coherence or self) N3 sense of )<br><br>S15. S13 OR S14<br><br>S16. S5 AND S15<br><br>S17. (DE "SPORTS injuries" OR DE "ACHILLES tendinitis" OR DE "AEROBICS injuries" OR DE "AQUATIC sports injuries" OR DE "BASEBALL injuries" OR DE "BASKETBALL injuries" OR DE "BOXING injuries" OR DE "COMMOTIO cordis" OR DE "CRICKET injuries" OR DE "EQUESTRIAN accidents" OR DE "FOOTBALL injuries" OR DE "GOLF injuries" OR DE "GYMNASTICS injuries" OR DE "HIKING injuries" OR DE "HOCKEY injuries" OR DE "HORSE sports injuries" OR DE "IN-line skating injuries" OR DE "JOGGING injuries" OR DE "JUDO | | |

Appendix A

| | | | |
|---|---|---|---|
| | injuries" OR DE "JUMPER'S knee" OR DE "KARATE injuries" OR DE "MARTIAL arts injuries" OR DE "NETBALL injuries" OR DE "RACKET game injuries" OR DE "RUGBY football injuries" OR DE "RUNNING injuries" OR DE "SKATEBOARDING injuries" OR DE "SOCCER injuries" OR DE "TENNIS injuries" OR DE "TURF toe" OR DE "VAULTING injuries" OR DE "VOLLEYBALL injuries" OR DE "WALKING (Sports) injuries" OR DE "WEIGHT training injuries" OR DE "WINTER sports injuries") AND (DE "SPORTS injuries" OR DE "SPORTS emergencies" OR DE "SPORTS injuries" OR DE "SPORTS ophthalmology" OR DE "WOUNDS & injuries" OR DE "BACKPACKING injuries" OR DE "BLUNT trauma" OR DE "CHRONIC wounds & injuries" OR DE "CRASH injuries" OR DE "DANCING injuries" OR DE "DECOMPRESSION sickness" OR DE "DISABILITIES" OR DE "DISLOCATIONS (Anatomy)" OR DE "HEAD injuries" OR DE "MARTIAL arts injuries" OR DE "MOUNTAINEERING injuries" OR DE "OVEREXERTION injuries" OR DE "OVERUSE injuries" OR DE "PENETRATING wounds" OR DE "PHYSIOLOGIC strain" OR DE "RUPTURE of organs, tissues, etc." OR DE "SOFT tissue injuries" OR DE "SPORTS injuries" OR DE "SUBLUXATION" OR DE "WOUND care")<br>S18 TI ( tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur* ) OR AB ( tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur* ) OR SU ( tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur* ) OR KW ( tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur* )<br><br>S19. S17 OR S18<br><br>S20. S16 AND S19<br><br>*Use of Thesaurus Function to find DE Terms | | |
| CINAHL Plus w / Full Text (EBSCO) | S1. (MH "Athletes, Amateur") OR (MH"Athletes, College") OR (MH "Athletes, Disabled") OR (MH "Athletes, Elite") OR (MH "Athletes, Female") OR (MH "Athletes, High School") OR (MH "Athletes, Male") OR (MH "Athletes, Master") OR (MH "Athletes, Professional") OR (MH "Athletes") | April 2/2020 | N=248 |

Appendix A

| | | | |
|---|---|---|---|
| 1937 – Present | S2. AB ( Paralympian or Olympian or athlet* ) OR TI ( Paralympian or Olympian or athlet* )<br><br>S3. (MH "Sports+")<br><br>S4. TI ( archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running ) OR AB ( archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running )<br><br>S5. S1 OR S2 OR S3 OR S4<br><br>S6. (MH "Self Concept+")<br><br>S7. (MM "Professional Identity") OR (MM "Social Identity") OR (MM "Role")<br><br>S8. TI ( (identity or esteem or efficacy or schema) N3 self ) OR AB ( (identity or esteem or efficacy or schema) N3 self )<br><br>S9. TI ( (identity or esteem or efficacy or schema) N3 athlet* ) OR AB ( (identity or esteem or efficacy or schema) N3 athlet* ) | | |

Appendix A

| | | | |
|---|---|---|---|
| | S10. TI ( (identity or esteem or efficacy or schema) N3 himself ) OR AB ( (identity or esteem or efficacy or schema) N3 himself )<br><br>S11. TI ( (identity or esteem or efficacy or schema) N3 herself ) OR AB ( (identity or esteem or efficacy or schema) N3 herself )<br><br>S12. TI ( (identity or esteem or efficacy or schema) N3 themselves ) OR AB ( (identity or esteem or efficacy or schema) N3 themselves )<br><br>S13. S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12<br><br>S14. TI ( (coherence or self) N3 sense of ) OR AB ( (coherence or self) N3 sense of )<br><br>S15. S13 OR S14<br><br>S16. S5 AND S15<br><br>S17. (MH "Athletic Injuries+") OR (MM "Contusions and Abrasions") OR (MM "Back Injuries") OR (MM "Fractures") OR (MH "Head Injuries") OR (MH "Leg Injuries") OR (MH "Ligament Injuries") OR (MM "Dislocations") OR (MM "Neck Injuries") OR (MM "Rupture") OR (MM "Soft Tissue Injuries") OR (MM "Spinal Cord Injuries") OR (MM "Spinal Injuries") OR (MM "Sprains and Strains") OR (MM "Tears and Lacerations") OR (MM "Tendon Injuries") OR (MM "Wounds, Penetrating") OR (MM "Wounds, Nonpenetrating") OR (MM "Subluxation") OR (MM "Reinjury")<br><br>S18. TI ( tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur* ) OR AU ( tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur* ) | | |

Appendix A

| | | | |
|---|---|---|---|
| | S19. S17 OR S18<br><br>S20. S16 AND S19<br><br>*Use of Subject Header Function to identify MH Terms | | |
| APA PsycInfo (OVID)<br><br><br>1806- March Week 4 2020 | 1. Athletes/<br>2. (Paralympian or Olympian or athlet*).tw,kf.<br>3. sports/ or baseball/ or basketball/ or bicycling/ or boxing/ or cricket sport/ or football/ or golf/ or gymnastics/ or hockey/ or martial arts/ or mountaineering/ or racquet sports/ or running/ or skating/ or snow sports/ or soccer/ or sports for persons with disabilities/ or “track and field”/ or volleyball/ or walking/ or water sports/ or weight lifting/ or wrestling/<br>4. (archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running).tw,kf.<br>5. 1 or 2 or 3 or 4<br>6. exp Self Concept/<br>7.((identity or esteem or efficacy or schema) adj 3 self).tw,kf.<br>8. ((identity or esteem or efficacy or schema) adj 3 athlet*).tw,kf.<br>9. ((identity or esteem or efficacy or schema) adj 3 himself).tw,kf.<br>10. ((identity or esteem or efficacy or schema) adj 3 herself).tw,kf.<br>11. ((identity or esteem or efficacy or schema) adj 3 themselves).tw,kf.<br>12. 7 or 8 or 9 or 10 or 11<br>13. ((coherence or self) adj 3 sense of).tw,kf.<br>14. 6 or 12 or 13<br>15. 5 and 14 | March 31/2020 | N=0 |

Appendix A

| | | | |
|---|---|---|---|
| | 16. exp "wounds and injuries"/<br>17. (tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur*).tw,kf.<br>18. 16 or 17<br>19. 5 and 14 and 18<br>20. Athletic Injuries/<br>21. 14 and 20<br>22. 19 or 21 | | |
| Sport Medicine & Education Index (ProQuest)<br><br>1970- Current | Concept 1. (MAINSUBJECT.EXACT("Athletes") OR ab((Paralympian or Olympian or athlet*)) OR pub((Paralympian or Olympian or athlet*)) OR if((Paralympian or Olympian or athlet*)) OR (MAINSUBJECT.EXACT("Winter sports") OR MAINSUBJECT.EXACT("Sports") OR MAINSUBJECT.EXACT("College sports") OR MAINSUBJECT.EXACT("High school sports") OR MAINSUBJECT.EXACT("Professional sports")) OR ab(archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running) OR pub(archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running) OR if(archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or | April 2/2020 | N=168 |

Appendix A

| | | | |
|---|---|---|---|
| | sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running))<br><br>AND<br><br>Concept 2. (MAINSUBJECT.EXACT("Self esteem") OR ab ((identity or esteem or efficacy or schema) NEAR/3 self) OR pub((identity or esteem or efficacy or schema) NEAR/3 self) OR if((identity or esteem or efficacy or schema) NEAR/3 self) OR ab((identity or esteem or efficacy or schema) NEAR/3 athlet*) OR pub((identity or esteem or efficacy or schema) NEAR/3 athlet*) OR if((identity or esteem or efficacy or schema) NEAR/3 athlet*) OR ab((identity or esteem or efficacy or schema) NEAR/3 himself) OR pub((identity or esteem or efficacy or schema) NEAR/3 himself) OR if((identity or esteem or efficacy or schema) NEAR/3 himself) OR ab ((identity or esteem or efficacy or schema) NEAR/3 herself) OR pub ((identity or esteem or efficacy or schema) NEAR/3 herself) OR if ((identity or esteem or efficacy or schema) NEAR/3 herself) OR ab ((identity or esteem or efficacy or schema) NEAR/3 themselves) OR pub ((identity or esteem or efficacy or schema) NEAR/3 themselves) OR if ((identity or esteem or efficacy or schema) NEAR/3 themselves) OR ab ((coherence or self) NEAR/3 sense of) OR pub ((coherence or self) NEAR/3 sense of) OR if ((coherence or self) NEAR/3 sense of))<br><br>AND<br><br>Concept 3. ((MAINSUBJECT.EXACT("Concussion") OR MAINSUBJECT.EXACT("Spinal cord injuries") OR MAINSUBJECT.EXACT("Bodily injury") OR MAINSUBJECT.EXACT("Fractures") OR MAINSUBJECT.EXACT("Traumatic brain injury") OR MAINSUBJECT.EXACT("Head injuries") OR MAINSUBJECT.EXACT("Joint and ligament injuries") OR MAINSUBJECT.EXACT("Sports injuries") OR MAINSUBJECT.EXACT("Trauma")) OR ab((tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur*)) OR pub((tear or separation or sprain or strain or break or fracture or | | |

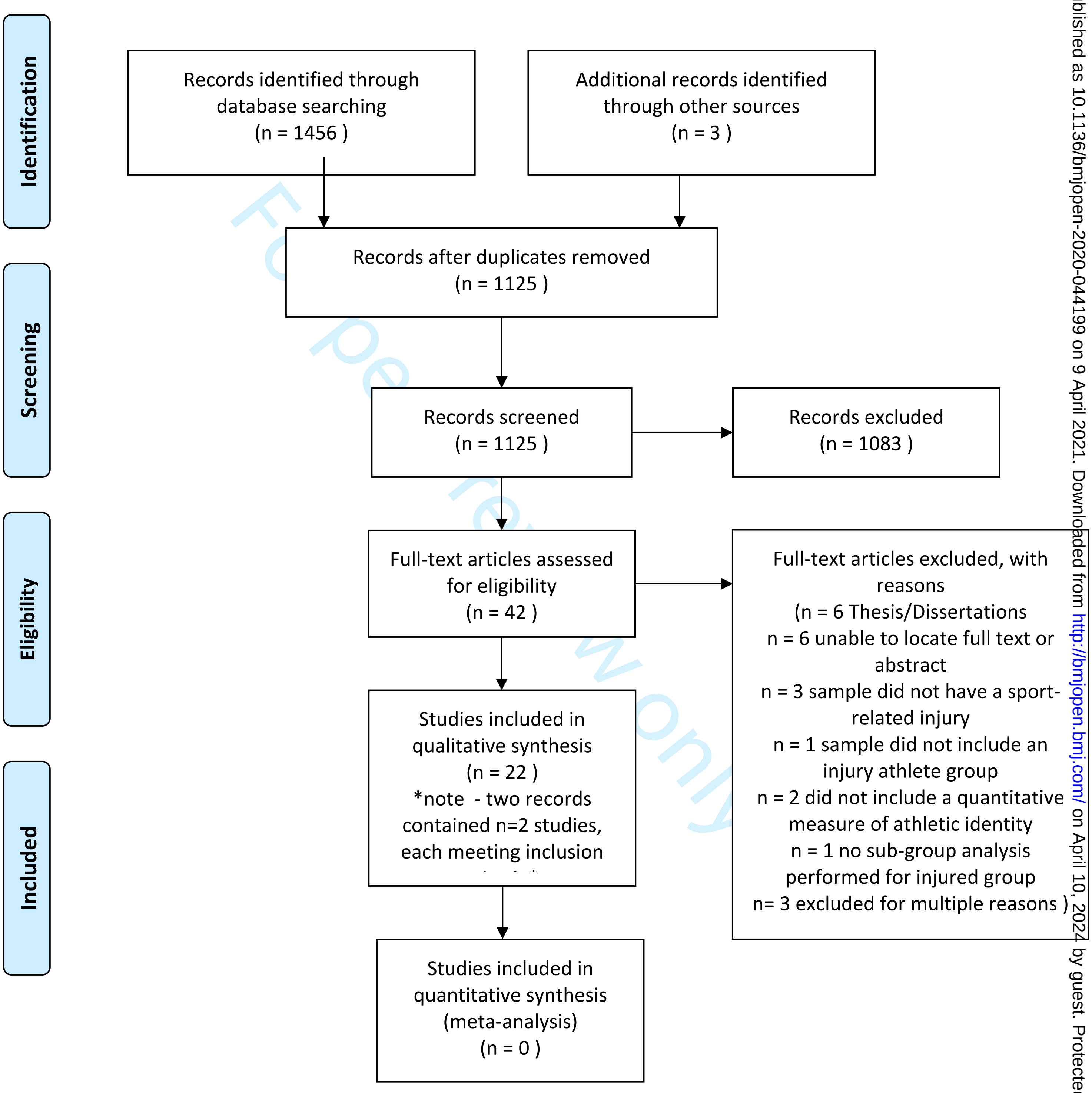
Appendix A

| | | | |
|---|---|---|---|
| | contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur*) OR if((tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur*))) | | |

TOTAL RECORDS IDENTIFIED: n= 1456

Appendix B

# Figure 1. PRISMA 2009 Flow Diagram




*From:* Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

**For more information, visit www.prisma-statement.org.**

Appendix C

## Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

| SECTION | ITEM | PRISMA-ScR CHECKLIST ITEM | REPORTED ON PAGE # |
|---|---|---|---|
| **TITLE** | | | |
| Title | 1 | Identify the report as a scoping review. | 1 |
| **ABSTRACT** | | | |
| Structured summary | 2 | Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives. | 2 |
| **INTRODUCTION** | | | |
| Rationale | 3 | Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach. | 5-6 |
| Objectives | 4 | Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives. | 7 |
| **METHODS** | | | |
| Protocol and registration | 5 | Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number. | N/A |
| Eligibility criteria | 6 | Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale. | 8-9 |
| Information sources* | 7 | Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed. | 7 |
| Search | 8 | Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated. | Table 1 |
| Selection of sources of evidence† | 9 | State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review. | 8 |
| Data charting process‡ | 10 | Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators. | 7-8 |
| Data items | 11 | List and define all variables for which data were sought and any assumptions and simplifications made. | 9 |
| Critical appraisal of individual sources of evidence§ | 12 | If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate). | N/A |
| Synthesis of results | 13 | Describe the methods of handling and summarizing the data that were charted. | 9-10 |

St. Michael's
Inspired Care.
Inspiring Science.

Appendix C

| SECTION | ITEM | PRISMA-ScR CHECKLIST ITEM | REPORTED ON PAGE # |
|---|---|---|---|
| **RESULTS** | | | |
| Selection of sources of evidence | 14 | Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram. | 10, Figure 1 |
| Characteristics of sources of evidence | 15 | For each source of evidence, present characteristics for which data were charted and provide the citations. | 10, 21-23 |
| Critical appraisal within sources of evidence | 16 | If done, present data on critical appraisal of included sources of evidence (see item 12). | N/A |
| Results of individual sources of evidence | 17 | For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives. | Table 2 & Table 3 |
| Synthesis of results | 18 | Summarize and/or present the charting results as they relate to the review questions and objectives. | 35-41 |
| **DISCUSSION** | | | |
| Summary of evidence | 19 | Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups. | 41-42 |
| Limitations | 20 | Discuss the limitations of the scoping review process. | 43 |
| Conclusions | 21 | Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps. | 43-44 |
| **FUNDING** | | | |
| Funding | 22 | Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review. | 4 |

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.

* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.

† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).

‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.

§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

*From:* Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.

St. Michael's
Inspired Care.
Inspiring Science.

Appendix D



**Figure 2.** Integrated model of psychological response to the sport injury and rehabilitation process (Wiese-Bjornstal et al., 1998)

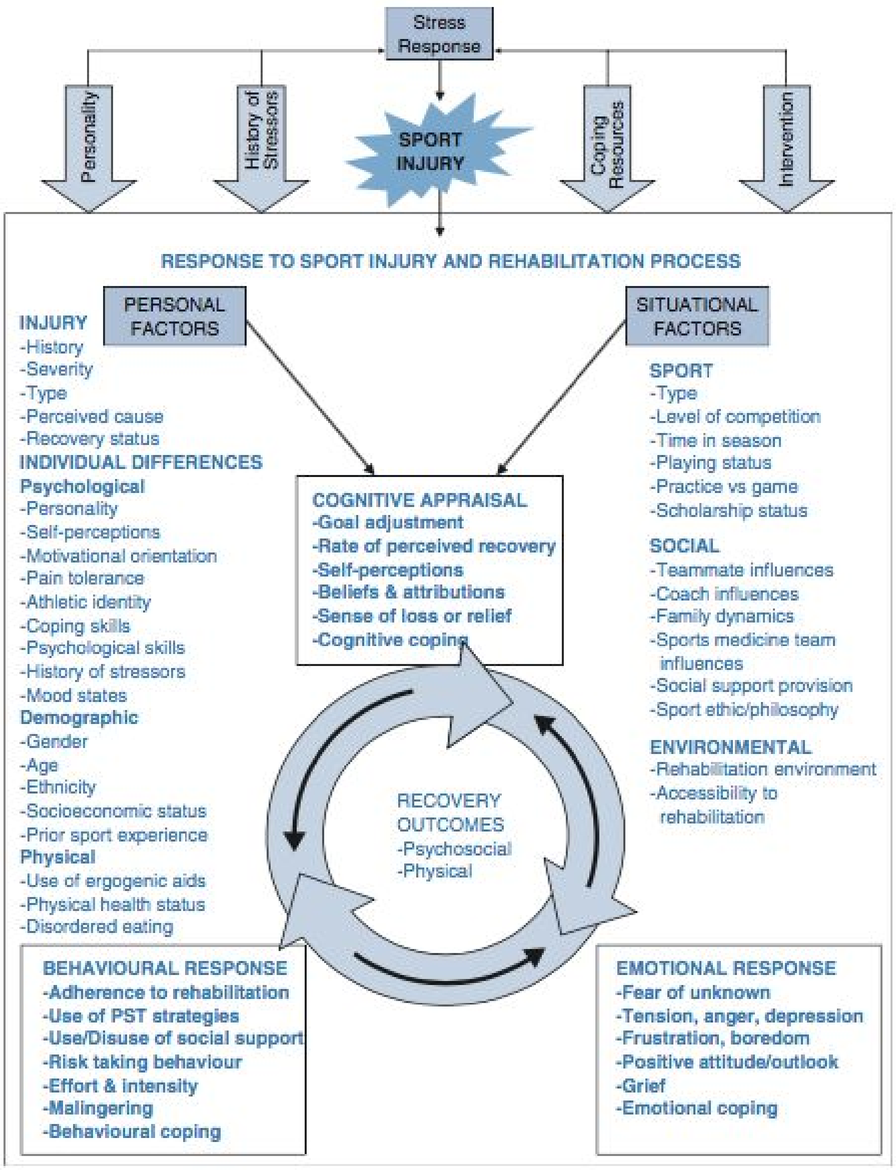



*Figure reproduced with permission from the original author*

BMJ Open

# Investigating correlates of athletic identity and sport-related injury outcomes: a scoping review.



| | |
|---|---|
| Journal: | *BMJ Open* |
| Manuscript ID | bmjopen-2020-044199.R1 |
| Article Type: | Original research |
| Date Submitted by the Author: | 16-Jan-2021 |
| Complete List of Authors: | Renton, Tian; University of Toronto Faculty of Medicine, Rehabilitation Sciences Institute; St Michael's Hospital, Centre for Depression & Suicide Studies<br>Petersen, Brian; University of Toronto, Faculty of Kinesiology & Physical Education<br>Kennedy, Sidney; St Michael's Hospital, Centre for Depression & Suicide Studies; University of Toronto Faculty of Medicine, Department of Psychiatry |
| <b>Primary Subject Heading</b>: | Rehabilitation medicine |
| Secondary Subject Heading: | Sports and exercise medicine |
| Keywords: | SPORTS MEDICINE, Orthopaedic sports trauma < ORTHOPAEDIC & TRAUMA SURGERY, REHABILITATION MEDICINE |
| | |



SCHOLARONE™ Manuscripts

*I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.*

*The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.*

*Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.*

**Title**: Investigating correlates of athletic identity and sport-related injury outcomes: a scoping review.

**Authors**: Tian Renton*, MSc [1,2], Brian Petersen[3], Sidney H. Kennedy, MD [2,4]

**Affiliations**:
1. Rehabilitation Sciences Institute, University of Toronto, Toronto, Ontario, Canada
2. Centre for Depression & Suicide Studies, St. Michael's Hospital, Toronto, Ontario, Canada
3. Faculty of Kinesiology & Physical Education, University of Toronto, Toronto, Ontario, Canada
4. Department of Psychiatry, University of Toronto, Toronto, Ontario Canada

**Contact Information**:
Tian Renton
The University of Toronto
Rehabilitation Sciences Institute
500 University Avenue, Suite 160
Toronto, Ontario
M5G 1V7
Phone: (416) 864-6060 ext. 7848
Email: tian.renton@mail.utoronto.ca
**Corresponding Author*

Brian Petersen
The University of Toronto
Faculty of Kinesiology & Physical Education
55 Harbord Street
Toronto, Ontario
M5S 2W6
Email: brian.petersen@mail.utoronto.ca

Dr. Sidney H. Kennedy
Professor of Psychiatry, University of Toronto
Centre for Depression and Suicide Studies, St. Michael's Hospital
193 Yonge Street, Suite 6-001A
Toronto, Ontario
M5B 1M8
Phone: 416-864-6099
Email: sidney.kennedy@uhn.ca

**Word Count**: 5583

**ABSTRACT**

**Objectives***:* To conduct a scoping review that i) describes what is known about the relationship between athletic identity and sport-related injury outcomes and ii) describes the relationship that an injury (as an exposure) has on athletic identity (as an outcome) in athletes.

**Design***:* Scoping review.

**Setting***:* N/A

**Participants***:* n= 1852 athletes from various sport backgrounds and levels of competition.

**Interventions***:* N/A

**Primary & Secondary Outcome Measures***:* The primary measure used within the studies identified was the Athletic Identity Measurement Scale. Secondary outcome measures assessed demographic, psychosocial, behavioural, physical function and pain-related constructs.

**Results***:* Twenty-two studies were identified for inclusion. Samples were dominated by male, Caucasian athletes. The majority of studies captured musculoskeletal injuries, while only three studies included sport-related concussion. Athletic identity was significantly and positively associated with depressive symptom severity, sport performance traits (e.g., ego-orientation and mastery-orientation), social network size, physical self-worth, motivation, rehabilitation over adherence, mental toughness and playing through pain, as well as injury severity and functional recovery outcomes. Findings pertaining to the association that an injury (as an exposure) had on athletic identity (as an outcome) were inconsistent and limited.

**Conclusions***:* Athletic identity was most frequently associated with psychosocial, behavioural and injury-specific outcomes. Future research should seek to include more diverse athlete samples (e.g., females, athletes of different races, para-athletes) and should continue to

reference theoretical injury models to inform study methodologies and to specify variables of interest for further exploration.

**Keywords**: athlete, athletic identity, sport, injury, rehabilitation

**Article Summary**

Strengths and limitations of this study

- The search strategy was constructed in consultation with a University of Toronto librarian.
- Citation management (EndNote) and systematic review citation screening software (Covidence) were used to allow reviewers to independently screen citations and extract data.
- Data extraction variables thoroughly described the study sample, injuries sustained, theoretical models referenced, athletic identity scores and timeline of administration, significant key findings as well as study strengths and limitations.
- A quality assessment was not conducted, and level of evidence ratings were not assigned to studies.

**Author Contributions:** TR was responsible for establishing the research questions, developing and conducting the literature search, performing the title, abstract and article screening process, extracting data from eligible articles, drafting and submitting the manuscript for publication, as well as responding to peer-reviewer feedback and completing the required revisions. BP was responsible for performing the title, abstract and article screening process, extracting data from eligible articles and contributing to results and discussion sections of the manuscript draft. SK was responsible for helping establish the research questions, advising on data extraction elements and editing/revising the manuscript draft prior to submission for publication.

**Acknowledgements**: Authors would like to thank Mrs. Erica Nekolaichuk (University of Toronto Librarian) for helping construct the search strategy used within this review. Authors would also like to thank Dr. Nick Reed, Dr. Sakina Rizvi, and Dr. John Cairney for their critical review of and feedback on the original scoping review protocol. Authors also to wish to thank the peer-reviewers for their comments; your feedback has substantially improved the quality of this written work.

**Funding:** This work was supported by a Canadian Institutes of Health Research (CIHR) Frederick Banting and Charles Best Canada Graduate Scholarship Doctoral Award (CGS-D) (fund # 505508)

**Conflicts of Interest:** None declared.

## INTRODUCTION

Participation in sport, be it in a formal (e.g., registered league) or in-formal (e.g., pick-up, drop-in) setting, is a popular pastime for individuals the world over. Positive benefits associated with sport participation include increased mental toughness (1), perseverance (1, 2), and positive self-esteem (2-4) as well as the development of fine and gross motor skills, team work and problem solving abilities (5). These benefits are aside from the countless physical (e.g., maintenance of a healthy body weight (6)), mental (e.g., reduction in depression (7) and anxiety symptoms (8)) and cognitive benefits (e.g., improved academic performance (9) and memory recall (10)) associated with physical activity in general. Despite these benefits, negative outcomes should also be considered, namely risk for injury. However, not all athletes are created equal, nor are their respective risks for sport injury. This is illustrated by several large-scale epidemiological studies describing marked differences in injury incidence when stratified by sport (11-16). Internal risk factors, such as an athlete's biological and physical characteristics (e.g., age, sex, anthropometry, skill level and physical fitness) as well as their psychological predisposition (e.g., personality, history of stressors and availability of coping resources) are also posited to modify injury risk (17-19). External factors, such as level of competition and playing surface, have also been implicated (18, 19).

Despite individual athlete (e.g., physicality, disposition) and sport specific differences (e.g., type, level, frequency of involvement, injury risk), all athletes are thought to embody an "athletic identity" (AI). Initially defined by Brewer and colleagues in 1993, AI is defined as "the exclusivity and strength with which an individual identifies with the athlete role, and looks to others for confirmation of that role" (20). To some extent, an athlete's self-perception of their

132 AI can provide an important measure of their longevity in sport (21). Stronger AIs have been
133 associated with positive health outcomes, increased sport engagement, enhanced athletic
134 performance, improved global self-esteem and confidence, as well as improved social
135 relationships (20, 22-25). Conversely, following a sport-related injury, stronger AIs have been
136 associated with depressive symptoms (26). It has also been suggested that athletes who hold a
137 stronger AI may neglect other identities and role responsibilities to maintain the athlete role
138 (20). Therefore, a strong AI may be helpful in some cases and harmful in others, especially
139 within a sport injury context.

140 Athletes will continue to sustain injuries so long as sport exists, thus illustrating the need
141 to understand factors associated with recovery. To inform stakeholders' (e.g., clinicians,
142 coaches, athletes) understanding and expectations, many theoretical injury recovery models
143 have been developed, several of which are presented here: *The Biopsychosocial Model* (27, 28);
144 *Biopsychosocial Model of Stress and Athletic Injury* (29); *Integrated Model of Psychological*
145 *Response to the Sport Injury and Rehabilitation Process (30)*; *Cognitive Appraisal Model of*
146 *Psychological Adjustment to Athletic Injury (31)*). Although not specific to sport, some models
147 have been developed to explain and predict outcomes associated with a *specific* injury, such as
148 concussion (*Neurobiopsychosocial Model of Concussion* (32)). Others have been adapted from
149 existing models (*Transactional Stress Model* (33)) to suit a sport injury context (*Injury Response*
150 *Model* (34, 35)). For a more comprehensive review of select models, please see the following
151 article (36). Despite variation in the labeling used within the models cited above, constructs can
152 be categorize as modifiable (i.e., flexible, subject to intervention) or non-modifiable (i.e., fixed,
153 unchanging). With respect to addressing recovery outcomes, attention is best focused on

modifiable factors because they are subject to intervention. Prior to implementing an intervention however, efforts should focus on describing recovery outcomes observed for a given factor. To our knowledge, AI (a modifiable factor), has not been summarized in detail with respect to its association with sport injury recovery outcomes.

To address this knowledge gap and to provide a comprehensive summary of what is known about AI in relation to sport-related injury outcomes, authors conducted a scoping review. To guide this review, the following questions were established *a priori*:

1. Is there an association between athlete self-reported AI and response to a sport-related injury? If so, what is known? Response to injury is operationally defined as any outcome observed following injury (e.g., psychosocial, behavioral, functional, cognitive, or performance).
2. Is there an association between a sport-related injury (as an exposure) and athlete self-reported AI (as an outcome)? If so, what is known?

**METHOD**

**Search Strategy & Study Identification**

Search strategies and terms were developed in consultation with a University of Toronto Health Science Librarian (E.N.; 01/20/2020). The following databases were searched in March and April 2020 by one reviewer (TR): MEDLINE, EMBASE, SPORTDiscus, CINAHL, APA PsycInfo, and Sport Medicine & Education Index (Proquest). The number of citations identified were recorded in Table 1.

174 Table 1. Search Strategies By Database

175

| Database | Search Strategy/Terms | Search Date | Number of Articles Returned |
|---|---|---|---|
| MEDLINE (OVID)<br><br><br>1946 – Present | 1. Athletes/<br>2. (Paralympian or Olympian or athlet*).tw,kf.<br>3. sports/ or baseball/ or basketball/ or bicycling/ or boxing/ or cricket sport/ or football/ or golf/ or gymnastics/ or hockey/ or martial arts/ or mountaineering/ or racquet sports/ or running/ or skating/ or snow sports/ or soccer/ or sports for persons with disabilities/ or “track and field”/ or volleyball/ or walking/ or water sports/ or weight lifting/ or wrestling/<br>4. (archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running).tw,kf.<br>5. 1 or 2 or 3 or 4<br>6. exp Self Concept/<br>7.((identity or esteem or efficacy or schema) adj 3 self).tw,kf.<br>8. ((identity or esteem or efficacy or schema) adj 3 athlet*).tw,kf.<br>9. ((identity or esteem or efficacy or schema) adj 3 himself).tw,kf.<br>10. ((identity or esteem or efficacy or schema) adj 3 herself).tw,kf.<br>11. ((identity or esteem or efficacy or schema) adj 3 themselves).tw,kf.<br>12. 7 or 8 or 9 or 10 or 11<br>13. ((coherence or self) adj 3 sense of).tw,kf.<br>14. 6 or 12 or 13<br>15. 5 and 14<br>16. exp “wounds and injuries”/ | March 31/2020 | n=250 |

| | | | |
|---|---|---|---|
| | 17. (tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur*).tw,kf.<br>18. 16 or 17<br>19. 5 and 14 and 18<br>20. Athletic Injuries/<br>21. 14 and 20<br>22. 19 or 21 | | |
| EMBASE CLASSIC + EMBASE (OVID)<br><br>1947 – March 30 2020 | 1. Athletes/<br>2. (Paralympian or Olympian or athlet*).tw,kf.<br>3. sports/ or baseball/ or basketball/ or bicycling/ or boxing/ or cricket sport/ or football/ or golf/ or gymnastics/ or hockey/ or martial arts/ or mountaineering/ or racquet sports/ or running/ or skating/ or snow sports/ or soccer/ or sports for persons with disabilities/ or "track and field"/ or volleyball/ or walking/ or water sports/ or weight lifting/ or wrestling/<br>4. (archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running).tw,kf.<br>5. 1 or 2 or 3 or 4<br>6. exp Self Concept/<br>7.((identity or esteem or efficacy or schema) adj 3 self).tw,kf.<br>8. ((identity or esteem or efficacy or schema) adj 3 athlet*).tw,kf.<br>9. ((identity or esteem or efficacy or schema) adj 3 himself).tw,kf.<br>10. ((identity or esteem or efficacy or schema) adj 3 herself).tw,kf.<br>11. ((identity or esteem or efficacy or schema) adj 3 themselves).tw,kf.<br>12. 7 or 8 or 9 or 10 or 11<br>13. ((coherence or self) adj 3 sense of).tw,kf.<br>14. 6 or 12 or 13 | March 31/2020 | N=357 |

| | | | |
|---|---|---|---|
| | 15. 5 and 14<br>16. exp "wounds and injuries"/<br>17. (tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur*).tw,kf.<br>18. 16 or 17<br>19. 5 and 14 and 18<br>20. Athletic Injuries/<br>21. 14 and 20<br>22. 19 or 21 | | |
| SPORTDiscus (EBSCO)<br><br>1800 – Present | S1. DE "ATHLETES" OR DE "AFRICAN athletes" OR DE "AMATEUR athletes" OR DE "ARAB athletes" OR DE "ARCHERS" OR DE "ASIAN athletes" OR DE "ATHLETES with disabilities" OR DE "BADMINTON players" OR DE "BASEBALL players" OR DE "BASKETBALL players" OR DE "BLACK athletes" OR DE "BOBSLEDDERS" OR DE "BODYBUILDERS" OR DE "BOWLERS" OR DE "BOXERS (Sports)" OR DE "BULLFIGHTERS" OR DE "CANADIAN athletes" OR DE "CANOEISTS" OR DE "CELEBRITY athletes" OR DE "CHILD athletes" OR DE "CHILDREN of athletes" OR DE "CHRISTIAN athletes" OR DE "COLLEGE athletes" OR DE "CRICKET players" OR DE "CROQUET players" OR DE "CURLERS (Athletes)" OR DE "CYCLISTS" OR DE "DEFENSIVE players" OR DE "DIABETIC athletes" OR DE "ELITE athletes" OR DE "ENDURANCE athletes" OR DE "EUROPEAN athletes" OR DE "FENCERS" OR DE "FOOTBALL players" OR DE "GAY athletes" OR DE "GLADIATORS" OR DE "GOLFERS" OR DE "GYMNASTS" OR DE "HANDBALL players" OR DE "HIGH school athletes" OR DE "HOCKEY players" OR DE "INTERSEX athletes" OR DE "JAI alai players" OR DE "JEWISH athletes" OR DE "JUNIOR high school athletes" OR DE "KABADDI players" OR DE "LACROSSE players" OR DE "LAWN bowlers" OR DE "LGBTQ athletes" OR DE "LONG-term athlete development" OR DE "MALE athletes" OR DE "MARTIAL artists" OR DE "MEXICAN athletes" OR DE "MIDDLE school athletes" OR DE "MOUNTAINEERS" OR DE "MUSLIM athletes" OR DE "NATIVE American athletes" OR DE "NETBALL players" OR DE "OFFENSIVE players" OR DE "OLDER athletes" OR DE "OLYMPIC athletes" OR DE "ORIENTEERS" OR DE "PACIFIC Islander athletes" OR DE "PROFESSIONAL athletes" OR DE "ROWERS" OR DE "RUGBY football players" OR DE "RUNNERS (Sports)" OR DE "SKATERS" OR DE "SKIERS" OR DE "SKYDIVERS" OR DE "SNOWBOARDERS" OR DE "SOCCER players" OR DE "SOFTBALL players" OR DE "SQUASH players" OR DE "STARTING players" OR DE | April 2/2020 | N=433 |

| | | | |
|---|---|---|---|
| | "SUBSTITUTE players" OR DE "SURFERS" OR DE "SWIMMERS" OR DE "TABLE tennis players" OR DE "TEAM handball players" OR DE "TENNIS players" OR DE "TRACK & field athletes" OR DE "TRIATHLETES" OR DE "VOLLEYBALL players" OR DE "WATER polo players" OR DE "WEIGHT lifters" OR DE "WINDSURFERS (Persons)" OR DE "WOMEN athletes" OR DE "WRESTLERS"<br><br>S2. AB ( Paralympian or Olympian or athlet* ) OR TI ( Paralympian or Olympian or athlet* ) OR SU (Paralympian or Olympian or athlet* ) OR KW (Paralympian or Olympian or athlet* )<br><br>S3. DE "RECREATION" OR DE "AMATEUR sports" OR DE "AQUATIC sports" OR DE "BALL games" OR DE "BASEBALL" OR DE "COLLEGE sports" OR DE "CONTACT sports" OR DE "ENDURANCE sports" OR DE "EXTREME sports" OR DE "GYMNASTICS" OR DE "HOCKEY" OR DE "INDIVIDUAL sports" OR DE "MILITARY sports" OR DE "OLYMPIC Games" OR DE "PROFESSIONAL sports" OR DE "RECREATIONAL sports" OR DE "SCHOOL sports" OR DE "SOFTBALL" OR DE "SPORTS competitions" OR DE "SPORTS for children" OR DE "SPORTS for girls" OR DE "SPORTS for people with disabilities" OR DE "SPORTS for youth" OR DE "SPORTS teams" OR DE "TARGETS (Sports)" OR DE "TEAM sports" OR DE "WINTER sports" OR DE "WOMEN'S sports"<br><br>S4. TI ( archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running ) OR AB (archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or | | |

| | | | |
|---|---|---|---|
| | taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running ) OR SU (archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running ) OR KW (archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running )<br><br>S5. S1 OR S2 OR S3 OR S4<br><br>S6. DE "SELF-perception" OR DE "BODY image" OR DE "SELF-esteem"<br><br>S7. DE "ATHLETIC identity (Psychology)" OR DE "IDENTITY (Psychology)" OR DE "ATHLETIC identity (Psychology)" OR DE "PHYSICALLY active people -- Identity" OR DE "PSYCHOLOGY of athletes" OR DE "ATHLETIC identity (Psychology)"<br><br>S8. TI ( (identity or esteem or efficacy or schema) N3 self ) OR AB ( (identity or esteem or efficacy or schema) N3 self ) OR SU ( (identity or esteem or efficacy or schema) N3 self ) OR KW ( (identity or esteem or efficacy or schema) N3 self ) | | |

| | | | |
|---|---|---|---|
| | S9. TI ( (identity or esteem or efficacy or schema) N3 athlet* ) OR AB ( (identity or esteem or efficacy or schema) N3 athlet* ) or SU ( (identity or esteem or efficacy or schema) N3 athlet* ) or KW ( (identity or esteem or efficacy or schema) N3 athlet* )<br><br>S10. TI ( (identity or esteem or efficacy or schema) N3 himself ) OR AB ( (identity or esteem or efficacy or schema) N3 himself ) OR SU ( (identity or esteem or efficacy or schema) N3 himself ) or KW ( (identity or esteem or efficacy or schema) N3 himself )<br><br>S11. TI ( (identity or esteem or efficacy or schema) N3 herself ) OR AB ( (identity or esteem or efficacy or schema) N3 herself ) OR SU ( (identity or esteem or efficacy or schema) N3 herself ) OR KW ( (identity or esteem or efficacy or schema) N3 herself )<br><br>S12. TI ( (identity or esteem or efficacy or schema) N3 themselves ) OR AB ( (identity or esteem or efficacy or schema) N3 themselves ) OR SU ( (identity or esteem or efficacy or schema) N3 themselves ) OR KW ( (identity or esteem or efficacy or schema) N3 themselves)<br><br>S13. S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12<br><br>S14. TI ( (coherence or self) N3 sense of ) OR AB ( (coherence or self) N3 sense of ) OR SU ( (coherence or self) N3 sense of ) OR KW ( (coherence or self) N3 sense of )<br><br>S15. S13 OR S14<br><br>S16. S5 AND S15<br><br>S17. (DE "SPORTS injuries" OR DE "ACHILLES tendinitis" OR DE "AEROBICS injuries" OR DE "AQUATIC sports injuries" OR DE "BASEBALL injuries" OR DE "BASKETBALL injuries" OR DE "BOXING injuries" OR DE "COMMOTIO cordis" OR DE "CRICKET injuries" OR DE "EQUESTRIAN accidents" OR DE "FOOTBALL injuries" OR DE "GOLF injuries" OR DE "GYMNASTICS injuries" OR DE "HIKING injuries" OR DE "HOCKEY injuries" OR DE "HORSE sports injuries" OR DE "IN-line skating injuries" OR DE "JOGGING injuries" OR DE "JUDO | | |

| | | | |
|---|---|---|---|
| | injuries" OR DE "JUMPER'S knee" OR DE "KARATE injuries" OR DE "MARTIAL arts injuries" OR DE "NETBALL injuries" OR DE "RACKET game injuries" OR DE "RUGBY football injuries" OR DE "RUNNING injuries" OR DE "SKATEBOARDING injuries" OR DE "SOCCER injuries" OR DE "TENNIS injuries" OR DE "TURF toe" OR DE "VAULTING injuries" OR DE "VOLLEYBALL injuries" OR DE "WALKING (Sports) injuries" OR DE "WEIGHT training injuries" OR DE "WINTER sports injuries") AND (DE "SPORTS injuries" OR DE "SPORTS emergencies" OR DE "SPORTS injuries" OR DE "SPORTS ophthalmology" OR DE "WOUNDS & injuries" OR DE "BACKPACKING injuries" OR DE "BLUNT trauma" OR DE "CHRONIC wounds & injuries" OR DE "CRASH injuries" OR DE "DANCING injuries" OR DE "DECOMPRESSION sickness" OR DE "DISABILITIES" OR DE "DISLOCATIONS (Anatomy)" OR DE "HEAD injuries" OR DE "MARTIAL arts injuries" OR DE "MOUNTAINEERING injuries" OR DE "OVEREXERTION injuries" OR DE "OVERUSE injuries" OR DE "PENETRATING wounds" OR DE "PHYSIOLOGIC strain" OR DE "RUPTURE of organs, tissues, etc." OR DE "SOFT tissue injuries" OR DE "SPORTS injuries" OR DE "SUBLUXATION" OR DE "WOUND care")<br>S18 TI ( tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur* ) OR AB ( tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur* ) OR SU ( tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur* ) OR KW ( tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur* )<br><br>S19. S17 OR S18<br><br>S20. S16 AND S19<br><br>*Use of Thesaurus Function to find DE Terms | | |
| CINAHL Plus w / Full Text (EBSCO) | S1. (MH "Athletes, Amateur") OR (MH"Athletes, College") OR (MH "Athletes, Disabled") OR (MH "Athletes, Elite") OR (MH "Athletes, Female") OR (MH "Athletes, High School") OR (MH "Athletes, Male") OR (MH "Athletes, Master") OR (MH "Athletes, Professional") OR (MH "Athletes") | April 2/2020 | N=248 |

| | | | |
|---|---|---|---|
| 1937 – Present | S2. AB ( Paralympian or Olympian or athlet* ) OR TI ( Paralympian or Olympian or athlet* )<br><br>S3. (MH "Sports+")<br><br>S4. TI ( archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running ) OR AB ( archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running )<br><br>S5. S1 OR S2 OR S3 OR S4<br><br>S6. (MH "Self Concept+")<br><br>S7. (MM "Professional Identity") OR (MM "Social Identity") OR (MM "Role")<br><br>S8. TI ( (identity or esteem or efficacy or schema) N3 self ) OR AB ( (identity or esteem or efficacy or schema) N3 self )<br><br>S9. TI ( (identity or esteem or efficacy or schema) N3 athlet* ) OR AB ( (identity or esteem or efficacy or schema) N3 athlet* ) | | |

| | | | |
|---|---|---|---|
| | S10. TI ( (identity or esteem or efficacy or schema) N3 himself ) OR AB ( (identity or esteem or efficacy or schema) N3 himself )<br><br>S11. TI ( (identity or esteem or efficacy or schema) N3 herself ) OR AB ( (identity or esteem or efficacy or schema) N3 herself )<br><br>S12. TI ( (identity or esteem or efficacy or schema) N3 themselves ) OR AB ( (identity or esteem or efficacy or schema) N3 themselves )<br><br>S13. S6 OR S7 OR S8 OR S9 OR S10 OR S11 OR S12<br><br>S14. TI ( (coherence or self) N3 sense of ) OR AB ( (coherence or self) N3 sense of )<br><br>S15. S13 OR S14<br><br>S16. S5 AND S15<br><br>S17. (MH "Athletic Injuries+") OR (MM "Contusions and Abrasions") OR (MM "Back Injuries") OR (MM "Fractures") OR (MH "Head Injuries") OR (MH "Leg Injuries") OR (MH "Ligament Injuries") OR (MM "Dislocations") OR (MM "Neck Injuries") OR (MM "Rupture") OR (MM "Soft Tissue Injuries") OR (MM "Spinal Cord Injuries") OR (MM "Spinal Injuries") OR (MM "Sprains and Strains") OR (MM "Tears and Lacerations") OR (MM "Tendon Injuries") OR (MM "Wounds,<br>Penetrating") OR (MM "Wounds, Nonpenetrating") OR (MM "Subluxation") OR (MM "Reinjury")<br><br>S18. TI ( tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur* ) OR AU ( tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur* ) | | |

| | | | |
|---|---|---|---|
| | S19. S17 OR S18<br><br>S20. S16 AND S19<br><br>*Use of Subject Header Function to identify MH Terms | | |
| APA PsycInfo (OVID)<br><br><br>1806- March Week 4 2020 | 1. Athletes/<br>2. (Paralympian or Olympian or athlet*).tw,kf.<br>3. sports/ or baseball/ or basketball/ or bicycling/ or boxing/ or cricket sport/ or football/ or golf/ or gymnastics/ or hockey/ or martial arts/ or mountaineering/ or racquet sports/ or running/ or skating/ or snow sports/ or soccer/ or sports for persons with disabilities/ or "track and field"/ or volleyball/ or walking/ or water sports/ or weight lifting/ or wrestling/<br>4. (archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running).tw,kf.<br>5. 1 or 2 or 3 or 4<br>6. exp Self Concept/<br>7.((identity or esteem or efficacy or schema) adj 3 self).tw,kf.<br>8. ((identity or esteem or efficacy or schema) adj 3 athlet*).tw,kf.<br>9. ((identity or esteem or efficacy or schema) adj 3 himself).tw,kf.<br>10. ((identity or esteem or efficacy or schema) adj 3 herself).tw,kf.<br>11. ((identity or esteem or efficacy or schema) adj 3 themselves).tw,kf.<br>12. 7 or 8 or 9 or 10 or 11<br>13. ((coherence or self) adj 3 sense of).tw,kf.<br>14. 6 or 12 or 13<br>15. 5 and 14 | March 31/2020 | N=0 |

| | | | |
|---|---|---|---|
| | 16. exp “wounds and injuries”/<br>17. (tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur*).tw,kf.<br>18. 16 or 17<br>19. 5 and 14 and 18<br>20. Athletic Injuries/<br>21. 14 and 20<br>22. 19 or 21 | | |
| Sport Medicine & Education Index (ProQuest)<br><br>1970- Current | Concept 1. (MAINSUBJECT.EXACT("Athletes") OR ab((Paralympian or Olympian or athlet*)) OR pub((Paralympian or Olympian or athlet*)) OR if((Paralympian or Olympian or athlet*)) OR (MAINSUBJECT.EXACT("Winter sports") OR MAINSUBJECT.EXACT("Sports") OR MAINSUBJECT.EXACT("College sports") OR MAINSUBJECT.EXACT("High school sports") OR MAINSUBJECT.EXACT("Professional sports")) OR ab(archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running) OR pub(archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running) OR if(archery or artistic swimming or athletics or badminton or baseball or softball or basketball or beach volleyball or boxing or canoe or cycling or diving or equestrian or fencing or football or golf or gymnastics or handball or hockey or judo or karate or marathon or pentathlon or rowing or rugby or | April 2/2020 | N=168 |

| | | | |
|---|---|---|---|
| | sailing or shooting or skateboarding or climbing or surfing or swimming or tennis or taekwondo or trampoline or triathlon or waterpolo or weightlifting or wrestling or skiing or biathlon or bobsleigh or cross country or curling or figure skating or ice hockey or luge or Nordic or skeleton or jumping or snowboard or dance or cheerleading or soccer or running))<br><br>AND<br><br>Concept 2. (MAINSUBJECT.EXACT("Self esteem") OR ab ((identity or esteem or efficacy or schema) NEAR/3 self) OR pub((identity or esteem or efficacy or schema) NEAR/3 self) OR if((identity or esteem or efficacy or schema) NEAR/3 self) OR ab((identity or esteem or efficacy or schema) NEAR/3 athlet*) OR pub((identity or esteem or efficacy or schema) NEAR/3 athlet*) OR if((identity or esteem or efficacy or schema) NEAR/3 athlet*) OR ab((identity or esteem or efficacy or schema) NEAR/3 himself) OR pub((identity or esteem or efficacy or schema) NEAR/3 himself) OR if((identity or esteem or efficacy or schema) NEAR/3 himself) OR ab ((identity or esteem or efficacy or schema) NEAR/3 herself) OR pub ((identity or esteem or efficacy or schema) NEAR/3 herself) OR if ((identity or esteem or efficacy or schema) NEAR/3 herself) OR ab ((identity or esteem or efficacy or schema) NEAR/3 themselves) OR pub ((identity or esteem or efficacy or schema) NEAR/3 themselves) OR if ((identity or esteem or efficacy or schema) NEAR/3 themselves) OR ab ((coherence or self) NEAR/3 sense of) OR pub ((coherence or self) NEAR/3 sense of) OR if ((coherence or self) NEAR/3 sense of))<br><br>AND<br><br>Concept 3. ((MAINSUBJECT.EXACT("Concussion") OR MAINSUBJECT.EXACT("Spinal cord injuries") OR MAINSUBJECT.EXACT("Bodily injury") OR MAINSUBJECT.EXACT("Fractures") OR MAINSUBJECT.EXACT("Traumatic brain injury") OR MAINSUBJECT.EXACT("Head injuries") OR MAINSUBJECT.EXACT("Joint and ligament injuries") OR MAINSUBJECT.EXACT("Sports injuries") OR MAINSUBJECT.EXACT("Trauma")) OR ab((tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur*)) OR pub((tear or separation or sprain or strain or break or fracture or | | |

| | | | |
|---|---|---|---|
| | contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur*)) OR if((tear or separation or sprain or strain or break or fracture or contusion or damage or dislocation or bruise or concussion or hernia or rupture or injur*))) | | |

TOTAL RECORDS IDENTIFIED: n= 1456

Search results were exported to EndNote (37) and duplicates were discarded (n=334). Thereafter, article titles and abstracts (n=1122) were exported to Covidence (38). Covidence collates each reviewer's decision to accept or reject a citation and identifies screening conflicts for resolution. The program also populates a PRISMA flow chart to reflect the number of citations included or excluded at each screening stage (see Appendix A, Figure 1). Reasons for exclusion were cited at the full-text screening stage only. Studies identified for inclusion at full-text screening also had their reference lists reviewed for additional studies. ClinicalTrials.gov was also searched using the following terms: "athlete", "identity", "injury" and "sport", but did not identify any additional studies. TR and BP independently performed each stage of the screening process (titles, abstracts and full-text screening) as well as full-text data extraction. After completing each stage, reviewers met virtually (via Zoom) to discuss and resolve conflicts. Progression to the next screening stage occurred only after 100% agreement was achieved. The same process was applied during the data extraction phase. For quality assurance, this scoping review was structured according to the PRISMA-ScR checklist (see Appendix B).

**Study Inclusion Criteria:**

1) AI was assessed using a self-report quantitative measure.

2) study sample consisted of at least one group with a sport-related injury which prevented them from engaging in sport.

3) injuries were real or hypothetical (i.e., imaginary).

4) studies captured athletes of any age and playing status (e.g., amateur or professional, retired or active). Studies that included athletes with disabilities (e.g., para-athletes) were permissible

however, the injury must have been secondary to the existing disability (i.e., study must pertain to a sport-related injury).

5) an objective measure was used to assess the injury or post-rehabilitation status or post-injury AI.

**Study Exclusion Criteria:**

1) Article not available in the English language.

2) Full text article could not be located following direct request to author(s) (if not available online).

3) Injury was not specified or assessed for severity.

4) AI was not self-reported (i.e., was reported by a coach, teammate or parent).

5) Conference proceedings or abstracts.

6) Qualitative studies.

7) Systematic, scoping or narrative reviews.

8) Theses or dissertations.

9) Consensus statements.

**Data Extraction**

The following data were extracted from each of the included studies and logged independently by reviewers into a blank, pre-formatted table (see Table 2 for template).

1) Description of sample: country of origin, sample size, sex, race, age, recruitment source, sport background, level of sport and history of sport involvement (e.g., frequency and years of participation).

2) Injury descriptors: definition of injury used (if any), type and severity of injury, time removed from sport, rehabilitation protocol administered, and surgical details (if any).

3) Study methodology: study design, primary and secondary objectives.

4) Theoretical support: author and model or theory used.

6) Outcome measures: AI measured used, timeline of administration, AI score, and additional outcome measures used.

7) Key findings: findings related to AI and other measured variables.

8) Study strengths & limitations.

Findings are presented as a narrative summary, and where possible, presented as a tally (i.e., number of studies that reported on a given finding) to denote trends in the literature. In keeping with the purpose of scoping review methodology which is "…to identify knowledge gaps, scope a body of literature, clarify concepts or to investigate research conduct" (39) as well as "… to identify strengths [and] weaknesses … in the research" (40), studies will not undergo quality review (i.e., assessment of bias) or be assigned a *Level of Evidence* rating.

**Patient and Public Involvement**

No patient(s) involved.

**RESULTS**

The search strategy identified 1456 records for consideration. See Table 1 for databases searched, search terms used, and number of records identified. Two additional articles were identified via hand searching of the included article reference lists. One additional article was previously known to others, but not identified in the searches. Two articles contained multiple studies. A total of 20 publications reporting on 22 studies were eligible for inclusion. Studies utilized cross-section observational (n=8), prospective longitudinal (n=13) and mixed-methods (n=1) designs.

**Sample Descriptors**

Studies originated from Australia (n=1), Canada (n=1), Israel (n=1), Slovenia (n=1), and the United States (n=18). Most studies included both sex groups, except for three studies which included all-male samples (41-43) and one which included an all-female sample (44). A total of n=1852 athletes were included; individual study samples ranged from a minimum of n=6 (45) to a maximum n=316 (43). Participants were a minimum of 13 (43) to a maximum of 70 years old (35). Participants were recruited from several clinical and non-clinical settings, with one study failing to specify a recruitment source (45). See Table 2, column 2.

Table 2. Article Data Extraction

| 1.Citation; Author (Year) | 2.Sample Descriptors<br><br>1) Country of Origin<br>2) n= (Sex %)<br>3) Race (%)<br>4) Age M ± SD; Range<br>5) Recruitment Source<br>6) Sport (%)<br>7) Level of Sport<br>8) History of Sport Engagement (Frequency / Years) | 3.Injury Description<br><br>1) Definition of Injury (Yes/No: Definition)<br>2) Sport Injury/Severity<br>3) Time out of Sport M (SD)<br>4) Rehabilitation Protocol & Surgery Details | 4.Study Design & Objectives<br><br>1) Study Design<br>2) Primary Objective<br>3) Secondary Objective | 5.Model or Theory Referenced<br><br>1) Authors (Year)<br>2) Model Name | 6.Outcomes Measures<br><br>1) AIMS: 7 or 10 items<br>2) Timeline of Administration<br>3) Group; Score (M±SD)<br>4) Names of Additional Measure Used | 7.Key Findings Pertaining to AI | 8.Study Strengths & Limitations |
|---|---|---|---|---|---|---|---|
| [49]; Padaki et al. (2018) | 1) US<br>2) n=24 (50% Male)<br>3) -<br>4) 14.5 ± 2.7<br>5) Tertiary care centre<br>6) Single sport (29.2%); Multi sport (58.3%)<br>7) -<br>8) - | 1) Yes: "ACL rupture requiring surgery"<br>2) ACL tear; 41.7% reporting concomitant meniscal injury<br>3) -<br>4) - | 1) Cross-sectional<br>2) To examine the psychological trauma, including potential PTSD symptomatology, following ACL rupture among young athletes. | 1) -<br>2) - | 1) 10 items<br>2) Baseline: pre-operation<br>3) Sex: Male = 53.4 vs. Female = 56.6<br><br>Sport Involvement: Single sport = 57.5 vs. Multi-sport = 52.8<br><br>Age: ≤ 14 years old = 54.5 vs. 15-21 years old = 54.1<br><br>SDs not provided<br><br>4) Level of Sports Specialization; IES-R | - single sport athletes had significantly higher AIMS scores than multi-sport athletes<br>- no significant difference in AIMS scores by age group ( ≤ 14 years old vs. 15 – 21 years old)<br>- no significant difference on IES-R between *high* (AIMS score: >50) and *low* AI groups (AIMS score: ≤ 49) | *Strengths:*<br>- only study to group athletes by sport specialization (as per the American Orthopedic Society for Sports Medicine definition; i.e., single vs. multi-sport athletes) and compare AIMS scores between groups<br>- only study to examine psychological trauma associated with a sport injury<br><br>*Limitations:*<br>- small sample size<br>- unknown how long athletes were removed from sport<br>- figures are provided, but exact values are not referenced<br>- does not appear that tests of statistical significance were conducted to compare *high* & *low* AI groups<br>- no pre-injury data available<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| [55];<br>Hilliard et al. (2017) | 1) US<br>2) n=79 (64.6% Male)<br>3) 70% Caucasian<br>4) 19.96 ± 1.56<br>5) Athletic training clinics in colleges or universities in Midwestern US<br>6) Football (35%); Soccer (18%); Basketball (11%); Track (10%); Baseball (6%); Volleyball (6%); Gymnastics/Dance (6%); Swimming (4%); Cross-Country (3%); Field Hockey (3%); Lacrosse (1%); Wrestling (1%); Not Specified (2%)<br>7) Division I (26%); Division II (15%); Division III (40%); and NAIA (19%)<br>8) 14.19 ± 9.40 hours spent training/week prior to injury; 10.45 ± 4.46 years involved in sport | 1) Yes: "experiencing a MSK injury considered moderate in severity that results in at least 7 days of missed practice or competition and receiving physiotherapy for the injury"<br>2) ACL tear (13.9%); sprains (12.6%); fractures (6.3%); undefined injury, only general area reported [e.g., right knee, lower back, etc.]( 67%)<br>3) As per definition, "…at least 7 days of missed practice or competition…"; median of 4 weeks reported since time of injury (range 1 to 63 weeks)<br>4) 42% of injuries required surgery, not otherwise specified | 1) Cross-sectional convergent parallel mixed methods<br>2) To explore what aspects of AI might predict over adherence to rehabilitation.<br>3) To get a better understanding of participants' views of their athletic participation and rehabilitation adherence. | 1) Wiese-Bjornstal et al. (1998)<br>2) Integrated Model of Response to Sport Injury | 1) 7 items<br>2) Baseline: post-injury<br>3) 5.78 ± 0.72 ⊗<br>4) ROAQ | - positive moderate and significant association between AIMS score and over adherence to rehabilitation protocols<br>- positive moderate and significant association between AIMS score and attempts to expedite rehabilitation process<br>- positive moderate but non-significant association between AIMS score and willingness to ignore practitioner recommendations pertaining to rehabilitation<br>- AIMS negative affectivity sub-scale independently predicted likelihood that athlete would: i) ignore practitioner recommendations and ii) attempt to expedite the rehabilitation process | *Strengths:*<br>- sample is described clearly and thoroughly (e.g., clear definition of injury, sport, level of play, frequency of sport involvement, type of sport injury, time removed from sport)<br>- range of sports and levels of play captured increase the generalizability of findings<br>- study design used does not prioritize one aspect of the research over the other (i.e., quantitative vs. qualitative)<br>- regression models have sufficient power<br>-captured a range of MSK injuries<br>-clear operational definition of injuries eligible for inclusion<br><br>*Limitations:*<br>- only one additional outcome measure administrated<br>- ROAQ assesses athlete *beliefs*, not *actual* behaviours<br>- sample is predominantly male<br>- statistical tests comparing AIMS scores to subscale scores increases likelihood of multicollinearity<br>- large variation in "time since injury": 1 week [acute] vs. 63 weeks [chronic]<br>- no pre-injury data available |
| [54];<br>O'Rourke et al. (2017) | 1) US<br>2) n=51 (52.9% Male)<br>3) -<br>4) 14.53 ± 1.85<br>5) Athletes presenting to a local hospital or university | 1) Yes: suffered a concussion in the past 14 days; unknown diagnostic criteria<br>2) Concussion<br>3) - | 1) Prospective longitudinal<br>2) To assess the role of psychological factors on self-reported post- | 1) Wiese-Bjornstal et al. (1998)<br>2) Integrated Model of Response to Sport Injury | 1) 7 items<br>2) Time 2: ~14-21 days post-concussion<br>3) 38.25 ± 6.23 | -moderate positive and significant association with AIMS score: mastery-orientation, ego-orientation, parent ego climate, intrinsic | *Strengths:*<br>- only study to capture and compare AI to presence of post-concussion symptoms at multiple time points in the acute recovery phase |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | affiliated outpatient concussion clinic<br>6) Soccer (24%); Lacrosse (10%); Football (8%); Other (58%; skiing, volleyball, hockey, swimming, Ultimate Frisbee, cheerleading and wrestling)<br>7) -<br>8) - | 4) - | concussion recovery in youth athletes within an existing theoretical and empirically supported framework.<br>3) To assess non-psychosocial variables previously shown to influence concussion symptomatology (e.g., age, gender, number of days post-concussion, and number of previous concussions). | | 4) SCAT-2; AGS-YS; MCS-YS; PIMCQ-2; SMS; SAS-2; SNS | and extrinsic motivation, social network size, post-concussion symptoms at Time 2 & 3<br>-small negative and significant association between AIMS score and social network satisfaction<br>-stronger AI significantly predicted more severe post-concussion symptoms at Time 3 (~21-28 days post-concussion) | - similar number of male and female athletes captured in sample<br>- thorough evaluation of athlete motivation captured via measures administered<br><br>Limitations:<br>- poorly described sample with respect to level of and frequency of sport involvement<br>- use of a hospital-based clinic as a recruitment source may have biased the study sample (i.e., captured athletes with more severe concussion symptoms)<br>- follow-up measures administered in close proximity (Time 1: ~1-14 days post-concussion; Time 2: ~14-21 days post-concussion; Time 3: ~21-28 days post-concussion)<br>- diagnostic criteria for concussion not stated<br>- no pre-injury data available |
| [52]; Baranoff et al. (2015) | 1) Australia<br>2) Time 1: n=44 (61.4% Male)<br>Time 2: n=26 (46.1% Male)<br>3) -<br>4) 27 ± 9.4<br>5) Physiotherapy clinics<br>6) Australian Rules Football (29.5%); Netball (18.2%); Basketball (13.6%)<br>7) -<br>8) - | 1) Yes: ACL tear<br>2) ACL tear<br>3) Mean time between injury and surgery: 7 weeks, 6 days (SD=9 weeks, 4 days)<br>4) ALCR Rehabilitation Protocol; ACL allograft reconstruction (11.4%); ACL autograft reconstruction (89%) | 1) Prospective longitudinal<br>2) To assess the roles of catastrophizing and acceptance in relation to depression, pain intensity, and substance use to cope with an injury 2 weeks post-ACL reconstructive surgery (Time 1) and 5 months of ALCR rehabilitation (Time 2). | 1) -<br>2) - | ) 7 items<br>2) Baseline: 0-2 weeks post-operation<br>3) 31.0 ± 9.0<br>4) AAQ; PCS; DASS 21 | -strong positive and significant association between AIMS score and depressive symptom severity | *Strengths*:<br>-equal representation of males and females in sample<br>- t-tests conducted to determine if there was a significant difference between athletes who submitted questionnaires at both time points vs. at Time 1 only; no significant difference between groups on measures of depression<br>-measure mean/SD provided for both groups (i.e., athletes who completed questionnaires at both time points vs. Time 1 only)<br><br>*Limitations*: |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | -small sample size<br>-only three sports captured<br>-frequency and years of sport involvement not provided for sample<br>-~ 8 weeks between occurrence of injury and questionnaire completion<br>-no pre-injury data on AI<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [45];<br>Samuel et al. (2015) | 1) Israel<br>2) n=6 (% Unknown)<br>3) -<br>4) 21.83 ± 2.93<br>5) Sports medicine centres<br>6) Basketball (33.3%); Judo (33.3%); Track and Field (16.7%); Gymnastics (16.7%)<br>7) Internationally ranked (83.3%); Nationally ranked (16.7%)<br>8) 11.17 ± 3.41 years involved in sport | 1) Yes: ACL tear<br>2) ACL tear<br>3) Range: 7 to 12 months<br>4) - | 1) Prospective longitudinal<br>2) To examine competitive athletes' experience of severe injuries. | 1) Samuel et al. (2011)<br>2) Scheme of Change for Sport Psychology Practice (SCSPP) | 1) 7 items<br>2) Multiple: Time 1: 2.25 months from date of initial injury; Time 2: 6.58 months from date of initial injury; Time 3: 10.08 months from date of initial injury<br>3) Time 1 = 45.17 ± 1.83<br>Time 2 = 43.33 ± 3.83<br>Time 3 = 44.55 ± 3.50<br>4) CEI; BCope | - no significant difference between AIMS scores as assessed at different time points | *Strengths:*<br>-years of sport involvement provided<br>-AI was assessed at multiple time points, with sufficient time between follow-ups<br><br>*Limitations:*<br>-small sample size<br>-participant raw data provided; means/SDs not calculated<br>-sex distribution of sample not provided<br>-recruitment source not provided<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [42];<br>Kroshus et al. (2015) | 1) US<br>2) n=146 (baseline); n=116 (post-season) (100% Male)<br>3) -<br>4) -<br>5) Collegiate teams<br>6) Ice Hockey<br>7) Division I (NCCA)<br>8) - | 1) Yes: NCCA definition of concussion<br>2) Concussion<br>3) -<br>4) - | 1) Prospective cohort<br>2) To assess the association between pre-season individual characteristics and post-season recall of within-season concussion symptom-reporting behaviours. | 1) Cialdini & Trost (1998)<br>2) Social Influence: Social Norms, Conformity and Compliance | 1) 7 items<br>2) Baseline: pre-season, pre-injury<br>3) 39.79 ± 4.73<br>4) Concussion History; CKI; CAI; HIQ | - significant interaction identified between perceived concussion reporting norms and AIMS score with respect to predicting non-reporting behaviours; stronger AI was associated with non-report<br>-AIMS score alone did not significantly predict | *Strengths:*<br>-only study to look exclusively at concussion reporting behaviours<br>-homogenous sport sample captured; all participants were NCAA Division I ice hockey players<br>-large sample size<br><br>*Limitations:*<br>-all male sample; not generalizable to females |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | non-reporting behaviours | -reporting behaviours subject to recall bias; follow-up questionnaires were administered at the end of hockey season<br>-reporting behaviours based on presence of post-impact concussion symptoms rather than incidence of unreported suspected concussions |
| [44]; Madrigal et al. (2014) | 1) US<br>2) n=4 (100% Female)<br>3) -<br>4) Only range was provided: 20-21 years old<br>5) NCAA Division I school teams; by referral via team athletic trainer<br>6) Softball; Women's Soccer<br>7) NCAA Division I<br>8) - | 1) Yes: "sport injury that is expected to prevent/limit his/her sport participation for at least 4 days"<br>2) Meniscus tear, leg injury (not otherwise specified), broken bone in hand, labrum tear in shoulder<br>3) Range: 5 weeks to 8 months<br>4) 50% required surgery | 1) Prospective longitudinal<br>2) To examine an athlete's psychological strengths (i.e., mental toughness, hardiness, and optimism) and emotional response to sport injury and rehabilitation and coping resources.<br>3) To examine individual differences and changes over time from injury to being cleared to play. | 1a) Wiese-Bjornstal et al. (1998)<br>2a) Integrated Model of Response to Sport Injury<br><br>1b) Lazarus & Folkman (1984)<br>2b) Stress Appraisal & Coping | 1) 10 items<br>2) Multiple: Time 1: preseason; Time 4: Cleared-To-Play<br>3) Time 1 = 54.25 ± 7.80 Time 4 = 53.67 ± 8.74<br>4) MTS; PPI-A; LOT-R; BCope; PRSII; RAQ; DRS | - no significant difference identified between AIMS score as measured at preseason and return-to-play following injury | *Strengths*:<br>-equal representation of males and females in sample<br>-assessed AI prior to injury<br>-captured a range of MSK injuries<br><br>*Limitations*:<br>-frequency and years of sport involvement not provided<br>-small sample size<br>-measure means/SDs not calculated for sample; participant raw data provided<br>-results were presented for each athlete, rather than summary for the entire sample<br>-narrow age range captured (20 to 21 years old) |
| [58]; Masten et al. (2014) | 1) Slovenia<br>2) n=68 (69.1% Male)<br>3) -<br>4) M=23.4; Range: 16 to 40 years old<br>5) Orthopedic clinic in Ljubljana, Slovenia<br>6) Handball (20.6%); Football (20.6%); Basketball (19.1%); Volleyball (6%); Alpine Skiing (<3%); Ice Hockey (<3%); Judo (<3%); Snowboarding (<3%); Tennis (<3%); Running | 1) Yes: according to a previously proposed injury rating scale; individuals categorized to be in *group 4* (i.e., rehab time expected to be up to one month) or *group 5* (i.e., rehab time expected to be over one month and up to 6 months).<br>2) Meniscus tear; ACL/PCL; patella injury; unreported (% not | 1) Cross-sectional<br>2) To examine if athletes differ from each other in depression, general irritability, and inhibition of behaviour regarding injury severity.<br>3) To examine the psychological response to injury on the basis of specific dispositional characteristics to | 1) -<br>2) - | 1) 7 items<br>2) Baseline: Pre-operation<br>3) -<br>4) FPI; STAI-X1; SIP 15; SIRBS; 6-item author-developed scale assessing social support provided by family, coach and sport colleagues, and athlete's motivation for rehabilitation | - AIMS scores independently predicted an athlete's motivation to engage in rehabilitation as well as their subjective value of rehabilitation; athletes with stronger AI were significantly more likely to have greater motivation and positive views towards rehabilitation | *Strengths*:<br>-only study to exclusively capture high-ranking athletes (e.g., world class, international and national)<br>-compared athletes by injury severity (more severely injured [expected rehab time > 1 month but ≤ 6 months] vs. less severely injured [expected rehab time ≤ 1 month])<br>-diverse group of athletes captured |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | (<3%); Gymnastics (<3%); Rugby (<3%); Standing/Acrobatic Skiing (<3%)<br>7) World-class and internationally ranking (41.2%); National Ranking or uncategorized (58.8%)<br>8) - | reported); Group 4 (8.8%), Group 5 (76.5%)<br>3) As per inclusion criteria, removed from sport for at least 1 month<br>4) Standard rehabilitation protocol, not otherwise specified; "knee surgery", not otherwise specified | identify those personality and dispositional traits that make athletes more prone to injury. | | | | -wide age range captured (16 to 40 years old)<br><br>*Limitations*:<br>-AIMS mean/SD not provided or compared between more severely injured vs. less severely injured athletes<br>-level of sport involvement was not provided for majority of sample<br>-questionnaires only administered at one time point; unable to make any conclusions about changes to AI as a result of sport injury |
| [41]; Petrie et al. (2014) | 1) US<br>2) n=26 (100% Male)<br>3) 52.2% Black<br>4) 20.08 ± 1.46<br>5) Football teams from the Southwestern US<br>6) Football<br>7) NCAA Division I<br>8) - | 1) Yes: "[an injury] defined as having occurred as a result of participation in an organized intercollegiate practice or game, requiring medical attention by a team athletic trainer or physician, and having resulted in the inability to participate for one or more days beyond the day of injury"<br>2) Lower extremity not otherwise specified (69%); upper extremity (31%)<br>3) 11.88 days ± 27.71<br>4) - | 1) Prospective longitudinal<br>2) To determine the direct effects of life stress, different sources of social support, AI and mental toughness on athletic injury over the course of a competitive season.<br>3) To examine the potential moderating effects of social support, AI, and mental toughness on the life stress-injury relationship. | 1) Andersen & Williams (1988)<br>2) A Model of Stress and Athletic Injury | 1) 6 items; one item removed due to lack of variability<br>2) Baseline: pre-season (i.e., pre-injury)<br>3) 32.23 ± 5.71<br>4) LESCA; MSPSS; SMTQ | - no significant associations between AIMS score: i) life stress, ii) injury outcome, iii) social support or iv) mental toughness were identified<br>- AIMS score was not a significant predictor of "time lost" (i.e., number of days removed from sport due to injury); AIMS score interaction terms with i) positive and ii) negative life stress were also non-significant | *Strengths:*<br>-homogenous sport sample captured; all participants were NCAA Division I football players<br>-sample was racially diverse<br>-assessed AI prior to sport injury<br>-clear operational definition of injuries eligible for inclusion<br><br>*Limitations:*<br>-small sample size<br>-frequency and years of sport involvement not provided<br>-findings not generalizable to females<br>-no post-injury assessment of AI<br>-no comparison between injured and un-injured athletes with respect to AIMS baseline scores |
| [50]; Brewer et al. (2013) | 1) US<br>2) n=91 (63.7% Male)<br>3) 92% Caucasian | 1) Yes: ACL tear<br>2) ACL tear<br>3) At least 6 weeks | 1) Prospective longitudinal<br>2) To identify predictors of | 1a) Lazarus & Folkman (1984) | 1) 7 items<br>2) Once: pre-operation<br>3) 30.07 ± 9.73 | - AIMS score did not significantly predict home exercise completion ratio (i.e., | *Strengths:*<br>-similar distribution of competitive vs. recreational athletes |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 4) 29.73 ± 10.24; range 14 to 54 years old<br>5) Physical therapy clinics<br>6) -<br>7) Competitive (43%); Recreational (54%)<br>8) - | 4) Accelerated ACL rehabilitation protocol as developed by Shelbourne et al.; emphasis placed on early attainment of ROM, quadriceps strength, and normal gait. Exercises tailored to and considered safe for patients' stage of recovery, patients may be encouraged to exceed the prescribed number of sets to hasten their recovery | adherence to a post-operative ACL home rehabilitation program. | 2a) Stress, Appraisal and Coping<br><br>1b) Wiese-Bjornstal et al. (1998)<br>2b) Integrated Model of Response to Sport Injury | 4) NEO-FFI- Neuroticism; LOT-R; POMS-B; Subjective Pain Rating; Subjective Daily Stress Rating | number of sets of home exercises completed compared to what was prescribed)<br>- significant interaction identified between AIMS score and daily stress as predictors of home exercise completion ratio; when daily stress was high, individuals with stronger AIs were more likely to complete their prescribed exercises | -one of three studies that assessed *actual* rehabilitation behaviours (e.g., home exercise completion, cryotherapy)<br><br>*Limitations:*<br>-sample was predominantly Caucasian; findings may not be generalizable to other racial groups<br>-sample was predominantly male<br>-sample was poorly described; frequency and years of sport involvement and sports captured were not provided<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [43]; McKay et al. (2013) | 1) Canada<br>2) n=316 (100% Male)<br>3) -<br>4) Median= 15; range 13 to 17 years old<br>5) Elite ice hockey teams in Calgary, Alberta<br>6) Ice Hockey<br>7) AAA, AA, A<br>8) Bantam age group: mean of 8.06 years of organized hockey; midget age group: mean of 9.57 years of organized hockey | 1) Yes: "any injury that required medical attention, resulted in the inability to complete the current session of activity, and/or required the cessation of sporting activity for at least 24 hours"<br>Subsequent injury: "any injury that occurred during the season, after the first reported injury, regardless of anatomical position or injury type"<br>2) n=143 injures reported: concussion (22.4%); muscle strain (14.7%); joint/ligament sprain (14.7%)<br>3) As per definition<br>4) - | 1) Prospective cohort<br>2) To determine the risk of injury associated with AI, attitudes towards body checking, competitive state anxiety, and re-injury fear in elite youth ice hockey players.<br>3) To determine if there is an elevated risk of subsequent injury associated with return-to-play before medical clearance. | 1) -<br>2) - | 1) 10 items<br>2) Baseline: within 3 weeks of hockey season start, pre-injury<br>3) 55.72 ± 7.54<br>4) CSAI-2R; BCQ; FRQ; MPQ-SF | -athletes with AIMS score below the 25th percentile were at greater risk for incurring an injury; this finding was significant<br><br>* findings omitted due to publishing authors' error; discrepancy between findings communicated in text of results section and tables* | *Strengths:*<br>-large sample size<br>-athletes grouped by age for analysis<br>-only study to examine AI in relation to injury risk<br>-injuries were reported by an external source<br>-homogenous sport sample captured; all participants were elite male ice hockey players<br>-only study to capture concussion and MSK injuries<br>-clear operational definition of injuries eligible for inclusion<br><br>*Limitations:*<br>-reporting discrepancy in findings pertaining to AI; authors were contacted for clarification but no response was provided |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | -no post-injury assessment of AI<br>-findings not generalizable to females<br>-narrow age range captured (13 to 17 years old) |
| [56]; Podlog et al. (2013) | *Study 1:*<br>1) US<br>2) n=118 (51.7% Male)<br>3) -<br>4) 15.97 ± 1.41<br>5) Teams in Texas<br>6) Football (36%); Basketball (24%); Soccer (11%); Volleyball (8%); Track and Field (5%); Baseball (4%); Softball (4%); Cheerleading (3%); Tennis (1.7%); Dance (0.8%); Swimming (0.8%)<br>7) School teams, local clubs or community leagues<br>8) 14.18 ± 8.93 hours per week spent training prior to injury; 6.69 ± 2.80 years involved in current sport (range: 1 to 14 years)<br><br>*Study 2:*<br>1) US<br>2) n=105 (59% Male)<br>3) -<br>4) -<br>5) NCAA teams across the US<br>6) Football (21%); Basketball (15%); Soccer (11%); Volleyball (9%); Track and Field (4%); Baseball (16%); Softball (3%); Cheerleading/Gymnastics (9%); Tennis (5%); Golf (0.9%); Rugby (0.9%); Swimming (2%); Lacrosse | *Study 1:*<br>1) Yes: "were currently experiencing an injury requiring a minimum 2-week absence from sport training and competition, and currently receiving physiotherapy for their injury"<br>2) ACL tear (34.7%); medial malleolus/fibula/distal tibia fracture (22.9%); shoulder dislocation (7.6%); Carpel Tunnel Syndrome (<1%)<br>3) M=2.7 months (SD=2.01); range: 0.5 to 7 months<br>4) 57.6% required surgery, not otherwise specified<br><br>*Study 2:*<br>1) Same as above<br>2) ACL (17.1%); fractured humerus/femur/clavicle (14.3%); shoulder dislocation (8.6%); sprain (7.6%)<br>3) M=2.49 months (SD=2.10); range: 0.5 to 7 months<br>4) 50.5% required surgery, not otherwise specified | *Study 1:*<br>1) Cross-sectional<br>2) To provide initial validation of a novel injury-rehabilitation over adherence measure.<br><br>*Study 2:*<br>1) Cross-sectional<br>2) To examine correlates of over adherence and premature return to sport. | *Study 1 & Study 2:*<br>1) Wiese-Bjornstal et al. (1998)<br>2) Integrated Model of Response to Sport Injury | *Study 1:*<br>1) 7 items<br>2) Baseline: post-injury<br>3) 5.67 ± 0.90 ⊗<br>4) SPSQ ⊗; ROAQ ⊗; I-PRRS ⊗<br><br>*Study 2:*<br>1) 7 items<br>2) Baseline: post-injury<br>3) 5.63 ± 0.96 ⊗<br>4) SPSQ ⊗; ROAQ ⊗; I-PRRS ⊗ | *Study 1 Only:*<br>- AIMS scores significantly predicted attempts to expedite the rehabilitation process; athletes with a stronger AI were significantly more likely to think and behave in a way that would expedite rehabilitation<br><br>*Study 1 & 2:*<br>- small positive and significant association between AIMS score and tendency to ignore practitioner rehabilitation recommendations<br>- AIMS scores significantly predicted rehabilitation tendencies; athletes with a stronger AI were significantly more likely to ignore practitioner recommendations | *Strengths (Study 1 & 2):*<br>-samples captured were thoroughly described<br>-wide range of sports and levels of involvement captured<br>-large sample size<br>-similar number of males and females captured<br>-captured a range of MSK injuries<br>-clear operational definition of injuries eligible for inclusion<br><br>*Limitations:*<br>-no post-injury assessment of AI (both studies)<br>-large variation in time lost (i.e., number of days removed from sport) due to sport injury (both studies)<br>-sample age (mean/SD) not provided in study 2 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | (2%); Snowboarding (2%); Missing (0.9%)<br>7) NCAA Division I, II, III<br>8) 14.06 ± 6.14 hours per week spent training prior to injury; 9.74 ± 4.60 involved in current sport (range: 1 to 20 years) | | | | | | | |
| [57]; Weinberg et al. (2013) | 1) US<br>2) n=130 (52.3%)<br>3) -<br>4)20.03 ± 1.60; range: 18 to 24 years old<br>5) Intramural teams at a midsized university in the Midwestern US<br>6) Basketball (100%)<br>7) Recreational<br>8) 6.64 ± 3.98 years involved in sport | 1) Yes: "playing through injury was defined in the current study as participating while still feeling pain so that a) the pain/injury needs some sort of mental attention during participation, b) involves some sort of loss of or change in function that would directly affect performance capabilities, therefore indicating a threat to wellbeing, and c) a decision process was necessary as to whether participation should and/or would be initiated and continued during the experience of pain/injury"<br>2) -<br>3) -<br>4) - | 1) Cross-sectional<br>2) To determine whether athletes' attitudes and behavioural intentions regarding playing through pain and injury differ as a function of their level of AI and their gender. | 1) -<br>2) - | 1) 10 items<br>2) Baseline: post-injury<br>3) 4.15 ± 1.21$^{\otimes}$<br>4) RPIQ $^{\otimes}$; PIB $^{\otimes}$ | -males scored significantly higher on each AIMS subscale compared to females<br>-AI significantly predicted athlete attitudes towards sport risk, pain and playing through pain; athletes scoring ≥ 75$^{th}$ percentile on the AIMS were more likely to have positive attitudes and behavioral tendencies to play through pain and injury compared to the moderate (between 25$^{th}$ and 75$^{th}$ percentile) and low AI groups (≤ 25 percentile)<br>-AIMS exclusivity and negative affect subscales significantly predicted RPIQ toughness (in regard to risk, pain and injury in sport), social role choice (willingness to accept risk, pain and injury in sport), and "pressed" (perceptions of pressure exerted by others to play with pain and injury) subscale scores; athletes scoring higher on the exclusivity and negative affect AIMS subscales were more likely to endorse | *Strengths:*<br>-large sample size<br>-equal representation of males and females<br><br>*Limitations:*<br>-homogenous sample of intramural basketball players; findings not generalizable to other sports<br>-few details provided about injury<br>-reporting behaviours subject to recall bias; questionnaires administered at an unknown time point following injury<br>-did not assess *actual* behaviours following injury; operational definition ( "playing through injury as defined…") applied as an inclusion criteria only<br>-narrow age range captured (18 to 24 years old) |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | toughness (i.e., risk, pain and injury)<br>-AIMS negative affect subscale scores significantly predicted athlete behavioural intentions to play through an injury; athletes with stronger AIs were more likely to play through an injury | |
| [48]; Brewer et al. (2010) | 1) US<br>2) n=108 (66.7% Male)<br>3) 90% Caucasian<br>4) 29.38 ± 9.93; range: 14 to 54 years old<br>5) Physical therapy clinics<br>6) -<br>7) Competitive 47%; Recreational 49%; Non-Athletes 4%<br>8) - | 1) Yes: ACL tear<br>2) ACL tear<br>3) -<br>4) - | 1) Prospective longitudinal<br>2/3) To test the following predictions in a sample of physically active people who tore their ACL and underwent reconstructive surgery and rehabilitation: (i) decreasing one's AI after ACL surgery could help to preserve self-esteem in the face of formidable threat to short- and potentially long-term sport participation, and ii) greater decrements in AI are expected for those individuals who are experiencing slow postoperative recovery. | 1) -<br>2) - | 1) 7 items<br>2) Multiple: Time 1: pre-operation; Time 2: 6-months post-operation; Time 3: 12-months post-operation; Time 4: 24-months post-operation.<br>3) Time 1 = 32.14 ± 8.83<br>Time 2 = 31.62 ± 8.23<br>Time 3 = 29.07 ± 8.47<br>Time 4 = 28.45 ± 8.09<br>4) Subjective rating of rehabilitation progress (%) | -Time 1 and Time 2, Time 3 and Time 4 AIMS scores were not significantly different; all other time point comparisons were significantly different and adjusted for age and gender<br>-subjective ratings of rehabilitation progress significantly predicted AIMS score differences between Time 2 and 3 after adjusting for Time 1 AIMS score, gender and age; athletes who experienced a slower recovery were more likely to experience greater decreases to their AI | Strengths:<br>- sufficient time between follow-up points<br>- long-term follow-up; only study to gather information 2-years post-injury<br>-Bonferroni correction applied to tests of multiple comparisons<br>-equal distribution of competitive and recreational level athletes<br>-wide age range captured (14 to 54 years old)<br><br>Limitations:<br>-details about sports captured not provided<br>-frequency and years of sport involvement not provided<br>-details about sport injury not provided<br>-males and Caucasians were overrepresented in the sample; findings not generalizable to females and other races<br>-small number of cases included in the data set for analysis (53.7% of total sample); no indication if tests of significance were conducted between included/excluded cases |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | | -limited number of covariates included in regression models<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [47];<br>Brewer et al. (2007) | 1) US<br>2) n=91 (63.7% Male)<br>3) 29.73 ± 10.24; range: 14 to 54 years old<br>4) Physical therapy clinics<br>5) -<br>6) Competitive 43%; Recreational 54% | 1) Yes: ACL tear<br>2) ACL<br>3) -<br>4) ACLR Rehabilitation | 1) Prospective longitudinal<br>2) To examine predictors of daily pain and negative mood over the first 6 weeks of rehabilitation following ACL reconstruction. | 1) Wiese-Bjornstal et al. (1998)<br>2) Integrated Model of Response to Sport Injury | 1) 7 items<br>2) Baseline: pre-operation<br>3) 30.36 ± 9.71<br>4) NEO-FFI – Neuroticism Subscale; LOT-R; PDS; number of physical therapy appointments per/day; HOMEX (frequency of exercise completion with and without videocassette use); HOMEXRAT (division of HOMEX by number of sets of home rehabilitation exercises prescribed for a given day); EXERCISE (number of minutes spent "on vigorous physical activity other than their rehabilitation exercises"); NRS; POMS-B | -AIMS score did not significantly and independently predict average daily pain<br>-AIMS score did not significantly and independently predict negative mood<br>-significant interaction between AIMS score and number of days since surgery with respect to predicting negative mood; athletes with stronger AIs experienced greater decreases in negative mood as number of days since surgery increased | Strengths:<br>-similar representation of recreational and competitive level athletes<br>-one of three studies that assessed *actual* rehabilitation behaviours (e.g., home exercise completion, cryotherapy)<br>-wide age range captured (14 to 54 years old)<br><br>Limitations:<br>-details about sports captured not provided<br>-frequency and years of sport involvement not provided<br>-details about sport injury not provided<br>-males and Caucasians were overrepresented in sample; findings not generalizable to females and other races<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [46];<br>Brewer et al. (2003) | 1) US<br>2) n=61<br>3) 92% Caucasian<br>4) 26.03 ± 7.99; range: 14 to 47 years old<br>5) Physical therapy clinic<br>6) -<br>7) Competitive 57%; Recreational 41%<br>8) - | 1) Yes: ACL tear<br>2) ACL<br>3) -<br>4) ACL reconstruction; Accelerated Rehabilitation Protocol | 1) Prospective longitudinal<br>2) To investigate whether prospective associations among psychological factors and rehabilitation adherence differ as a function of age through re-analysis of | 1a) Wiese-Bjornstal et al. (1998)<br>2a) Integrated Model of Response to Sport Injury<br><br>1b) Brewer (1994) | 1) 10 items<br>2) Baseline: ~ 10 days pre-operation<br>3) 44.16 ± 9.98<br>4) SMI; SSI; BSI; SIRAS [x]; ratio of appointments attended to scheduled; Home Rehabilitation Adherence – Exercise Completion; Home Rehabilitation | -significant interaction between age and AIMS score with respect to predicting: i) home exercise adherence and ii) cryotherapy use; younger athletes with stronger AIs were more likely to complete at home exercises and to utilize cryotherapy | *Strengths:*<br>-one of three studies that assessed *actual* rehabilitation behaviours (e.g., home exercise completion, cryotherapy)<br>-wide age range captured (14 to 47 years old)<br><br>*Limitations:* |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | data from a previously published report. | 2b) Cognitive Appraisal Models of Adjustment | Adherence – Cryotherapy | | -competitive athletes were overrepresented in sample<br>-males and Caucasians were overrepresented in sample; findings not generalizable to females and other races<br>-details about sports captured not provided<br>-frequency and years of sport involvement not provided<br>-AIMS only assessed at one time point<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [53]; Manuel et al. (2002) | 1) US<br>2) Time 1 (baseline): n=48 (58.3% Female); Time 2 (3 weeks) n=44; Time 3 (6 weeks) n=40; Time 4 (12 weeks) n=34<br>3) 85% Caucasian<br>4) Range: 15 to 18 years old<br>5) MSK Outpatient Physical Therapy Department at Wakeforest University<br>6) Males: Football (56%); Baseball (11%); Wrestling (11%); Females: Soccer (25%); Basketball (21%); Track (14%); Volleyball (7%)<br>7) -<br>8) - | 1) Yes: "athletes who would be out of sports for at least 3 weeks."<br>2) Most common injury was ACL (no % provided); Injury Severity Scale as completed by the attending orthopedic surgeon. Scores range from 1 to 4, with a lower score indicating a less severe injury; M=2.50 (SD=1.26).<br>3) As per definition, out of sport for at least 3 weeks<br>4) - | 1) Prospective longitudinal<br>2) To explore patterns of psychological distress in adolescents experiencing sport injuries. | 1) -<br>2) - | 1) 10 items<br>2) Baseline: post-injury<br>3) 47.20 ± 9.78<br>4) ISS[x]; APES; PRQ-R-S; ACS; BDI | -AIMS score significantly predicted depression scores; athletes with stronger AIs were more likely to experience more severe depressive symptoms | *Strengths:*<br>-range of sports captured<br>-one of two studies to assess injury severity (based on physician rating)<br><br>*Limitations:*<br>-frequency and years of sport involvement not provided<br>-few details provided with respect to injuries captured<br>-small sample size<br>-Caucasians were over-represented in sample; findings may not be generalizable to other races<br>-AIMS only assessed at one time point<br>-narrow age range captured (15 to 18 years old) |
| [35]; Green et al. (2001) | 1) US<br>2) n=30 (60% Male)<br>3) 93.3% Caucasian<br>4) M=30.8 (SD=missing); range: 19 to 70 years old<br>5) Sport medicine clinics, physical therapy clinics and orthopedic centers | 1) Yes: "discontinuance of regular physical activity/sport that was operationally defined as 30 minutes of physical activity a week, for a period of at least 6 weeks." | 1) Cross-sectional<br>2) To examine coping skills and social support to better understand those individuals most vulnerable to injury. | 1a) Kubler-Ross et al. (1969)<br>2a) Stage Models of Grief<br><br>1b) Brewer (1994) | 1) 10 items (note: 5-point Likert response scale used)<br>2) Baseline: post-injury<br>3) 43.10 ± 11.51<br>4) ACSI; POMS; PSPP; SSQ | -negative but non-significant association between AIMS score and depressive mood<br>-moderate positive and significant association between AIMS score and physical conditioning | *Strengths:*<br>-captured a range of MSK injuries<br>-wide age range captured (19 to 70 years old)<br>-clear operational definition of injuries eligible for inclusion |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | 6) -<br>7) -<br>8) Minimum of 30 minutes of sport or physical activity /week. | 2) 50% knee injury; 26.7% other (three foot injuries, one broken tibia/fibula, one herniated disc, one broken arm); 10% shoulder injury; 6.7% hip injury; 3% ankle injury<br>3) As per definition "at least 6 weeks", no additional data provided<br>4) - | | 2b) Cognitive Appraisal Models of Adjustment<br><br>1c) Lazarus & Folkman (1984)<br>2c) Cognitive Appraisal Models of Adjustment<br><br>1d) Andersen & Williams (1988)<br>2d) A Model of Stress and Athletic Injury<br><br>1e) Wiese-Bjornstal et al. (1998)<br>2e) Integrated Model of Response to Sport Injury | | -AIMS score did not significantly predict depressive symptom severity | *Limitations:*<br>-information about sports and levels of athlete sport involvement not provided<br>-Caucasians were over-represented in sample; findings may not be generalizable to other races<br>-small sample size<br>-AIMS only assessed at one time point |
| [51]; Brewer et al. (2000) | 1) US<br>2) n=95 (70.5% Male)<br>3) 88% Caucasian<br>4) 26.92 ± 8.23<br>5) Physical therapy clinic<br>6) -<br>7) Competitive (52%); Recreational (43%); Non-Athletes (3%); Missing (2%)<br>8) - | 1) Yes: ACL tear<br>2) ACL tear<br>3) -<br>4) Accelerated ACL rehabilitation protocol as developed by Shelbourne et al.; emphasis on early attainment of ROM, quadriceps strength and normal gait | 1) Prospective longitudinal<br>2) To examine the relationships among psychological factors, rehabilitation adherence, and rehabilitation outcomes after ACL reconstruction. | 1a) Brewer (1994)<br>2a) Cognitive Appraisal Models of Adjustment<br><br>1b) Wiese-Bjornstal et al. (1998)<br>2b) Integrated Model of Response to Sport Injury<br><br>1c) Self-developed by authors<br>2c) Adapted model based on above referenced models (see article) | 1) 10 items<br>2) Baseline: ~ 10 days pre-operation<br>3) 41.65 ± 12.16<br>4) SMI; SSI; BSI; SIRAS [x]; ratio of appointments attended to scheduled; Home Rehabilitation Adherence – Exercise Completion; Home Rehabilitation Adherence – Cryotherapy; KT 1000 (Joint Laxity); One Leg Hop Distance; LKSS | -small positive and significant association between AIMS score and motivation<br>-moderate positive and significant association between AIMS score and joint laxity as measured 6 months following ACL reconstructive surgery<br>-small positive and significant association between AIMS score and i) one leg hop distance and ii) knee function as measured 6 months following ACL reconstructive surgery<br>-AIMS score significantly predicted joint laxity as measured 6 months following ACL reconstructive surgery; athletes with stronger | *Strengths:*<br>-large sample size<br>-only study to measure functional injury outcomes (e.g., joint laxity, one leg hop distance, pain) using objective measures<br><br>*Limitations:*<br>-exclusively captured ACL injuries; findings may not be generalizable to other injuries<br>-frequency and years of sport involvement not provided<br>-males and Caucasians were over-represented in sample; findings may not be generalizable to females and other races<br>-AIMS only assessed at one time point |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| | | | | | | AIs were more likely to have similar knee joint stability between the affected and unaffected leg | -exclusively captured ACL injuries; findings may not be generalizable to other injuries |
| [26];<br>Brewer (1993) | *Study 3*<br>1) US<br>2) n=121 (M: 66.9%)<br>3) -<br>4) -<br>5) Sport medicine clinics in Phoenix, Arizona<br>6) -<br>7) -<br>8) -<br><br>*Study 4*<br>1) US<br>2) n=90 (Injured: 16.7%); 100% Male<br>3) -<br>4) -<br>5) University of California Varsity Football Team<br>6) -<br>7) -<br>8) - | *Study 3*<br>1) No<br>2) Physician-rated injury severity on a 3-point scale (1=mild, 2=moderate, 3=severe); M=2.10<br>3) Injury status at time of enrollment on a 7-point scale (1=acutely injured, 7=completely recovered) M= 3.53<br>4) -<br><br>*Study 4*<br>1) No<br>2) -<br>3) -<br>4) - | *For Both Studies*<br>1) Cross Section Observational<br>2) To test the prediction that individuals who maintain strong, exclusive identification with the athlete role are more likely to become depressed following an athletic injury than individuals without such an identification.<br><br>*Study 3*<br>3) To assess the extent to which AI was related to depressed mood in a sample of athletes who were already injured.<br><br>*Study 4*<br>3) To investigate the relationship between AI and depressed mood in a sample of both injured and uninjured athletes. | 1a) Abramson et al. (1989); Alloy et al. (1988); Beck (1967, 1970); Dance & Kuiper (1987); Linville (1987); Robins & Block (1988)<br>2a) Cognitive Diathesis-Stress Models of Depression<br><br>1b) Oatley & Bolton (1985)<br>2b) Social-Cognitive Theory of Reactive Depression | *Study 3*<br>1) 10 items<br>2) Baseline: ~2 weeks following injury<br>3) 47.93 ± 9.98<br>4) PSPP-G; SARRS; POMS-D; BDI<br><br>*Study 4*<br>1) 10 items<br>2) Baseline: pre-season<br>3) Injured = 48.47 ± 9.09 Non-Injured = 51.60 ± 9.09<br>4) PSPP-G; SARRS; POMS-D; BDI | *Study 3:*<br>-AIMS score was not significantly associated with depressive symptom severity<br>-AIMS score was a significant independent predictor of depressive symptom severity; athletes with stronger AIs were more likely to experience more severe symptoms of depression<br>-small positive and significant association between AIMS scores and physician-rated injury severity<br><br>*Study 4:*<br>-significant interaction between AIMS score and physician-rated injury severity in regard to predicting depressive symptom severity; athletes with a stronger AI and more severe injury were more likely to experience depressive symptoms of a greater severity<br>-no significant difference in AIMS score between injured and uninjured groups | *Strengths (Study 3):*<br>-one of two studies to assess injury severity (based on physician rating)<br>-large sample size<br><br>*Limitations (Study 3)*:<br>-males were overrepresented in sample; findings may not be generalizable to females<br><br>*Strengths (Study 4):*<br>-only study to compare AIMS scores between injured and uninjured group of athletes<br><br>*Limitations (Study 4):*<br>-exclusively captured male football players; findings may not be generalizable to females and other sports<br>-very small proportion of injured athletes captured (20% of total sample)<br><br>*Strengths (Both Studies):*<br>-cross validated depressive symptom severity using two measures of depression<br><br>*Limitations (Both Studies):*<br>-details about sport injury not provided<br>-frequency and years of sport involvement not provided<br>-AIMS only assessed at one time point<br>-no operational definition of sport injury provided |

Legend: - = missing data point, × = clinician reported data; ⊗ = item mean score; AAQ = Acceptance and Action Questionnaire; ACL = anterior cruciate ligament; ACS = Adolescent Cope Scale; ACSI – Adolescent Coping Skills Inventory; AER = Attempt an Expedited Rehabilitation; AGS-YS = Achievement Goal Scale for Youth Sports; AI = athletic identity; AIMS = Athletic Identity Measurement Scale; ACLR = Anterior Cruciate Ligament Reconstruction; BC = Brief Cope; BCope = Brief COPE; BCQ = Body Checking Questionnaire; BDI = Beck Depression Inventory ; BSI = Brief Symptom Inventory; CAI = Rosenbaum and Arnett's Concussion Attitudes Index; CEI = Change-Event Inventory; CKI = Concussion Knowledge Index; CSAI-2R = Competitive State Anxiety Inventory 2-R; DASS 21 = Depression, Anxiety and Stress Scale; DRS = Dispositional Resiliency Scale; FPI = Freiburger Persönlichnkeitsinventar – Personality; FRQ = Fear of Reinjury Questionnaire; HOMEX = home exercise completion with and without videocassette; IES-R = Horowitz Impact of Event Scale – Revised ; IPR = Ignore Practitioner Recommendations; ISS = Injury Severity Scale ; LESCA = Life Events Survey for Collegiate Athletes; LKSS = Lysholm Knee Scoring Scale; LOT-R = Life Orientation Test – Revised; MCS-YS = Motivational Climate Scale for Youth Sports; MPQ-SF = McGill Pain Questionnaire-Short Form; MSK = musculoskeletal; MSPSS = Multidimensional Scale of Perceived Social Support; MTS = Mental Toughness Scale; NAIA = National Association of Intercollegiate Athletics; NCAA = National Collegiate Athletics Association; NEO-FFI – Neuroticism Subscale = NEO Five Factor Inventory = Neuroticism Subscale; NRS = Numerical Rating Scale; PCL = posterior cruciate ligament; PCS = Pain Catastrophizing Scale; PDS = Perceived Daily Stress; PIB = Perceived Injury Behaviour; PIMCQ-2 = Parent-Initiated Motivational Climate Questionnaire-2; PPI-A = Psychological Performance Inventory-A; POMS = Profile of Mood States; POMS-B = Profile of Mood States – B (Abbreviated Version); POMS-D = Profile of Mood States – Depression; PRSII = Psychological Response to Sport Injury Inventory ; PSPP = Physical Self-Perception Profile; PSPP-G = Physical Self-Perception Profile – Global Physical Self-Worth Subscale; RAQ = Rehabilitation Adherence Questionnaire; ROAQ = Rehabilitation Over Adherence Questionnaire; ROM = range of motion; RPIQ = Risk of Pain and Injury Questionnaire; RPQ-R-S = Personal Resource Questionnaire-Revised-Social Support; SARRS = Social and Athletic Readjustment Scale; SAS-2 = Sport-Anxiety Scale-2; SIP 15 = Sports Inventory for Pain; SIRAS = Sport Injury Rehabilitation Adherence Scale; SIRBS = Sport Injury Rehabilitation Belief Scale; SMI = Self-Motivation Inventory; SMS = Sport Motivation Scale; SMTQ = Sports Mental Toughness Questionnaire; SNS = Social Network Scale; SPSQ = Self Presentation in Sport Questionnaire; SSI = Social Support Inventory; STAI X1 = State Anxiety

**Sports & Athlete Descriptors**

Athletes were involved in a range of team and individual sports however several studies did not specify sport background (26, 35, 46-51). Furthermore, two studies included a small proportion (3% (48) and 4% (51)) of self-defined “non-athletes”. Authors of this review chose to include these studies due to the small number of non-athletes (n = 7 total) included in analyses. Samples consisted of recreational (e.g., house league) and competitive athletes (e.g., elite, NCAA). Several studies did not report on this metric (26, 35, 49, 52-54). Sport involvement (e.g., frequency of and years involved in sport) was heterogeneous and reported within six studies (35, 43, 45, 55-57). Sport participation ranged from 30 minutes (35) to 14.19 (SD= 9.40) hours per week (55) and years of sport involvement ranged from 6.64 years (SD=3.98) (57) to 11.17 years (SD= 4.31) (45). See Table 2, column 2.

**Injury Descriptors**

Musculoskeletal (MSK) injuries were the most common injuries cited. Nine studies reported exclusively on anterior cruciate ligament (ACL) surgical outcomes, while two (42, 54) exclusively examined concussion. The remaining 11 studies captured various MSK injuries. Of these 11 studies,  one did not specify an exact injury but indicated injury to lower or upper extremities (41), one captured both MSK injuries and concussion (43) and two studies did not define the injuries sustained (26, 53). Of these two, one indicated injury severity on a scale ranging from 1 (mild) to 3 (severe) (26) while the other stated that the majority of injuries were ACL tears, but did not specify the exact proportion (53). Time away from sport due to injury varied, ranging from 24 hours (41, 43) to 63 weeks (55). Ten studies did not specify a length of absence. Three studies (41, 43, 57) reported on athletes who sustained multiple injuries during the data collection period while the remaining 19 captured a first (i.e., initial) injury only. See Table 2, column 3.

**Definitions & Theoretical Models**

Operational definitions of injury were specified in each study except one (26). Those that captured ACL and concussions exclusively, indicated a diagnosed ACL tear or diagnosed or self-reported concussion in lieu of an operational definition. Eleven studies referenced injury models as a means of justification for study methodologies used. The most frequently cited model was the *Integrated Model of Response to Sport Injury (30)*. Several other theories unrelated to sport injury were also referenced. See Table 2, column 5.

Wiese-Bjornstal and colleagues' injury model (30) (see Appendix C, Figure 2) suggests an athlete's cognitive appraisal (e.g., rate of perceived recovery, cognitive coping, etc.) of the injury is a primary driver of outcome (i.e., physical, behavioural and emotional). Seven studies explicitly measured cognitive appraisal via subjective rehabilitation progress (48), coping skills and strategies used (35, 44, 45, 53), psychological response to injury (44), readiness to return to sport (56) and rehabilitation beliefs (58). Most outcome measures sought to typify athlete personal factors. A small proportion of studies (n=6) used measures that isolated situational factors (e.g., sport, social and environmental) (35, 41, 46, 51, 54, 58), but only assessed social support (e.g., availability, quality and source).

**Measuring AI**

The Athletic Identity Measurement Scale (AIMS) (59), 7 or 10-item version, was used exclusively to quantify the strength of AI (see Table 2, column 6). The AIMS consists of three sub-scales: social identity (i.e., the extent to which the individual views themselves as occupying the athlete role), exclusivity (i.e., the extent to which the individual defines their self-worth based on the athlete role), and negative affectivity (i.e., the extent to which the individual experiences negative emotions from undesired outcomes associated with the athlete role) (59). The findings summarized below are specific to AI. Analyses that did not consider AI were excluded from the summary. Findings were grouped into the following categories: demographic, psychosocial, behavioural, injury-specific and pain. Several studies also investigated the association between injury (as an exposure) and AI (as an outcome). These findings are presented at the end of this section.

**Demographics**

Findings pertaining to AI and sex were presented in two studies but were inconsistent. One study found that sex significantly predicted AIMS sub-scales scores, with males having significantly higher scores on each subscale (e.g., social, exclusivity and negative affect) than females (57). Padaki and colleagues also compared AIMS scores by sex (M=56.6 vs. 53.4 for females and males, respectively), but this difference was not significant (p=0.092). They also examined AIMS scores by sport involvement (single vs. multi-sport athletes) and was the only study to have done so. Interestingly, single sport athletes reported a significantly stronger AI (M=57.7) compared to multi-sport athletes (M=52.8, p=0.043). Two studies investigated AI and age (42, 49), with both identifying a negative non-significant association (as age increased, AI decreased). See Table 2, column 7.

**Psychosocial**

Depressive symptoms were measured in six studies, but only five presented findings in relation to AIMS scores. Correlational analyses were conducted in two of the studies (35, 52) while regression models were constructed in the other three (26, 47, 53). Correlational analysis identified a large positive significant association between AI and depression scores (52), while findings from the other study identified a small negative but non-significant association (35). Beta coefficients generated from regression models illustrated a similar positive relationship between AI and depressive symptom severity, while also adjusting for several covariates. Two studies included AIMS scores in their models as an interaction term, one with injury severity (26) and one with number of days since surgery (47). Although both models indicated that interaction terms explained a greater variance in depression scores compared to when AIMS scores were entered alone, only one interaction coefficient was significant (47). Despite evidence suggesting that athletes with stronger AIs were more likely to experience depressive symptoms following a sport-related injury, findings also indicated that they experienced greater improvements in their mood throughout the post-surgical follow-up period (47). Four studies assessed anxiety, but only one study compared anxiety symptoms (e.g., sport-related performance, somatic, concentration disruption and worry) to AI (54). Despite anxiety symptoms being positively, albeit weakly, correlated to AI (*r*= 0.14; 0.13; 0.21; 0.05, respectively, for the type of anxiety symptoms noted in the previous sentence), findings were not significant. Another study assessed athletes for symptoms of post-traumatic stress disorder (PTSD; e.g., hyperarousal, avoidance, and intrusive thoughts) (49) and compared PTSD scores between “high” and “low” AI groups prior to ACL reconstructive surgery. Group differences were not significant.

AI was significantly associated with several other, albeit more abstract, psychosocial constructs including sport performance traits, physical self-worth, motivation, and social

363 network size. Traits associated with sport performance such as ego-orientation (example scale 364 item: "The most important thing is to be the best athlete") and mastery-orientation (example 365 scale item: "My goal is to learn new skills and get as good as possible") were significantly 366 associated with AI as represented by the moderate effect sizes observed (54). One study 367 correlated physical self-worth (i.e., perceived sport competence, perceived muscular and 368 physical strength and conditioning) to AI and identified a positive moderate and significant 369 association among athletes shortly after they began a rehabilitation program (35). One study 370 also identified a small significant association between AI and generalized motivation (51). 371 Similarly, a moderate positive significant association was also identified between motivational 372 climate in sport (as facilitated by parental figures) and AI. Athletes with stronger AIs also 373 maintained greater intrinsic and extrinsic motivation towards participation in sport (54). 374 Although social support was assessed in seven studies, only two presented findings in relation 375 to AI. Findings indicated that the maintenance of larger social networks was moderately 376 positively and significantly associated with AI (54). Petrie and colleagues also examined the 377 relationship between AI and social support but with respect to family, friends and significant 378 others. Small positive but non-significant associations were identified between support 379 provided by family, friends and AI but a negative association for significant others. See Table 2, 380 column 7.

381 **Behavioural**

382 Several studies investigated the relationship between AI and rehabilitation over 383 adherence, motivation, completion of exercises and accompanying treatments (e.g., 384 cryotherapy). One study identified a small significant positive association between AI and

385 beliefs pertaining to rehabilitation over adherence (55) and another found that stronger AIs
386 significantly and independently predicted over adherence (i.e., ignoring practitioner
387 recommendations and attempting to expedite the rehabilitation process) (56). Contrariwise,
388 one study found that athletes with AIs > 75$^{th}$ percentile were *less* likely attempt to return-to-
389 sport prior to medical clearance (43).

390 Exercise completion was assessed in three studies (46, 50, 51). Findings were
391 inconsistent. In one study, correlational analyses identified a small positive but non-significant
392 association between AI and exercise completion (51). Authors also entered AI as an interaction
393 term in regression models. When entered with subjective stress (50) a small positive significant
394 interaction was found. However, when entered with age in a different study, a negative
395 significant association was identified (46). Researchers also found that younger athletes were
396 significantly more likely to complete their exercises and cryotherapy treatments compared to
397 older athletes. Interestingly, the opposite relationship was observed in an earlier study but
398 findings were not significant (51).

399 In alignment with the findings discussed above, athletes with stronger AIs were
400 significantly more likely to place a greater value on and maintain greater motivation towards
401 the rehabilitation process (58). Similarly, beliefs and attitudes regarding rehabilitation were also
402 examined (57). Authors allocated athletes into sub-groups based on their AIMS score (*low* = <
403 25$^{th}$ percentile; *moderate* = between 25 and 75$^{th}$ percentile; *high* = > 75$^{th}$ percentile). Athletes
404 in the *high* sub-group reported significantly greater positive attitudes and tendencies to play
405 through pain and injury than athletes in the *low* and *moderate* groups. When entered into a
406 hierarchical regression model, AIMS exclusivity and negative affect subscales significantly

predicted attitudes pertaining to toughness (i.e., regarding risk, pain and injury in sport), social role choice (i.e., willingness to accept risk, pain and injury in sport as a part of the athlete role) and “pressed” (i.e., the perception of pressure felt from others to play with pain and injury) across each sub-group. However, only the AIMS negative affect sub-scale was found to be a significant independent predictor of perceived injury behaviours (i.e., intention to play through injury) (57). A similar finding was identified by Kroshus and colleagues in their investigation of concussion reporting behaviours. They found that athletes with stronger AIs were slightly and significantly more likely to engage in non-reporting behaviours than athletes with weaker AIs (42). Additional variance was explained when perceived concussion reporting norms were added to their model. See Table 2, column 7.

**Injury-Specific Outcomes**

Injury severity, risk and functional outcomes were examined in several studies. Significant small effect sizes were identified between AI and physician-rated injury severity (26). Similarly, another study indicated that stronger AIs were moderately positively and significantly associated with concussion symptom severities at follow-up time points (~14-21 and ~21-28 days post-concussion). When entered into a hierarchical regression model, AI significantly predicted post-concussion symptom severities ~21-28 days following injury (54). With respect to injury risk, one study found that athletes with AIMS scores < $25^{th}$ percentile faced a greater risk compared to those > $25^{th}$ percentile, but this difference was not significant (43). Notably, athletes with AIMS scores > $75^{th}$ percentile were significantly more likely to have incurred a subsequent injury during the data collection period.

Only one study assessed functional recovery outcomes. Measured 6 months following ACL reconstructive surgery, AI was moderately positively and significantly associated with improved joint stability (i.e., less anterior and posterior laxity in the knee joint, improved single leg hoping scores, and improved subjective knee function [i.e., limping, locking, instability, support, swelling, stairclimbing, and squatting]) (51). Findings were replicated in regression models which indicated that AI was a significant and positive independent predictor of joint stability. Psychological distress was identified as a significant negative independent predictor. See Table 2, column 7.

**Pain**

Measures assessing subjective ratings of pain were administered in six studies, however only two analyzed pain ratings in relation to AIMS scores (47, 52). Both studies identified small negative non-significant associations between AI and post-surgical pain ratings. See Table 2, column 7.

**The Relationship Between Injury as an Exposure & AI as an Outcome**

Of the three studies that assessed AI at multiple time points (44, 45, 48), only one (44) assessed AI prior to and following injury. One study found that AIMS scores decreased significantly over time (pre-surgery compared to 6, 12 and 24 months post-surgery) after adjusting for age, sex and rehabilitation progress (48). Scores did not change significantly between pre-op and 6-months nor between 12 and 24-month follow up, but all other comparisons were significant. Madrigal et al., also assessed AIMS at two time points: pre-season and return-to-sport (44). Small decrements in AI were observed but were non-significant. The final study did not conduct tests of statistical significance (45). See Table 2, column 6 & 7.

**Study Strengths & Limitations**

The studies captured within this review have several strengths and limitations for the reader to consider. First, the body of literature spans a 25-year period (1993 to 2018). This artifact implies that any trend or change with respect to athletes' conceptualization of AI that may have occurred as a result of cultural progression (i.e., a shift over time in group norms, the importance of the athlete role, and cultural values and ideals as they pertain to sport) is represented within the data itself. Most studies either defined a specific injury (e.g., ACL tear) or provided an operational definition of sport injury, thus ensuring that inclusion criteria were applied consistently. Due to exclusive use of the AIMS, AI was conceptualized and assessed equivocally across all studies. This allows for a direct comparison of AIMS scores from one study to another. Finally, almost half of the studies included athletes from a variety of sport backgrounds, increasing the external validity of these respective studies' findings.

One of the most important limitations for readers to consider is that AI was not the primary construct of interest within the majority of the studies identified; only seven studies (26, 41, 43, 48, 55, 57) explicitly stated that AI was a primary variable of interest within objective statements, and therefore the main variable of interest within statistical tests. Therefore, it is possible that significant relationships between AI and the assessed injury outcomes were present but went unidentified. Being that a self-report measure was used to quantify the strength of AI, reports may have been skewed by a social desirability bias; athletes may have reported a stronger AI than their *actual* AI because this would be seen as desirable to

471 other members (e.g., teammates, coaches) of their social group. Another limitation with
472 respect to the AIMS was timing and frequency of administration; 17 of 22 studies administered
473 the AIMS *following* an injury and 19 studies administered the AIMS at one time point.
474 Therefore, the existing body of literature cannot speak definitively to i) any change over time
475 with respect to the relationships observed between AI and the various injury outcomes
476 observed and ii) the relationship (if any) that exists between an injury (as an exposure) and AI
477 (as an outcome).

478 Being that most studies were conducted in the United States, findings represent
479 athletes who embody Western cultural values and attitudes towards sports and athletics.
480 Females and athletes who identify as having a disability (e.g., para-athletes) are
481 underrepresented in the literature, thus limiting the applicability of findings to these athlete
482 populations. Studies captured a variety of MSK injuries, but few investigated AI in athletes who
483 had sustained a sport-related concussion. Findings may not be generalizable to this population.
484 The majority of studies had small samples sizes (n<100: n=15; n>100: n=7). This may have
485 limited the type (e.g., correlation vs. regression modelling) and the extent (e.g., number of
486 predictor variables included in regression models) of statistical tests performed by authors.
487 Overall, sport involvement (e.g., frequency and years of involvement) as well as injury severity
488 was poorly described within most studies. This oversight makes it difficult to gauge the dose-
489 response relationship that exists between sport involvement and AI, and how this then relates
490 to the injury outcomes observed. See Table 2, column 8.

491

492 **DISCUSSION**

493

Literature describing the relationship between AI and sport-related injury outcomes has grown steadily over the past 25 years. Importantly, 18 of 22 studies identified for inclusion in this review originated from the United States. This is important to consider when interpreting the findings presented herein given the cultural importance that different societies place on specific sports and the athlete role (60-62). The athletes described were representative of many different sports and varying levels of competition, thus increasing the external validity of this review's findings to the general athlete population. Importantly, half of the identified studies referenced a theoretical model to inform study design and methodology. However, most investigators did not discuss or interpret their findings within the context of the models originally used to position their work. The integration of novel findings as they relate to the theoretical injury outcome models referenced is necessary to progress towards predictive modelling.

Injury outcomes associated with AI were grouped into five categories. Psychosocial, behavioural and injury-related outcomes dominated the literature, with relatively few studies reporting results within demographic, and pain-related categories. Several studies identified moderate to strong positive relationships between AI and depressive symptoms following injury. This aligns with cognitive diathesis-stress models of depression (63-68) as well as previous research that has identified sport injury as a risk factor for depression in athletes (69-72). When an athlete is unable to engage in sport, as is the case when an athlete sustains an injury, depressive symptoms may occur due to *ego dissonance* (i.e., an incongruence between who an individual believes themselves to be and their ability to fulfill their role responsibilities). As per cognitive diathesis-stress models (67), athletes low in self complexity (i.e., a self-schemata consisting of a limited number of identities or significant identity overlap) are subject to a greater risk for experiencing depression following an identity disruption (e.g., a sport injury) than athletes who maintain a multifaceted self-schemata (i.e., maintenance of multiple identities and roles). However, this explanation fails to account for if and how the *strength* and *importance* of a given identity (e.g., AI) moderates depression risk. Alternatively, depressive symptoms may manifest due to the fact that the athlete is no longer receiving the reciprocal benefits associated with role engagement. For example, studies captured in this review identified a significant positive relationship between AI and physical self-worth (35) and general motivation (51).

Behaviourally, evidence suggested that athletes with stronger identities were more likely to over adhere to prescribed rehabilitative protocols (55, 56). This could be due to an athlete's attempt to remain in an *ego syntonic* state. The athlete seeks congruence between who they think they are (an athlete) and their associated role responsibilities (engaging in competition, training with teammates), so they engage in behaviours that will expedite their recovery. This behaviour may be useful, as evidence suggested that stronger AIs were associated with improved functional outcomes (51).

Interestingly, pain appears to be negatively associated (although non-significantly) with AI. This might suggest that an element of mental toughness or grit accompanies stronger AIs (i.e., the ability to play through and downplay pain); both of the above traits having been previously associated with sport involvement (1, 2). It may also be the case that athletes with stronger AIs develop better coping skills to deal with injury pain and are better equipped to push through. An alternative explanation: athletes with stronger identities opt to push through minor injuries and ignore minor indicators of injury (i.e., pain) up to a certain threshold, which is supported by study findings (47, 52). Additional support for this explanation is provided by studies that identified positive significant associations between AI and injury severity (26, 54).

As stated previously, only three studies (44, 45, 48) assessed AI at multiple time points, with only one of these three having assessed AI prior to and following injury (44). Based on the available literature, there is insufficient evidence to define the relationship that exists (if any) between an injury (as an exposure) and AI (as an outcome).

**Strengths & Limitations**

Readers should consider the following strengths and limitations of the methodology used with this review. The search strategy used to identify studies was co-constructed with the help of a University of Toronto librarian. This collaboration ensured that i) the relevant databases for the review topic were searched, ii) the search strategy notation was applied correctly for each database, and iii) that the search terms (e.g., key words, subject headings) were exhaustive and appropriate to capture studies relevant to the review topic. To prevent bias, Covidence was used to blind reviewers' decisions to accept or reject articles throughout all screening stages. Use of Covidence also ensured that all studies identified within the search were reviewed (i.e., records were not missed). Finally, data extraction was conducted independently by both reviewers. This reduced the probability that study findings were transcribed erroneously within the data table and summarized incorrectly.

With respect to methodological limitations, authors did not conduct a quality and bias assessment of the identified studies. This is required and necessary prior to delineating implications for clinical care or conducting an intervention that seeks to alter AI in an attempt to improve injury outcomes. However, authors wish to remind readers that this is not the purpose of a scoping review (73) and is instead better suited to a systematic review. Researchers who wish to update this review with newly published literature should consider the use of a rigorous and widely accepted method of qualitative evaluation (e.g., *Downs & Black Checklist for Quality Assessment* (74)*)*. The exclusion of qualitative studies, theses/dissertations and non-English articles may have resulted in the exclusion of relevant data. Finally, the search strategy used herein primarily utilized databases (e.g., PubMed) to identify relevant studies. The incorrect labeling (e.g., MeSH subject headings) of studies or studies published within journals not indexed within the databases searched were therefore missed (if any).

**CONCLUSIONS**

Findings from this review highlighted several significant and positive associations between AI and psychosocial (e.g., depressive symptoms, performance traits, physical self-worth, motivation), behavioural (e.g., rehabilitation over adherence, playing through pain and suspected injury) and injury-related (e.g., function and injury severity) outcomes. Assessing AI prior to the start of a rehabilitation protocol may give both the athlete and treating clinician a road map of what to expect with respect to mindset, behaviours and recovery outcomes. Importantly, readers should consider the floor and ceiling effects of AI with respect to the relationships identified. A somewhat limited variability in mean AIMS scores does not allow for a complete representation of the AI as it relates to injury outcomes. Future studies should aim to capture athletes with a wider range of AIMS scores (i.e., AI of varying strengths) as well as non-athletes who have also experienced an injury. Readers should also consider the over representation of Caucasian male, able-bodied athletes and MSK injuries identified in this review. Homogeneity in these domains limits the external validity of findings to other racial groups, females, and sport-related concussion populations. Subsequent studies should include para-athletes as no study included in this review considered this population. Importantly, limitations associated with study design and methodology within this body of literature preclude any causal inferences from being made (i.e., AI as a cause of the injury outcomes observed).

This review also highlights a large gap in knowledge with respect to the association (if any) that exists between injury (as an exposure) and AI (as an outcome). Studies must utilize prospective longitudinal designs that assess AI prior to and following the occurrence of injury in order to speak to this relationship. Additional consideration should be given to the inclusion of multiple long-term follow-up observations. As per the Wiese-Bjornstal et al. injury model (30), an athlete's cognitive appraisal of the injury event is a central tenant to the outcomes observed. Despite its importance, few studies directly assessed an athlete's cognitive appraisal of their injury. Researchers may wish to inform the development of their study protocols while referencing a theoretical model. This will facilitate a more holistic understanding of the outcomes observed.

**Data Sharing**

All data relevant to the study are included in the article or uploaded as supplementary information.

**REFERENCES**

1. Guillén F, Laborde S. Higher-order structure of mental toughness and the analysis of latent mean differences between athletes from 34 disciplines and non-athletes. *Pers Individ Dif*2014;60:30-5.
2. Laborde S, Guillén F, Mosley E. Positive personality-trait-like individual differences in athletes from individual- and team sports and in non-athletes. *Psychol Sport Exerc*2016;26:9-13.
3. Kipp LE. Psychosocial aspects of youth physical activity. *Pediatr Exerc Sci*2017;29(1):35-8.
4. Slutzky CB, Simpkins SD. The link between children's sport participation and self-esteem: exploring the mediating role of sport self-concept. *Psychol Sport Exerc*2009;10(3):381-9.
5. Merkel DL. Youth sport: positive and negative impact on young athletes. *Open Access J Sports Med*2013;4:151-60.
6. Varkevisser RDM, van Stralen MM, Kroeze W, et al. Determinants of weight loss maintenance: a systematic review. *Obesity Reviews*2019;20(2):171-211.
7. Hu MX, Turner D, Generaal E, et al. Exercise interventions for the prevention of depression: a systematic review of meta-analyses. *BMC Public Health*2020;20:1255.
8. McDowell CP, Dishman R, Gordon BR, et al. Physical ativity and anxiety: a systematic review and meta-analysis of prospective cohort studies. *Am J Prev Med*2019;57(4):545-56.
9. Singh A, Uijtdewilligen L, Twisk JWR, et al. Physical activity and performance at school: a systematic review of the literature including a methodological quality assessment. *Arch Pediatr Adolesc Med*2012;166(1):49-55.
10. Loprinzi P, Frith E, Edwards MK, et al. The effects of exercise on memory function among young to middle-aged adults: systematci review and recommendations for future research. *Am J Health Promot*2018;32(3):691-704.
11. Bueno AM, Pilgaard M, Hulme A, et al. Injury prevalence across sports: a descreptive analysis on a representative sample of the Danish population. *Inj Epidemiol*2018;5(6).
12. Räisänen AM, Kokko S, Pasanen K, et al. Prevalence of adolescent physical-activity-related injuries in sports, leisure time, and school: the National Physical Activity Behaviour Study for children and adolescents. *BMC Musculoskelet Disord*2018;19(1):58.
13. Fridman L, Fraser-Thomas JL, McFaull SR, et al. Epidemology of sports-related injuries in children and youth presenting to Canadian emergency departments from 2007-2010. *BMC Sports Sci Med Rehabil*2013;5:30.
14. Centers for Disease Control and Prevention. Sports-related injuries among high school athletes-United States, 2005-06 school year. *Morb Mortal Wkly Rep*55(38):1037-40.
15. Steinbrück K. Epidemiology of sports injuries— 25-year-analysis of sports orthopedic-traumatologic ambulatory care. *Sportverletz Sportschaden*1999;13(2):38-52.
16. Yang J, Tibbetts AS, Covassin T, et al. Epidemiology of overuse and acute injuries among competitive collegiate athletes. *J Athl Train*2012;47(2):198-204.
17. Williams JM, Andersen MB. Psychosocial antecedents of sport injury: review and critique of the stress and injury model. *J Appl Sport Psychol*1998;10(1):5-25.
18. Wiese-Bjornstal DM. Sport injury and college athlete health across the lifespan. *Journal of Intercollegiate Sports*2009;2:64-80.
19. Meeuwisse WH. Assessing causation in sport injury: a multifactorial model. *Clin J Sport Med*1994;4:166-70.

20. Brewer BW, Van Raalte J, Linder DE. Athletic identity: Hercules' muscles or Achilles heel? *Int J Sport Psychol*1993;24(2):237-54.
21. Chen S, Snyder S, Magner M. The effects of sport participation on student-athletes' and non-athelte students' social life and identity. *J Issues Intercoll Athl* 2010;3:176-93.
22. Horton R, Mack D. Athletic identity in marathon runners: functional focus on dysfunctional commitment. *J Sport Behav*2000;23(2):101-19.
23. Marsh HW, Perry C, Horsely C, et al. Multidimensional self-concepts of elite athletes: how do they differ from the general population. *J Sport Exerc Psychol*1995;17(1):70-83.
24. Petitpas A. Identity foreclosure: a unique challenge. *Personnel and Guidance Journal*1978;56(9):558.
25. Porat Y, Lufi D, Tenenbaum G. Psychological components contribute to select young female gymnasts. *Int J Sport Psychol*1989;20(4):279-86.
26. Brewer BW. Self-identity and specific vulnerability to depressed mood. *Journal of Personality*1993;61(3):343-64.
27. Brewer BW. Psychology of sport injury rehabiltiation In: G Tenenbaum, Eklund R, eds. Handbook of Sport Psychology. Hoboken, NJ: Wiley & Sons 2007:404-24.
28. Brewer BW. Injury prevention and rehabilitation. In: Brewer BW, ed. Sport Psychology. Chichester, UK: Wiley-Blackwell 2009:83-96.
29. Appaneal R, Perna F. Biopsychosocial model of injury. In: Eklund R, Tenenbaum G, eds. Encyclopedia of Sport and Exercise Psychology. United States: SAGE Publications, Inc. 2014: 74-6.
30. Wiese-Bjornstal DM, Smith AM, Shaffer SM, et al. An integrated model of response to sport injury: psychological and sociological dynamics. *J Appl Sport Psychol*1998;10(1):46-69.
31. Brewer BW. Review and critique of models of psychological adjustment to athletic injury. *J Appl Sport Psychol*1994;6(1):87-100.
32. McCrea M, Broshek DK, Barth JT. Sports concussion assessment and management: future research directions. *Brain Inj*2015;29(2):276-82.
33. Lazarus RS, Folkman S. Stress, Appraisal and Coping. New York, NY: Springer Publishing Company, Inc. 1984.
34. Eileen U. Coping and social support among injured athletes following surgery. *J Sport Exerc Psychol*1997;19:71-90.
35. Green SL, Weinberg RS. Relationships among athletic identity, coping skills, social support, and the psychological impact of injury in recreational participants. *J Appl Sport Psychol*2001;13(1):40-59.
36. Santi G, Pietrantoni L. Psychology of sport injury rehabilitation: a review of models and interventions. *J Hum Sport Exerc*2013;8(4).
37. Clarivate Analytics: EndNote (Version 7.7.1). Philadelphia, USA. Available from: https://endnote.com
38. Innovation VH: Covidence Systematic Review Software. Melborne, Australia. Available from: https://www.covidence.org
39. Munn Z, Peters MDJ, Stern C, et al. Systematic review or scoping review? Guidance for authors when choosing between a systematic or scoping review approach. *BMC Med Res Methodol*2018;18(1):143-7.

40. Caron JG, Bloom GA, Falcão WR, et al. An examination of concussion education programmes: a scoping review methodology. *Inj Prev*2015;21(5):301-8.

41. Petrie TA, Deiters J, Harmison RJ. Mental toughness, social support, and athletic identity: moderators of the life stress-injury relationship in collegiate football players. *Sport Exerc Perform Psychol*2014;3(1):13-27.

42. Kroshus E, Kubzansky LD, Goldman RE, et al. Norms, athletic identity, and concussion symptom under-reporting among male collegiate ice hockey players: a prospective cohort study. *Ann Behav Med*2015;49(1):95-103.

43. McKay C, Campbell T, Meeuwisse W, et al. The role of psychosocial risk factors for injury in elite youth ice hockey. *Clin J Sport Med*2013;23(3):216-21.

44. Madrigal L, Gill DL. Psychological responses of Division I female athletes throughout injury recovery: a case study approach. *J Clin Sport Psychol*2014;8(3):276-98.

45. Samuel RD, Tenenbaum G, Mangel E, et al. Athletes' experiences of severe injuries as a career-change event. *J Sport Psychol Action*2015;6(2):99-120.

46. Brewer BW, Cornelius AE, Van Raalte JL, et al. Age-related differences in predictors of adherence to rehabilitation after anterior cruciate ligament reconstruction. *J Athl Train*2003;38(2):158-62.

47. Brewer BW, Cornelius AE, Sklar JH, et al. Pain and negative mood during rehabilitation after anterior cruciate ligament reconstruction: a daily process analysis. *Scand J Med Sci Sports*2007;17(5):520-9.

48. Brewer BW, Cornelius AE, Stephan Y, et al. Self-protective changes in athletic identity following anterior cruciate ligament reconstruction. *Psychol Sport Exerc*2010;11(1):1-5.

49. Padaki AS, Noticewala MS, Levine WN, et al. Prevalence of posttraumatic stress disorder symptoms among young athletes after anterior cruciate ligament rupture. *Orthop J Sports Med*2018;6(7):2325967118787159.

50. Brewer BW, Cornelius AE, Van Raalte JL, et al. Predictors of adherence to home rehabilitation exercises following anterior cruciate ligament reconstruction. *Rehabil Psychol*2013;58(1):64-72.

51. Brewer BW, Raalte JLV, Cornelius AE, et al. Psychological factors, rehabilitation adherence, and rehabilitation outcome after anterior cruciate ligament reconstruction. *Rehabil Psychol*2000;45(1):20-37.

52. Baranoff J, Hanrahan SJ, Connor JP. The roles of acceptance and catastrophizing in rehabilitation following anterior cruciate ligament reconstruction. *J Sci Med Sport*2015;18(3):250-4.

53. Manuel JC, Shilt JS, Curl WW, et al. Coping with sports injuries: an examination of the adolescent athlete. *J Adolesc Health*2002;31(5):391-3.

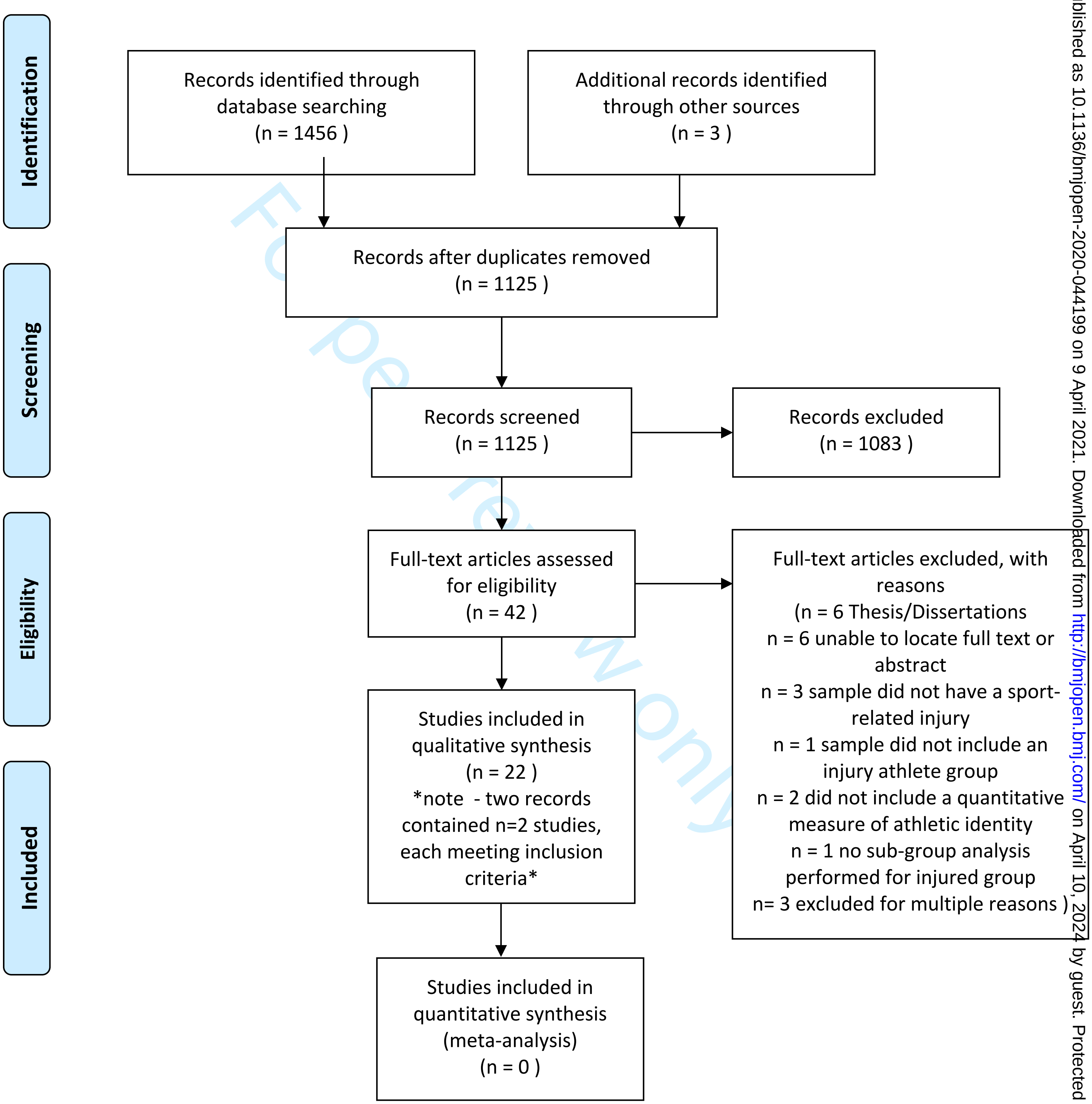
54. O'Rourke DJ, Smith RE, Punt S, et al. Psychosocial correlates of young athletes' self-reported concussion symptoms during the course of recovery. *Sport Exerc Perform Psychol*2017;6(3):262-76.

55. Hilliard RC, Blom L, Hankemeier D, et al. Exploring the relationship between athletic identity and beliefs about rehabilitation overadherence in college athletes. J *Sport Rehabil*2017;26(3):208-20.

56. Podlog L, Gao Z, Kenow L, et al. Injury rehabilitation overadherence: preliminary scale validation and relationships with athletic identity and self-presentation concerns. *J Athl Train*2013;48(3):372-81.
57. Weinberg R, Vernau D, Horn T. Playing through pain and injury: psychosocial considerations. *J Clin Sport Psychol*2013;7(1):41-59.
58. Masten R, Stražar K, Žilavec I, et al. Psychological response of athletes to injury. *Kinesiology*2014;46(1):127-34.
59. Brewer BW, Cornelius AE. Norms and factorial invariance of the Athletic Identity Measurement Scale. *Academic Athletic Journal*2001;15:103-13.
60. Bradshaw L. Why do certain countries excel at certain sports? 2017. Available from: https://theculturetrip.com/middle-east/articles/why-do-certain-countries-excel-at-certain-sports/. Accessed August 2020.
61. Pot N, Van Hilvoorde I. Generalizing the effects of school sports: comparing the cultural contexts of school sports in the Netherlands and the USA. *Sport Soc*2013;16(9):1164-75.
62. Andreff W. The correlation between economic underdevelopment and sport. *ESMQ*2001;1(4):251-79.
63. Beck AT, Rush AJ. Cognitive approaches to depression and suicide. In: Serban G, ed. Cognitive Deficits in the Development of Mental Illness. New York: Brunner/Mazel 1978:235-57.
64. Beck AT. Depression: Clinical, Experimental and Theoretical Aspects. New York: Harper & Row 1967.
65. Abramson LY, Seligman ME, Teasdale J. Learned helplessness in humans: critique and reformulation. *J Abnorm Psychol*1978;87:49-74.
66. Dance KA, Kuiper NA. Self-schemata, social roles, and a self-worth contingency model of depression. *Motiv Emot*1987;11(3):251-68.
67. Linville PW. Self-complexity as a cognitive buffer against stress-related illness and depression. *J Pers Soc Pscyhol*1987;52:663-76.
68. Beck AT. Depression: Causes and Treatment. Philadelphia: University of Pennsylvania Press 1970.
69. Appaneal RN, Levine BR, Perna FM, et al. Measuring postinjury depression among male and female competitive athletes. *J Sport Exerc Psychol*2009;31(1):60-76.
70. Cox CE, Ross-Stewart L, Foltz BD. Investigating the prevalence and risk factors of depression symptoms among NCAA Division I collegiate athletes. *J Sports Sci*2017;5:14-28.
71. Mainwaring LM, Hutchison M, Bisschop SM, et al. Emotional response to sport concussion compared to ACL injury. *Brain Inj*2010;24(4):589-97.
72. Smith AM, Scott SG, O'Fallon WM, et al. Emotional responses of athletes to injury. *Mayo Clin Proc*1990;65(1):38-50.
73. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol*2005;8(1):19-32.
74. Downs SH, Black N. The feasibility of creating a checklist for the assessment of the methodological quality of both of randomised and non-randomised studies of health care interventions. *J Epidemiol Community Health*1998;52:377-84.

Appendix A

# Figure 1. PRISMA 2009 Flow Diagram




*From:* Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

**For more information, visit www.prisma-statement.org.**

Appendix B

## Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist

| SECTION | ITEM | PRISMA-ScR CHECKLIST ITEM | REPORTED ON PAGE # |
|---|---|---|---|
| **TITLE** | | | |
| Title | 1 | Identify the report as a scoping review. | 1 |
| **ABSTRACT** | | | |
| Structured summary | 2 | Provide a structured summary that includes (as applicable): background, objectives, eligibility criteria, sources of evidence, charting methods, results, and conclusions that relate to the review questions and objectives. | 2-3 |
| **INTRODUCTION** | | | |
| Rationale | 3 | Describe the rationale for the review in the context of what is already known. Explain why the review questions/objectives lend themselves to a scoping review approach. | 5-7 |
| Objectives | 4 | Provide an explicit statement of the questions and objectives being addressed with reference to their key elements (e.g., population or participants, concepts, and context) or other relevant key elements used to conceptualize the review questions and/or objectives. | 7 |
| **METHODS** | | | |
| Protocol and registration | 5 | Indicate whether a review protocol exists; state if and where it can be accessed (e.g., a Web address); and if available, provide registration information, including the registration number. | N/A |
| Eligibility criteria | 6 | Specify characteristics of the sources of evidence used as eligibility criteria (e.g., years considered, language, and publication status), and provide a rationale. | 21-22 |
| Information sources* | 7 | Describe all information sources in the search (e.g., databases with dates of coverage and contact with authors to identify additional sources), as well as the date the most recent search was executed. | 7 & 21 |
| Search | 8 | Present the full electronic search strategy for at least 1 database, including any limits used, such that it could be repeated. | Table 1 |
| Selection of sources of evidence† | 9 | State the process for selecting sources of evidence (i.e., screening and eligibility) included in the scoping review. | 21 |
| Data charting process‡ | 10 | Describe the methods of charting data from the included sources of evidence (e.g., calibrated forms or forms that have been tested by the team before their use, and whether data charting was done independently or in duplicate) and any processes for obtaining and confirming data from investigators. | 21 |
| Data items | 11 | List and define all variables for which data were sought and any assumptions and simplifications made. | 21-22 |
| Critical appraisal of individual sources of evidence§ | 12 | If done, provide a rationale for conducting a critical appraisal of included sources of evidence; describe the methods used and how this information was used in any data synthesis (if appropriate). | N/A |

St. Michael's
Inspired Care.
Inspiring Science.

Appendix B

| SECTION | ITEM | PRISMA-ScR CHECKLIST ITEM | REPORTED ON PAGE # |
|---|---|---|---|
| Synthesis of results | 13 | Describe the methods of handling and summarizing the data that were charted. | 23 |
| **RESULTS** | | | |
| Selection of sources of evidence | 14 | Give numbers of sources of evidence screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally using a flow diagram. | Figure 1 |
| Characteristics of sources of evidence | 15 | For each source of evidence, present characteristics for which data were charted and provide the citations. | 23-24 |
| Critical appraisal within sources of evidence | 16 | If done, present data on critical appraisal of included sources of evidence (see item 12). | N/A |
| Results of individual sources of evidence | 17 | For each included source of evidence, present the relevant data that were charted that relate to the review questions and objectives. | Table 2 |
| Synthesis of results | 18 | Summarize and/or present the charting results as they relate to the review questions and objectives. | 23-24 & 40-48 |
| **DISCUSSION** | | | |
| Summary of evidence | 19 | Summarize the main results (including an overview of concepts, themes, and types of evidence available), link to the review questions and objectives, and consider the relevance to key groups. | 49-52 |
| Limitations | 20 | Discuss the limitations of the scoping review process. | 52-53 |
| Conclusions | 21 | Provide a general interpretation of the results with respect to the review questions and objectives, as well as potential implications and/or next steps. | 53-54 |
| **FUNDING** | | | |
| Funding | 22 | Describe sources of funding for the included sources of evidence, as well as sources of funding for the scoping review. Describe the role of the funders of the scoping review. | 4 |

JBI = Joanna Briggs Institute; PRISMA-ScR = Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews.
* Where *sources of evidence* (see second footnote) are compiled from, such as bibliographic databases, social media platforms, and Web sites.
† A more inclusive/heterogeneous term used to account for the different types of evidence or data sources (e.g., quantitative and/or qualitative research, expert opinion, and policy documents) that may be eligible in a scoping review as opposed to only studies. This is not to be confused with *information sources* (see first footnote).
‡ The frameworks by Arksey and O'Malley (6) and Levac and colleagues (7) and the JBI guidance (4, 5) refer to the process of data extraction in a scoping review as data charting.
§ The process of systematically examining research evidence to assess its validity, results, and relevance before using it to inform a decision. This term is used for items 12 and 19 instead of "risk of bias" (which is more applicable to systematic reviews of interventions) to include and acknowledge the various sources of evidence that may be used in a scoping review (e.g., quantitative and/or qualitative research, expert opinion, and policy document).

*From:* Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMAScR): Checklist and Explanation. Ann Intern Med. 2018;169:467–473. doi: 10.7326/M18-0850.

Appendix C 1

**Figure 2.** Integrated model of psychological response to the sport injury and rehabilitation process (Wiese-Bjornstal et al., 1998)