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Return to Play After an Anterior Cruciate Ligament Reconstruction in the Collegiate Athlete: A Systematic Review Evaluating Return to Play Proportions and Associated Factors

OBJECTIVE: To estimate anterior cruciate ligament reconstruction (ACLR) return-to-play (RTP) factors and proportions across all National Collegiate Athletics Association (NCAA) sports.

DESIGN: Systematic review with prognosis and etiology components.

LITERATURE SEARCH: Two independent reviewers searched PubMed, Cochrane Library, and Embase databases using terms related to RTP, ACLR, and NCAA for articles published up to June 30, 2023.

STUDY SELECTION CRITERIA: Articles were included if RTP proportions or factors affecting RTP were reported and if the study population included NCAA collegiate athletes recovering from an ACLR.

DATA SYNTHESIS: The proportion represents the total number of athletes who returned to play after ACLR over the total number of ACLR athletes from each cohort. The cumulative proportion represents the aggregated total from each included study. When eligibility information was available (ie, athletes in their final year of eligibility), RTP proportions were adjusted. The Newcastle-Ottawa Scale (NOS) was used to assess the study quality and scored by 2 raters.

RESULTS: Nine studies were included. RTP criteria varied across the studies. Proportions of RTP ranged from 69% to 92%, with a cumulative RTP proportion after ACLR of 84% (628/745). The primary factors associated with the proportion of RTP were scholarship status, competitive eligibility remaining, depth chart position, and surgical graft type.

CONCLUSIONS: The cumulative proportion of RTP was 84% and was associated with patient-specific and operative factors. Psychological and functional factors were not routinely reported, and rehabilitation protocols were unknown. Data were not explicitly available for any athletes outside of Division I. The criteria for RTP after ACLR varied.
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KEY WORDS: *ACL, college, repair, return to sport, RTS*

The National Collegiate Athletic Association (NCAA) has nearly 500 000 athletes who participate in intercollegiate athletics across all Divisions (I, II, III). Injury during NCAA sport is common, although most injuries are minor and do not require an extended recovery before return to play (RTP).[25] In contrast, an anterior cruciate ligament (ACL) rupture is often season-ending and typically results in surgical reconstruction (ACL reconstruction [ACLR]).[13,25] Surgical reconstruction, prolonged recovery period, and an effective rehabilitation protocol may increase the likelihood of a successful RTP after an ACLR.[1,18,25] An ACL rupture was the most frequent severe injury (ie, missing more than 21 days of sport participation) in the following 9 NCAA-sponsored sports: women's lacrosse (28.1% of all severe injuries in the sport), women's soccer (25.9%), women's volleyball (25.7%), women's basketball (20.8%), softball (14.8%), women's gymnastics (13.9%), men's lacrosse (17.4%), men's football (14%), and men's basketball (12%).[25]

These data align closely with recent epidemiological research on ACL rupture estimated injury rates in collegiate athletics, as women's soccer (2.60), women's gymnastics (1.77), women's basketball (1.74), women's lacrosse (1.5), men's football (1.44), men's lacrosse (1.10), men's wrestling (1.00), and men's soccer (0.93) had the highest injury rates per 10 000 athlete exposures of all NCAA sports included in

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the NCAA Injury Surveillance Program.[13] Therefore, ACL ruptures represent a long-term injury that may impact a large subset of the diverse NCAA population, and stakeholders must remain current about the best available evidence to reduce injury risk and inform treatment paradigms, including salient factors for RTP.

There is dissonance between patients' expectations for restoring function, return to preinjury performance levels, and future injury risk. Following ACLR, the majority of patients expect to return to preinjury levels of activity. However, many stop playing competitive sports.[42] In fact, only about half of individuals who undergo ACLR return to competitive sport,[4] and physiological and psychological factors often are associated with sport performance.[4–6,35,39,44] There is a high incidence of secondary injury (eg, reinjury of ACL graft or contralateral ACL rupture) and a high prevalence of knee osteoarthritis following ACLR.[28,38,45,46] Thus, evaluating factors that are associated with RTP is imperative and greater clarity is needed as NCAA athletes are competing at a very high level and dedicate substantial time and effort to their sport.

Previous work has reported on proportions and factors affecting RTP after an ACLR and included NCAA athletes.[15,26,29] However, they were not specific to NCAA athletes, or information about the cohorts (eg, NCAA Division) was missing. McCullough et al published RTP proportions from the Multicenter Orthopaedic Outcomes Network (MOON) cohort study but did not specify which NCAA Division the athletes participated in.[29] Lai et al combined multiple datasets for collegiate and professional athletes, without analysis of collegiate data in isolation.[26] Ellman et al reported RTP proportions but was not specific to NCAA athletes.[15]

There is an increasing need for high-quality RTP information specific to NCAA athletes. Therefore, the purpose of this systematic review was to estimate available evidence regarding proportions of RTP and factors affecting RTP after ACLR in NCAA athletes.

METHODS

The PRISMA guidelines[37] guided how this systematic review was conducted and reported.

Search Strategy

The evidence search was performed by 2 independent reviewers (C.L.B. and P.R.W.) and included the earliest available date of each database PubMed (1974), Cochrane Library (1949), and Embase (1974) databases up to June 30, 2023. The following keywords in the title or abstract were included in the search strategy: "anterior cruciate ligament" OR "ACL" AND "National Collegiate Athletic Association" OR "NCAA" OR "college" OR "collegiate" OR "university" AND "'return to play" OR "RTP" OR "return to sport" OR "RTS." After reviewing all eligible articles, the references were also screened for additional relevant publications.

Study Selection and Eligibility Criteria

Articles were included in the screening if proportions of RTP or factors affecting RTP were reported as an outcome measure, and if the study population included NCAA collegiate athletes who were recovering from an ACLR. We did not establish an "a priori" definition of RTP and relied on the criteria used by each study. When an eligible abstract matched the inclusion criteria, both reviewers read the manuscript to confirm inclusion. English-language, peer-reviewed full-text articles on human athletes in academic journals were required for inclusion. Articles were excluded when collegiate athletes were not reported in isolation.

Six articles[12,22,24,29,36,47] excluded individuals in their reported RTP statistics if an athlete had no remaining eligibility and thus could not effectively meet RTP criteria or reported this information separately (ie, RTP statistics were parsed between those who could and could not effectively meet RTP criteria due to remaining eligibility requirements). Three articles[14,21,48] did not distinguish in their RTP statistics whether or not those that had no remaining eligibility were omitted or if this information was unclear.

Quality Assessment

The Newcastle-Ottawa Scale (NOS) was used to assess the quality of included studies.[43] Two reviewers (D.R.D. and P.R.W.) independently evaluated each included article and determined a NOS score. If the NOS score for an article was contested, consensus was used to resolve the discrepancy.

Within the NOS "Selection" category, the representativeness of the exposed cohort was defined as an "NCAA athlete" and the selection of the nonexposed cohort defined community as "NCAA athletes without ACLR" or "other injury/illness." Any studies that had a retrospective design did not fulfill the fourth criterion in the "Selection" category: "demonstration that outcome of interest was not present at the start of the study." For the NOS "Comparability" category, the most important factor that the article needed to control for was additional or subsequent injury prior to RTP, with an additional factor being RTP excluded if eligibility was exhausted. For the NOS "Outcome" category, adequate follow-up time was defined as ≥1-year post-ACLR, at least 80% of the cohort had follow-up data reported, and both criteria needed to be explicitly met within the study. When scoring the quality of the included studies, ≥7 was considered "good quality," 2 to 6 was considered "fair quality," and ≤1 was considered "poor" quality.[30] The systematic review was not registered with PROSPERO.

Data Synthesis

Participants were included in the cumulative proportion of RTP if they had remaining collegiate eligibility (ie, excluded seniors in the final year that could not effectively meet RTP criteria due to time constraints). The cumulative proportion of RTP was calculated as the number of included athletes who returned to play

divided by the total number of included athletes (ie, the sum of all included athletes, regardless of RTP). When factors associated with RTP were reported by the included studies, those variables were extracted and included in the analysis.

RESULTS

Study Selection and Bias Assessment

The database search yielded 401 records. Of these, 276 were excluded because they did not examine recovery after ACL reconstruction, did not study college-age participants, did not report proportions of RTP or factors (**FIGURE**), were duplicates, or were not printed in English. Of the 125 articles that received a full-text assessment, 116 were excluded. Seventy-three articles did not specifically report on NCAA athletes, two were not ACL related, 41 did not report RTP. Nine articles met the inclusion criteria.[12,14,21,22,24,29,36,47,48]

Six included studies reported on data only from "Power 5" conferences,[12,21,22,24,36,48] with four of those studies reporting data from single institutions.[22,24,36,48] Men's football was the most frequently represented sport, in six of the 9 studies.[12,22,24,29,47,48] **TABLE 1** provides a summary of the 9 studies included in the systematic review and details the criteria for RTP for each study.

The NOS scores are reported in **TABLE 2**. The number of NOS items fulfilled ranged from 3 to 6 (ie, all considered "fair quality"). Study quality was primarily influenced by the lack of a nonexposed cohort, lack of demonstrating that the outcome was not present at the start of the study (eg, retrospective review), and the adequacy of the follow-up.

RTP After ACL Reconstruction

The proportions of RTP in individual studies of NCAA athletes ranged from 69% to 92%. The cumulative proportion of RTP was 84% (628/745).[12,14,21,22,24,29,36,47,48] Details related to RTP criteria, proportion of RTP, sport population, and time to RTP are in **TABLE 1**.

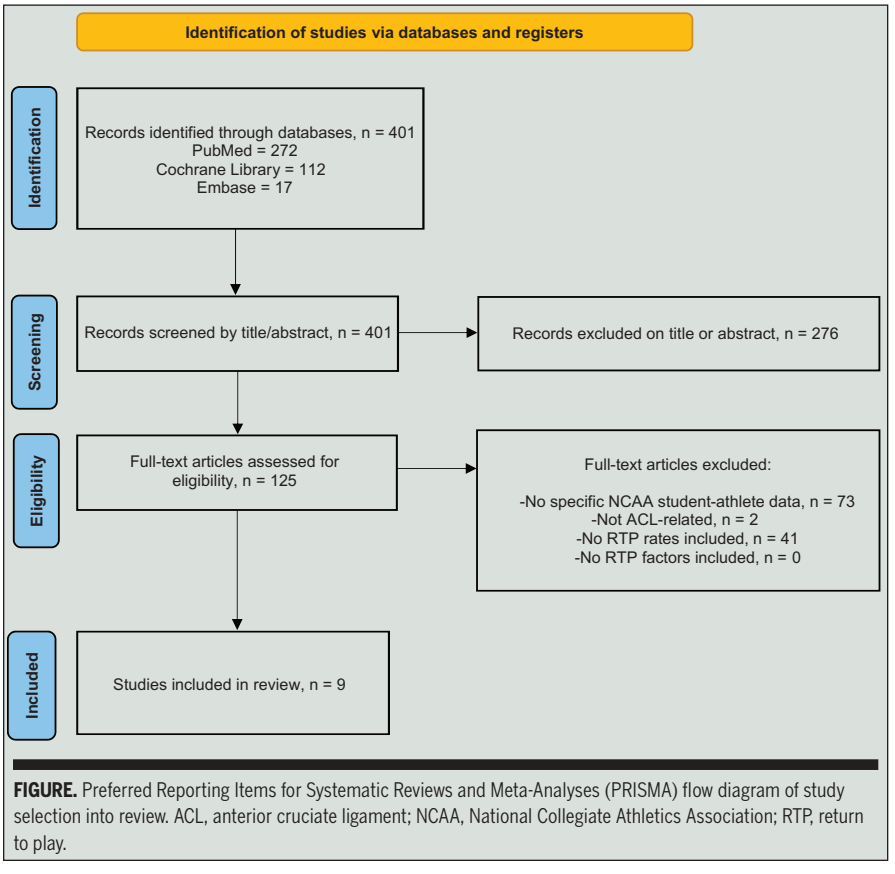

FIGURE. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of study selection into review. ACL, anterior cruciate ligament; NCAA, National Collegiate Athletics Association; RTP, return to play.

Time to RTP After ACL Reconstruction

The median time to RTP in practice was 5.5 months (range, 3.8-12.7 months).[21] One study reported a median RTP time for games of 6.1 months (range, 3.9-33.2 months),[21] while another reported an average RTP time of 10.6 months (range, 3.8-20.9 months).[22] For studies reporting practice and game participation combined, the average time to RTP was between 8.2 months and 251 days (~8.4 months) (**TABLE 1**).[12,48] For authors who reported on RTP by sex within a sport, men's and women's time to RTP were basketball (7.8 vs 8.9 months), gymnastics (8.6 vs 7.1 months), and overall (7.0 vs 8.1 months).[24]

Sex Differences in RTP

Only 2 studies included male and female athletes.[24,48] Zampogna et al reported an overall RTP proportion of 92%, with men's RTP proportion at 98% and women's at 89%.[48] Kamath et al did not stratify by sex.[24]

Player-Specific Factors Associated With RTP After ACLR for Scholarship Recipients

Authors reported significantly greater proportions of RTP for scholarship athletes compared to nonscholarship athletes in both Division I women's soccer (91% vs 46%, respectively)[21] and men's football (88% vs 69%, respectively) athletes[12] (**TABLE 3**).

Eligibility Remaining

RTP was higher for individuals with more years of eligibility remaining compared to those with less eligibility remaining. In women's soccer athletes, RTP post-ACLR was significantly higher for years 1 through 3 versus years 4 and 5 (**TABLE 3**).[21] Most ACL ruptures occurred later in the season; fourth- or fifth-year athletes were less likely to successfully RTP in part due to the time remaining in what may have

TABLE 1 Return-to-Play (RTP) Rates Reported for NCAA Athletes After an ACL Reconstruction

Author and Publication Year	Sport Population	Criteria for RTP	Overall RTP Rate	Time to RTP	Timeframe for Included Data
McCullough et al,[29] 2012	All NCAA Divisions *All Conferences* Men's Football	Self-reported RTP with no criteria defined	18/26 (69%)	Not reported	2002-2003
Kamath et al,[24] 2014	NCAA Division I-FBS *UNC Chapel Hill* All Sports[a]	Successful return to varsity roster for a minimum of 1 season	38/43 (88%)	Not reported	2000-2013
Daruwalla et al,[12] 2014	NCAA Division I-FBS *ACC, SEC, PAC-12* Men's Football	Achieving full, unrestricted participation in practice, a scrimmage, or a regular season game at any time after surgery	151/184 (82%)	Practice/Game Average 251 days	2004-2010
Howard et al,[21] 2016	NCAA Division I *SEC* Women's Soccer	Returning to soccer competition during their collegiate career	66/78 (85%)	Practice Median 5.5 months (range, 3.8-12.7) Game Median 6.1 months (range, 3.9-33.2)	2003-2011
Dugas et al,[14] 2016	All NCAA Divisions *All Conferences* Men's Baseball	Self-reported RTP with no criteria defined	8/11 (89%)	Not reported	2001-2011
Otero et al,[36] 2017	NCAA Division I-FBS *University of Iowa* Men's Wrestling	The ability to record a statistic in public records confirming participation in varsity competition	11/13 (85%)[b]	Not reported	2002-2011
Wise and Gallo,[47] 2019	NCAA Division I-FBS *All Conferences* Men's Football	The ability to record a statistic or return to game via team press releases or online media outlets	242/285 (85%)	Not reported	2010-2015
Zampogna et al,[48] 2021	NCAA Division I-FBS *University of Iowa* All Sports	Achieving full, unrestricted participation in practice, a scrimmage, or a regular season game at any time after surgery	69/75 (92%)	Practice/Game Average 8.2 months (range, 3-16)	2001-2013
Jeffers et al,[22] 2021	NCAA Division I-FBS *Louisiana State University* Men's Football	Participation in game play in a NCAA	25/30 (85%)	Game Average 10.6 months (range, 3.8-20.9)	2001-2016

Abbreviations: ACC, Atlantic Coast Conference; ACL, anterior cruciate ligament; FBS, Football Bowl Subdivision; NCAA, National Collegiate Athletic Association; PAC-12, Pacific-12 Conference; RTP, return to play; SEC, Southeastern Conference.
[a]*Sports included: baseball, basketball, fencing, field hockey, football, golf, gymnastics, lacrosse, rowing, soccer, softball, swimming/diving, tennis, track/cross country, wrestling.*
[b]*2/15 from data received surgery after their fifth year and were not included in the RTP rate.*

been their final season (although final-year athletes were excluded from our analysis). Daruwalla et al reported proportions of RTP for men's football athletes by year of eligibility: redshirt freshman (33%), freshman (83%), sophomore (94%), junior (89%), senior (73%), and fifth-year senior (75%).[12] Except for redshirt freshmen, there were significantly higher proportions of RTP between athletes with more eligibility remaining than those with less eligibility remaining in their collegiate athletic career when sufficient recovery time was available (**TABLE 3**).

Depth Chart Level and Position

Both Howard et al and Daruwalla et al organized athletes into 3 categories: starter, utility-player, and rarely played.[12,21] RTP was not different in NCAA Division I women's soccer athletes when comparing these 3 groups (90% vs 90% vs 70%, respectively) (**TABLE 3**).[21] However, significantly higher RTP in men's football athletes were reported for starters compared to utility athletes and those who rarely played (94% vs 81% [combined utility and rarely used]).[12] For position-specific RTP data, offensive linemen had the lowest proportion of athletes who returned to play (64%), while defensive linemen had the highest (91%).[47] Furthermore, running backs, defensive backs, wide receivers, quarterbacks, and linebackers reported proportions of RTP of 82%, 85%, 88%, 90%, and 91%, respectively.[47]

Operative Factors

Two studies reported RTP stratified by graft type (autograft vs allograft).[12,21] Daruwalla et al found a significant difference in proportions of RTP for NCAA men's football athletes when comparing autograft to allograft recipients (85% vs 69%).[12]

TABLE 2 The Newcastle-Ottawa Scale Scoring

	Selection				Comparability	Outcome			Score and Quality Rating[a]
	1	2	3	4	5	6	7	8	
McCullough et al[29]	★		★		★		★	★	5 Fair
Kamath et al[24]	★		★		★	★	★		5 Fair
Daruwalla et al[12]	★		★		★★	★	★		6 Fair
Howard et al[21]	★		★			★	★		4 Fair
Dugas et al[14]	★		★		★	★	★		5 Fair
Otero et al[36]	★		★			★			3 Fair
Wise and Gallo[47]	★	★		★	★	★			5 Fair
Zampogna et al[48]	★		★			★			3 Fair
Jeffers et al[22]	★		★		★	★	★		5 Fair

Item numbers represent (1) representativeness of exposed cohort, (2) selection of nonexposed cohort, (3) ascertainment of exposure, (4) demonstration that outcome of interest was not present at start of the study, (5) comparability of cohorts on the basis of the design or analysis, (6) assessment of outcome, (7) was follow-up long enough for outcomes to occur, (8) adequacy of follow-up cohorts. A maximum of one star can be given for items in the selection and outcome sections, while a maximum of 2 stars can be given in the comparability section.
[a]*≥7 was considered "good quality," 2-6 was considered "fair quality," and ≤1 was considered "poor" quality.*

Howard et al found no significant difference in proportions of RTP when comparing autograft to allograft recipients in women's soccer (88% vs 75%) (**TABLE 4**).[21] A subgroup analysis of different autograft types (ie, patellar [n = 140] vs hamstring [n = 15]), exhibited no significant differences in proportions of RTP (84% and 93%, respectively). Three studies reported no significant differences in RTP proportions for athletes undergoing an isolated ACLR versus an ACLR with a concurrent procedure (eg, meniscus or multiligament surgery).[12,21,22]

DISCUSSION

A high proportion of NCAA athletes RTP after an ACLR.[12,14,21,22,24,29,36,47,48] Without individual-level data, a rough estimation of central tendencies for practice RTP timelines is 6 to 8 months and 8 to 10 months for games, with game RTP data having much larger ranges (ie, up to 2.8 years). There was heterogeneity in specific RTP criteria, including no criteria; making the roster; participating in a practice, scrimmage, or game; self-reported RTP; and recording a statistic in a game. Only 4 studies reported data on recovery timelines.[12,21,22,48] Practice-only RTP timelines reported a median of 5.5 months (range, 3.8-12.7 months).[21] Game-only RTP timelines reported a median of 6.1 months (range, 3.9-33.2)[21] and a mean of 10.6 months (range, 3.8-20.9).[22] When RTP timeline data were combined for practice and games, there was a mean RTP of 8.4 months[12] and 8.2 months (range, 3-16).[48] It is premature to draw definitive, generalizable conclusions on RTP proportions and time to RTP in NCAA athletes from the available data.

We organized factors thought to affect RTP by player-specific and operative factors. Mental/physical resilience and athletic skill level may also play a role in RTP after prolonged rehabilitation, but were not reported in the NCAA literature included in this review.[10] Player-specific factors of RTP in NCAA athletes were analyzed in only 2 studies.[12,21] They included depth chart level, scholarship status, and eligibility remaining. Depth chart level and scholarship status were statistically significant. Depth chart level appeared to affect men's football players but not women's soccer.[12,21] Perhaps athletes lower on the depth chart before their injury perceived their chances of competing even less likely after injury, thus reducing motivation and possibly making it more difficult for them to return.[6] Similarly, scholarship status may be closely linked to depth chart status as starters and immediate backups may be more likely to be on scholarship and may have greater motivation to retain their academic and financial aid. One or more severe time loss injuries early in their career may have been a barrier to career progression and may have contributed to why only one in

TABLE 3 Player-Specific Factors of RTP After ACLR Specific to NCAA Division I Athletes

Variable	Return-to-Play Rate n (%)
Scholarship recipient	
Women's soccer[21,a]	
Yes	61 of 67 (91%)
No	5 of 11 (46%)
Men's football[12,a]	
Yes	127 of 145 (88%)
No	22 of 32 (69%)
Year of eligibility at time of ACL rupture	
Women's soccer[21,a]	
Year 1	28 of 30 (93%)
Year 2	18 of 20 (90%)
Year 3	16 of 18 (89%)
Years 4 and 5	4 of 10 (40%)
Men's football[12,a]	
Redshirt freshman	33%
Freshman	83%
Sophomore	94%
Junior	89%
Senior	73%
Depth chart level	
Women's soccer[21]	
Starter	34 of 38 (90%)
Utility player	18 of 20 (90%)
Rarely played	14 of 20 (70%)
Men's football[12,a]	
Starter	65 of 69 (94%)
Utility player	50 of 59 (88%)
Rarely played	35 of 48 (73%)

Abbreviations: ACLR, anterior cruciate ligament reconstruction; NCAA, National Collegiate Athletic Association; RTP, return to play.
[a]*Denotes manuscript reported P value of ≤.05.*

3 redshirt freshmen (33%) RTP, whereas the proportion of RTP of the other classes was higher (73%-94%).[12]

The only operative factor that was associated with RTP after ACLR for NCAA collegiate athletes was graft type. Autografts are superior to allografts for young, active patients.[23] Additionally, when asked about treatment preferences, current collegiate, semiprofessional, and/or professional team surgeons strongly preferred autograft bone-patellar tendon-bone and quadriceps tendon for young and pivoting athletes.[8] More operative data are needed for the NCAA athlete population.

Position-specific RTP proportions in men's football ranged from 64% to 91% but were not statistically analyzed.[47] Offensive linemen had much lower RTP proportions (64%) than any other football position.[47] The high body mass index may have contributed to the low RTP.[11,47] Future studies are needed to explore the reasoning behind low RTP in this subgroup. There were several other notable findings from the articles that were included in our review. First, the datasets were almost entirely from athletes at Division I-FBS (Football Bowl Subdivision) institutions, which represent only 30% to 40% of the total NCAA athlete population.[32] Second, only men's football,[12,22,29,47] men's wrestling,[36] women's soccer,[21] and baseball[14] data were explicitly reported, with the remaining 2 studies reported on all sports.[24,48] Only two of the 9 NCAA sports (women's soccer and men's football) in which ACL ruptures are the most frequent severe injury have robust RTP data (>15 cases) available.[25]

In 2020, Meredith et al[31] reported on a consensus meeting of an international and multidisciplinary group of ACL experts (eg, orthopedic surgeons, physical therapists, and scientists) called the Panther Symposium. They described RTP as a continuum from returning to unrestricted training to returning to preinjury level performance. RTP decision-making should include objective physical examination data, a validated RTP battery, functional and psychological assessments, contextual factors (eg, type of sport, position, level of competition, etc), and considerations of concurrent injuries.[31] Previous studies support the idea of RTP being multivariable and a continuum.[2,34] Unfortunately, none of the NCAA-specific studies provide such a multivariable RTP approach or report on the criteria used for RTP decisions.

Outside of the NCAA, there are many factors that are associated with RTP, including age, sex, level of sport participation, primary ACL reconstruction versus revision, preoperative and postoperative outcome scores, intraoperative analgesia, physical readiness, psychological factors (eg, self-efficacy, locus of control, fear of reinjury, readiness), and delaying RTP.[3,4,16,18,20,21,27,33,40] Readiness includes both physical and psychological factors and was commonly discussed, but not analyzed, as a variable of interest in the included studies. A multifactorial approach should be included when determining RTP in NCAA athletes.[9,17,19,31,41]

Two final limitations of the current literature on RTP after ACLR in NCAA athletes are the lack of matched cohorts

TABLE 4 Operative Factors of RTP After ACLR Specific to NCAA Division I Athletes

Variable	Return-to-Play Rate[a]; *P Value*
Women's soccer[20]	
[1]Autograft vs allograft	88% vs 75%; $P = .314$
[2]Femoral tunnel techniques	$P = .726$
[3]Tibial interference screw vs other fixation techniques	$P = .784$
[4]Femoral fixation techniques	$P = .053$
Isolated ACLR vs ACLR and concurrent procedure(s)	89% vs 77%; $P = .192$
Men's football[12]	
Autograft vs allograft	85% vs 69%; **$P = .045$**
Patellar vs hamstring autografts	84% vs 93%; $P = .321$
[5]Isolated ACLR vs ACLR and concurrent procedure(s)	$P = .18$

Abbreviations: ACLR, anterior cruciate ligament reconstruction; NCAA, National Collegiate Athletics Association; RTP, return to play.
[a]The authors did not report an RTP for all operative variables.
[1]RTP Rates: autograft (patellar [90%], hamstring [77%], and quadriceps tendons [100%]) vs allograft (patellar [100%], tibialis anterior [100%], Achilles [100%], peroneal [0%], and hamstring [0%] tendons).
[2]RTP Rates: transtibial (86%), accessory anteromedial (79%), outside-in (85%), flip cutter (75%), and unknown (100%).
[3]RTP Rates of other fixation technique: cross-pin (100%), post/screw (82%), and suspensory button (0%).
[4]RTP Rates: cross-pin (83%), interference screw (93%), post/screw (67%), and suspensory button (56%).
[5]Medial and/or lateral meniscectomy, meniscal repair, and collateral ligament repair.

and the lack of control for multiple comparisons. Comparisons across matched sports could have provided insight into determining if sex differences were present; however, only 2 studies reported on more than 1 sport, and neither statistically tested proportions of RTP and time to RTP by sex.[24,48] While some RTP factors displayed significant differences in time to RTP, several studies included in our review did not control for multiple comparisons.[12,14,21,24,29,47] Thus, findings should be interpreted with caution as the statistical approaches may have increased the risk of type I errors. Adjustments for multiple comparisons (eg, Benjamini-Hochberg procedure, Bonferroni correction, etc) should be considered in future studies when several family-wise comparisons are made.[7] Despite the limitations of this systematic review (eg, inconsistent RTP criteria), the findings highlight the need for further research in this area. Several opportunities exist to generate robust data sets that can be analyzed to inform clinical practice, empower athletes, and improve clinical outcomes.

Limitations

While this is the first systematic review evaluating proportions of RTP and factors in NCAA athletes, there were several issues that limit the generalizability: (1) six of the 9 studies reported data exclusively on Division I-FBS institutions (57%), and men's football (70%) dominated the cumulative cohort representation, leaving the data for the majority of the NCAA athletes unexplored, (2) the definition of RTP varied across studies and requires uniformity for meaningful comparison, (3) the lack of sex-matched data (eg, men's soccer vs women's soccer) precluded sex comparisons, (4) the lack of statistically controlling for multiple comparisons, (5) relevant studies may have been missed due to the limited terms used in the search strategy.

CONCLUSION

The proportion of NCAA athletes who returned to sport after ACLR ranged from 69% to 92%, with a cumulative proportion RTP of 84%. Factors associated with RTP were scholarship status, competitive eligibility remaining, depth chart position, and graft choice. Psychological and functional factors were not routinely reported.

KEY POINTS

FINDINGS: This is the first study to report on the proportions of RTP following ACLR exclusively in NCAA athletes. Collegiate athletes exhibited nearly equivalent proportions of RTP (cumulative RTP of 84%), compared to a systematic review of elite athletes (83%).
IMPLICATIONS: Research examining the proportion of RTP following ACLR must be expanded to and supported by NCAA Divisions I-FCS, II, and III and offer greater representation of the female sex.
CAUTION: The use of common data elements or standardized benchmarks of recovery (eg, return to practice, game, record a game stat) across NCAA Divisions will facilitate data collaborations and enhance generalizability in future research. The available evidence presented should not be applied across the NCAA.

STUDY DETAILS

AUTHOR CONTRIBUTIONS: Concept/idea/research design: C.L.B., P.R.W., D.R.D., M.J.O. Acquisition of data: C.L.B., P.R.W., D.R.D. Analysis and interpretation of data: C.L.B., P.R.W., D.R.D., G.A.R. Writing/review/editing of manuscript: C.L.B., P.R.W., D.R.D., G.A.R., M.J.O. Final approval of the manuscript: C.L.B., P.R.W., D.R.D., G.A.R., M.J.O.
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