Economic and Performance Impact of Anterior Cruciate Ligament Injury in National Basketball Association Players

Nicholas J. Vaudreuil,*† MD, Carola F. van Eck,‡ MD, PhD, Stephen J. Lombardo,† MD, and F. Daniel Kharrazi,† MD

Investigation performed at the Department of Orthopaedic Sports Medicine, Kerlan-Jobe Institute/ Cedars Sinai, Los Angeles, California, USA

Background: Anterior cruciate ligament (ACL) tears are one of the most devastating injuries seen in the National Basketball Association (NBA). No previous studies have examined the economic impact of ACL tears in the NBA.

Purpose/Hypothesis: The purpose of this study was to examine the economic impact of ACL tears on NBA players and teams by calculating the costs of recovery (COR) and classifying players based on preinjury success level (All-Star or equivalent, starter, or reserve) and salary (in US$ million: $<$1.5, 1.5-4, or $>$4 per season). It was hypothesized that players with a lower preinjury salary or primarily a reserve role would have decreased costs, lower rates of return to play (RTP), and shorter careers.

Study Design: Descriptive epidemiology study.

Methods: We reviewed the publicly available records of NBA players treated with ACL reconstruction from 2000 to 2015. Data collected included player demographics, player salaries, statistical performance using player efficiency rating (PER), and specifics regarding time missed and RTP rate.

Results: A total of 35 players met the study inclusion criteria. The cumulative economic loss from ACL injuries in the NBA from 2000 to 2015 was $99 million. The average COR was $2.9 million per player. RTP rate was 91% overall, with 70% retention at 3 years. Players that made a salary of less than $1.5 million per season before the injury had a significant drop in PER (difference of –7), RTP rate of 63%, and only 37% retention at 3 years. Conversely, recovering All-Star players also had a significant drop in PER (–6.2), and no players repeated as All-Stars in the season after ACL reconstruction (0%), although they did have a 100% RTP rate and an average career length of 5.6 seasons postinjury.

Conclusion: While the RTP rate in NBA athletes remained high, ACL reconstruction can result in decreased statistical performance and/or inability to return to prior levels of play. Players who made less than $1.5 million preinjury or played primarily in a reserve role were associated with lower RTP and retention in the NBA at 3 years.

Keywords: ACL reconstruction; basketball; economic analysis

Anterior cruciate ligament (ACL) tears are one of the most common and serious injuries seen in American professional sports. In the National Basketball Association (NBA), ACL injuries have a reported incidence of roughly 2.5 per year in players.[4,7] Players in the NBA are at high risk of ACL injury given the explosive nature of the sport, with frequent cutting, pivoting, jumping, and landing.[15] Several studies have examined ACL injuries in NBA players dating back to the 1980s; these have focused largely on return-to-play (RTP) rates and performance outcomes.[2,4,6,7,10,11] After ACL reconstruction, NBA players have been reported to have an RTP between 78% and 98%.[2,4,7] After ACL reconstruction, professional-caliber basketball players have been previously reported to perform similarly in objective measurements of speed, agility, and quickness when matched by age, size, and position.[8] Despite high rates of recovery, players may require 9 months or longer after surgery before returning to the court.[10] In addition, many players that return to play are unable to perform with the same level of success, especially in the first season after recovery.[6,10,11]

In the NBA, the majority of players have guaranteed contracts, meaning that teams will continue to pay players regardless of injury. Prolonged recovery time required after ACL reconstruction thus has financial ramifications for the teams and players. NBA teams endure paying a guaranteed salary to a player who is not contributing to the team. Alternatively, players may face difficulties in returning to NBA

The Orthopaedic Journal of Sports Medicine, 9(9), 23259671211026617
DOI: 10.1177/23259671211026617

play at their preinjury success level. To the best of the authors' knowledge, at this time no literature exists to examine the economic impact of ACL tears in the NBA. Furthermore, limited data does exist to identify performance metrics based on preinjury success level.

The purpose of this study was to examine the economic impact of ACL tears on NBA players and teams by calculating costs of recovery and classifying players based on preinjury success level and preinjury salary. It was hypothesized that cost of recovery (COR) for ACL tears represents a large financial burden in the NBA; the expectation was that players with higher preinjury success or salary would have increased costs but also a higher rate of RTP and longer careers, and players with a lower preinjury salary or primarily hold a reserve role would have decreased rates of return to NBA play.

METHODS

Male NBA players who sustained an ACL injury that required surgery were reviewed from the 2000 to 2001 season through the 2014 to 2015 season. Injured players and associated information were identified and verified through at least 2 sources, including individual NBA team websites (https://www.nba.com) and various internet-based collections of statistics (https://www.rotowire.com/basketball/, https://www.basketball-reference.com/). All data were publicly available, thus precluding a formal institutional review process. Exclusion criteria included players who did not play in the NBA before having an ACL injury (ie, sustained injury in college) or those who did not have documented salary data preinjury. Players with a concomitant significant knee injury such as posterior cruciate, medial or lateral collateral ligament, medial or lateral meniscus, or cartilage injury were excluded when additional injury details were available. For players who had documentation of ACL retear or required revision surgery, data were included from the index surgery only. The 2014 to 2015 season was chosen as the last season in the inclusion criteria to allow 3 years of postsurgery salary data.

Player demographic data were collected including height, weight, age at time of surgery, and primary position. Specific data regarding injury included date of injury, date of surgery, games missed from injury both during both the current season and subsequent season, time in days missed between NBA games, rate of RTP in NBA, retention of player in the NBA at 3 years after injury, number of years played after injury, and rate of reinjury to reconstructed ACL. Specifics of surgical techniques, including graft choice, were unable to be collected. Return to NBA play was determined by whether a player had documented minutes played in a game postinjury. Postseason and preseason games were not included in games-missed calculations.

Performance metrics were assessed based on player efficiency rating (PER), an NBA-specific metric that incorporates statistical performance based on productivity and efficiency in several positive (points, rebounds, etc) and negative (turnovers, fouls, etc) parameters.[2,5] This metric was chosen because it assesses performance by adjusting to a per-minute basis and thus is ideal for players who may play limited minutes or miss several games in the season of RTP after injury. The league average for PER is 15.0, and for the 2014 to 2015 season Anthony Davis had the highest PER at 30.89. Data collected were PER for season of injury, PER for season of return from injury, and the PER difference between before and after injury.

A novel scale was created at the discretion of the senior author (F.D.K.) in an attempt to objectively grade players based on career accolades achieved and percentage of games played in the starting lineup in the NBA. While not previously validated by another study, this scale was included in this study to give another barometer for player success level other than salary or statistical performance. The scale was as follows: level 4 (maximum) was a highly successful NBA player (first, second, or third team All-NBA, All-Star, Most Valuable Player, Defensive Player of the Year, or Sixth Man of the Year), level 3 was an NBA player who started in more than 50% of games played (but did not win awards necessary to reach level 4), level 2 was primarily a reserve NBA player who started in less than 50% of games played, and level 1 was no NBA play and included D league or other professional level. These maximum values were recorded for each injured player pre- and postinjury.

Salary information was obtained from the HoopsHype salary database (http://hoopshype.com/salaries/players/), which provided values adjusted for inflation in current US dollars in 2020. Preinjury yearly salary for all players was assessed and categorized; group C was greater than $4 million per year, group B was $1.5 million to $4 million per year, and group A was less than $1.5 million per year. Cutoffs for groups were determined before study initiation using estimates of median league salary and average league minimum salary for veteran players over the study period. Salary-based group categorizations were similar to

*Address correspondence to Nicholas J. Vaudreuil, MD, Everett Bone and Joint / Proliance Surgeons, 1100 Pacific Ave, Suite 300, Everett, WA, 98201, USA (email: nicholas.vaudreuil@gmail.com) (Twitter: @NickVaudreuil).
†Department of Orthopaedic Sports Medicine, Kerlan-Jobe Institute/Cedars Sinai, Los Angeles, California, USA.
‡Center for Sports Medicine, UPMC Department of Orthopaedic Surgery, Pittsburgh, Pennsylvania, USA.
Final revision submitted January 15, 2021; accepted February 23, 2021.
The authors declared that there are no conflicts of interest in the authorship and publication of this contribution. AOSSM checks author disclosures against the Open Payments Database (OPD). AOSSM has not conducted an independent investigation on the OPD and disclaims any liability or responsibility relating thereto.
Ethical approval was not sought for the present study.

recently published data.[13] The player salaries were also recorded for 3 postinjury seasons. COR was calculated for each player by multiplying per-game salary by number of games missed. This was a gross estimate because indirect costs (surgery, imaging, physical therapy, etc) were not available. Time missed during the offseason was not included because this does not demonstrate a substantial financial impact to NBA teams.

Data were analyzed using SPSS (SPSS Version 26, IBM). Continuous data were evaluated using analysis of variance with post hoc Tukey tests. Categorical data were evaluated with Fisher exact tests. Significance was set at P less than .05 for all tests.

TABLE 1
Year-by-Year Tabulation of Anterior Cruciate Ligament (ACL) Injuries in the National Basketball Association From 2000 to 2015[a]

Year	No. of ACL Tears	Cumulative Economic Loss, $[b]
2001	2	2,100,061.26
2002	4	5,602,886.45
2003	2	5,233,440.59
2004	0	0.00
2005	2	4,689,619.24
2006	2	3,372,562.78
2007	2	5,858,030.44
2008	2	3,773,548.35
2009	3	6,862,837.68
2010	1	2,221,107.30
2011	1	3,088,010.49
2012	6	21,524,248.24
2013	3	26,606,794.94
2014	3	6,206,692.84
2015	2	2,793,792.10
Total	35	99,933,632.71

[a]Cumulative economic losses included for each season and overall.
[b]All values are in US dollars adjusted for inflation. The year of currency calculation was 2020.

RESULTS

From 2000 to 2015, a total of 54 NBA players sustained an injury that required ACL reconstruction. Nineteen patients were excluded (10 concomitant ligamentous/meniscal/cartilage knee injuries, 7 injuries before NBA career, and 2 patients who underwent revision ACL reconstruction but only data from the first surgery were included). In total, 35 players met the inclusion criteria and were included in the analysis. For the overall player cohort the RTP rate was 91%, with 70% player retention in the NBA at 3 years postinjury. Return to previous level of success was 66% overall. Average age for the group was 24.4 years, weight was 218.9 pounds, and height was 78.7 inches. All 5 player positions sustained injuries; the distribution was 22.9% point guard, 22.9% shooting guard, 14.3% small forward, 17.1% power forward, and 22.9% center. ACL retear rate was 11.4% overall. The most ACL injuries occurred in 2012 (6 total); a year-by-year breakdown is given in Table 1. Cumulative economic loss was calculated from the summation of all COR for players during a given season. All-Star–caliber players represented the highest individual COR with an average of $6.3 million, which was significantly higher than all other groups ($P = .003$). As a group, All-Star players had a COR of $31.5 million. Starting lineup–caliber players

TABLE 2
Mean Salary Data, Length of Recovery Time, and Cost of Recovery for National Basketball Association–Injured Players in Each Salary Group[a]

	Group A (n = 12; 34.3%)	Group B (n = 13; 37.1%)	Group C (n = 10; 28.6%)
Salary[b]			
Preinjury, y of injury	$1,051,522.88 ± $268,440.25	$2,422,533.36 ± $715,847.03	$7,943,387.85 ± $3,361,758.41
Per game, y of injury	$12,823.45 ± $3,273.66	$29,543.10 ± $8,729.85	$96,870.58 ± $40,997.05
Postinjury y 1	$1,528,533.63 ± $1,282,432.43	$2,888,273.00 ± $1,610,050.93	$8,992,717.85 ± $4,457,571.78
Postinjury y 2	$1,526,254.75 ± $2,095,439.70	$3,398,290.21 ± $2,605,011.50	$9,030,183.38 ± $5,265,985.36
Postinjury y 3	$1,636,075.63 ± $2,468,046.03	$3,815,281.00 ± $3,053,859.31	$8,191,615.31 ± $6,770,169.22
% change			
Y 1	127%	124%	139%
Y 2	134%	147%	141%
Y 3	107%	110%	105%
Games missed			
Season of injury	41.6 ± 25.2	48.4 ± 25.8	34.1 ± 26.3
Season after injury	45.0 ± 35.8	6.6 ± 12.0	20.1 ± 29.9
Total	**86.6 ± 35.6**	55.0 ± 25.1	54.2 ± 26.0
Recovery time, d	385.1 ± 189.7	292.8 ± 77.5	340.8 ± 107.56
Cost of recovery	$1,071,121.43 ± $430,406.33	$1,671,595.32 ± $977,716.24	**$5,227,871.30 ± $3,447,199.79**

[a]Group A (<$1.5 million per year), group B ($1.5 million-$4 million per year), group C (>$4 million per year). Data are reported as mean ± SD unless otherwise indicated. Bold values indicate statistically significant difference among groups ($P < .05$).
[b]All values are in US dollars adjusted for inflation. The year of currency calculation was 2020.

TABLE 3
Performance Outcomes and Return to Sport for Anterior Cruciate Ligament–Injured National Basketball Association (NBA) Players Based on Preinjury Salary Groups[a]

	Group A (n = 12; 34.3%)	Group B (n = 13; 37.1%)	Group C (n = 10; 28.6%)
PER			
Before injury	12.7 ± 3.8	11.6 ± 2.9	17.0 ± 4.3
Season after injury	5.7 ± 4.9	11.1 ± 3.5	13.6 ± 4.1
Difference	**–7.0 ± 4.5**	–0.5 ± 3.8	–3.4 ± 4.2
Return to play in NBA, %	63	100	100
Out of NBA in 3 y, %	63	21	31
No. of seasons played postinjury	**2.6 ± 3.4**	7.3 ± 4.3	6.0 ± 3.0
Highest preoperative level	2.5 ± 0.8	2.5 ± 0.5	3.1 ± 0.8
Highest postoperative level	1.9 ± 0.8	2.6 ± 0.6	2.8 ± 0.7
Returned to highest level, %	**38**	93	54

[a]Group A (<$1.5 million per year), group B ($1.5 million-$4 million per year), group C (>$4 million per year). Data are reported as mean ± SD unless otherwise indicated. Bold values indicate statistically significant difference among groups ($P < .05$). PER, player efficiency rating.

TABLE 4
Performance Outcomes and Return to Sport for Anterior Cruciate Ligament–Injured National Basketball Association (NBA) Players based on Preinjury Success Level[a]

	Reserve (n = 15; 42.9%)	Starter (n = 15; 42.9%)	All-Star (n = 5; 14.2%)
PER			
Before injury	12.5 ± 3.4	13.6 ± 4.3	18.9 ± 3.5
Season after injury	8.1 ± 5.1	12.8 ± 4.2	12.8 ± 3.7
Difference	–4.4 ± 4.8	–0.8 ± 3.5	**–6.2 ± 5.2**
Return to play in NBA, %	**80**	100	100
Out of NBA in 3 y, %	50	20	20
No. of seasons played postinjury	4.1 ± 3.4	7.4 ± 4.6	5.6 ± 2.0
Highest preoperative level	2.0	3.0	4.0
Highest postoperative level	2.1 ± 0.8	2.9 ± 0.6	2.6 ± 0.6
Returned to highest level, %	80	70	**0**

[a]Data are reported as mean ± SD unless otherwise indicated. Bold values indicate statistically significant difference among groups ($P < .05$). PER, player efficiency rating.

were the group with the highest total COR at $45.0 million, with an average COR of $2.9 million. Reserve players had the lowest COR for individuals ($1.5 million) and as a group ($23.4 million).

Stratifying by salary in the season of ACL injury, there were 12 players in group A (<$1.5 million), 13 players in group B ($1.5 million-$4 million), and 10 players in group C (>$4 million). Table 2 lists the salary data for the 3 presalary groups. Group A players missed a significantly higher number of cumulative games (86.6; $P = .03$) and had the longest average time missed (385.1 days; $P = .23$). COR was incrementally increased from groups A to C. The group C players had a significantly higher COR at $5.2 million per player ($P < .0001$).

Performance outcomes were broken down by preinjury salary and player caliber. These data are shown in Tables 3 and 4, respectively. All groups demonstrated a decrease in PER in the season after injury. Group A players had significant findings of largest PER difference in season after injury (–7.0; $P = .004$), fewest seasons played postinjury (2.6; $P = .03$), and lowest rate of return to preinjury highest level (38%; $P = .01$). Players in group A also had the lowest rate of return to NBA play (63%; $P = .19$) and retention in the NBA at 3 years (37%; $P = .14$), although these did not reach significance. All-Star–caliber players had a significantly higher drop in PER postinjury (–6.2; $P = .03$) and a lower level of return to previous highest-caliber level (0%; $P = .01$), compared with both starter and reserve groups. Reserve players had a significantly lower return to NBA rate (80%; $P = .009$) after recovering from an ACL injury. Reserve players also had the lowest number of average seasons played postinjury (4.1; $P = .08$) and the highest rate of leaving the NBA within 3 years (50%; $P = .15$), but these findings did not reach statistical significance.

DISCUSSION

To date, no previously published studies to our knowledge have investigated the economic impact of ACL tears on NBA players. This study aimed to identify trends in costs across 2 variables; preinjury maximum level of success and preinjury salary were chosen as unique categories. Based on salary, this study observed that players in the lowest salary group (<$1.5 million per season before injury) had a significantly lower PER (difference of –7), RTP rate of 63%, and only 37% player retention in the NBA at 3 years postinjury. Similarly, using a novel scale for player level of success, players who played primarily a reserve role had a significantly lower RTP rate of 80% with only a 50% player retention rate in the NBA at 3 years. Conversely, recovering All-Star players demonstrated a significant drop in PER (–6.2), and no players repeated as All-Stars in the season after ACL reconstruction (0%). Despite these findings, All-Star players did have a 100% RTP rate and an average career length of 5.6 seasons postinjury. This study suggests that a player's salary and performance before injury may affect performance outcomes and career longevity.

Currently, NBA player salaries rank among the highest worldwide in professional sports.[14] Combined with the fact that NBA rosters can include only 15 players maximum (during the regular season), the effect of each individual player who is lost to injury is amplified. Although return to play in NBA athletes remains high, ACL tears can be devastating injuries resulting in decreased statistical performance and/or inability to return to prior levels of play. In the salary cap era, it is crucial for teams and players to have an understanding of the costs and timing associated with recovery from ACL reconstruction. Player salaries, although frequently guaranteed, are often heavily incentivized and contingent on player performance. In addition,

continued performance at a high level is necessary for contract renewals and extensions, especially as shorter-term deals remain commonplace in the NBA.

The primary outcome of this study was COR; the COR outcome was described recently in a 2020 article by Meldau et al,[9] who performed a cost analysis of pitchers undergoing ulnar collateral ligament reconstruction for Major League Baseball teams. The present study found 35 NBA players between 2001 and 2015 who underwent primary isolated ACL reconstruction. The cumulative economic loss from ACL injuries in the NBA from 2001 to 2015 was $99 million, with an average COR of $2.9 million per player. Examining all players, the highest individual COR was $11.8 million whereas the lowest was $660,380. COR was significantly higher for players in the salary group C (>$4 million per year) and for All-Stars. For the 3-year period after injury, no significant differences were noted in salaries for the 3 groups. Very few published reports exist regarding the effects of NBA player injuries on salary. As mentioned previously, no studies have looked at this for ACL injuries in NBA players. Harris et al[4] examined NBA players undergoing knee microfracture surgery and noted no difference pre- and postoperatively in salary or number of players who made an All-Star game. Similar to the present study, a study performed by Secrist et al[13] examining ACL injuries in the National Football League reported that players who made less than $2 million per season before injury had a lower mean salary after injury and were less likely to remain in the league.

The demographic data of the players in this cohort were similar in age, height, and weight to previously published data regarding NBA ACL injuries.[2] In an epidemiologic analysis of all reported injuries in the NBA over a 17-year period, Drakos et al[3] reported no correlation between injury rate and weight, height, or years of NBA experience. Average length of recovery and RTP rate were also similar to published data. Length of recovery has been reported at 360 days for NBA players recovering from ACL reconstruction.[4] The current study had an average RTP after 62 games (75% of an entire NBA season) or 332 days. The overall RTP rate of 91% was within the range of published reports of 78% to 98%.[2,4,7] Players who made less than $1.5 million had an RTP rate of 63%, and at 3 years only 37% remained in the NBA. Similarly, reserve players had an RTP rate of 80% but at 3 years only 50% remained in the NBA. Overall career length in the NBA has been reported to be 4.5 years on average; in their study of recovery after ACL reconstruction in NBA players, Kester et al[6] reported an average decrease in career length of 1.8 years. The present study had an overall career length after injury of 5.7 years. Salary group A (<$1.5 million per year) had a significantly shorter career length postinjury at 2.6 seasons.

Performance outcomes after ACL reconstruction are helpful to gauge a player's recovery. The meticulous statistics compiled for NBA players allow for facile comparisons. Harris et al[4] examined performance outcomes and noted decreased statistical performance after reconstruction in number of games played, minutes, points, rebounds, and field goal percentage; however, they did not include PER as an outcome. A 2017 study by Nwachukwu and colleagues[10] on 12 NBA players' status following ACL reconstruction reported their PER dropped an average of 4.9 points during the season after injury. Kester et al[6] similarly saw a drop of 2.4 in PER in the season after ACL reconstruction on average. Busfield et al[2] reported that 44% of the players in their cohort decreased their PER after injury. The present study examined 2 main outcomes for performance measures: PER change in season following injury and return to previous level of success. The cohort had a PER decline of –2.5 overall, with a return to previous level of success of 66%. Performance metrics were most notable in 2 groups: low preinjury salary (group A) and All-Stars. Players who made less than $1.5 million preinjury had a significantly larger decrease in PER (–7.0) and lower rate of return to highest level (38%). All-Stars surprisingly had a significantly higher PER drop (–6.3) and a lower rate of return to highest level (0%). All-Stars were the only group not to return any players to their previous level of success in the season following their injury. For both groups, the statistical decline was likely at least partly due to minutes restrictions in the season following ACL reconstruction. Because 8 of the 12 salary group A players were reserves at their highest success level, these players likely played fewer minutes because their contributions were less essential for their teams. Alternatively, All-Star players might have been held back to allow for a slower recovery because they represented more of a long-term investment for their teams. While the exact reasons for the statistical drops are uncertain, these contrasting groups highlight the importance of preinjury standing (both in level of success and in salary) for RTP and long-term chances of remaining in the NBA.

Clearly, ACL injuries in the NBA represent a difficult problem for the players and for their teams. The staggeringly high COR for players at all salary levels highlights just how expensive the injury can be for NBA teams. Players meanwhile have to go through the physical and emotional roller coaster of surgery and extended rehabilitation in their recovery process. Decreasing the incidence of ACL injuries for their players should thus be an important target for the NBA. ACL injury prevention strategies have been described at many levels.[1,12] Programs for improving balance, landing mechanics, and muscle activation may be useful for athletic trainers, physical therapists, and physicians working with high-level athletes.[12]

Limitations

There are several limitations in this study to be discussed. There may be bias associated with the retrospective nature of the analysis. The data were obtained from publicly available sources so completeness and accuracy of the cohort may not be as reliable as an established database. The end result was a relatively small sample size, which limits the strength and generalizability of the findings. Players with concomitant meniscal and ligamentous injuries were excluded even though not all these injuries required surgery or dramatic changes to postoperative protocol. In addition, news sources that we reviewed may have underreported concomitant injuries. RTP data were measured from the date of injury rather

than the date of surgery because this information was more readily available from public sources. This may allow for some variation from other literature that typically reports from date of surgery. The player success objective scale was not validated before this study and thus can provide only limited conclusions. The COR outcome was based on the number of regular season games missed for the injured player, but it did not attempt to include indirect costs such as surgery, rehabilitation, imaging, doctor visits, and braces. In addition, the salary data used for calculations may represent some variability because values did not include incentives and bonuses. Thus, the outcome was an estimate based on available information, but actual total costs may be substantially higher. Finally, this study involved comparing only ACL-injured players. The lack of a control group of uninjured NBA players for comparison limits the final conclusions.

CONCLUSION

ACL injuries in the NBA represent a source of crucial economic loss for NBA teams because of guaranteed contracts and prolonged recovery after ACL reconstruction. Players recovering from ACL reconstruction have a generally high RTP rate; however, this rate drops with reserve players and those who made lower preinjury salaries. Players who return to NBA competition face an uphill battle against decreased statistical performance and shorter career lengths. The findings of this study suggest that a player's preinjury standing (salary and success level) within the NBA before injury seems to affect performance outcomes and career longevity.

REFERENCES

1. Benjaminse A, Otten B, Gokeler A, Diercks RL, Lemmink KAPM. Motor learning strategies in basketball players and its implications for ACL injury prevention: a randomized controlled trial. *Knee Surg Sport Traumatol Arthrosc*. 2017;25(8):2365-2376. doi:10.1007/s00167-015-3727-0
2. Busfield BT, Kharrazi FD, Starkey C, Lombardo SJ, Seegmiller J. Performance outcomes of anterior cruciate ligament reconstruction in the National Basketball Association. *Arthroscopy*. 2009;25(8):825-830. doi:10.1016/j.arthro.2009.02.021
3. Drakos MC, Domb B, Starkey C, Callahan L, Allen AA. Injury in the National Basketball Association: a 17-year overview. *Sports Health*. 2010;2(4):284-290. doi:10.1177/1941738109357303
4. Harris JD, Erickson BJ, Bach BR, et al. Return-to-sport and performance after anterior cruciate ligament reconstruction in National Basketball Association players. *Sports Health*. 2013;5(6):562-568. doi:10.1177/1941738113495788
5. Hollinger J. *Pro Basketball Forecast*. Potomac Books; 2005.
6. Kester BS, Behery OA, Minhas SV, Hsu WK. Athletic performance and career longevity following anterior cruciate ligament reconstruction in the National Basketball Association. *Knee Surg Sport Traumatol Arthrosc*. 2017;25(10):3031-3037. doi:10.1007/s00167-016-4060-y
7. Mai HT, Chun DS, Schneider AD, et al. Performance-based outcomes after anterior cruciate ligament reconstruction in professional athletes differ between sports. *Am J Sports Med*. 2017;45(10):2226-2232. doi:10.1177/0363546517704834
8. Mehran N, Williams PN, Keller RA, Khalil LS, Lombardo SJ, Kharrazi FD. Athletic performance at the National Basketball Association Combine after anterior cruciate ligament reconstruction. *Orthop J Sport Med*. 2016;4(5):2325967116648083. doi:10.1177/2325967116648083
9. Meldau JE, Srivastava K, Okoroha KR, Ahmad CS, Moutzouros V, Makhni EC. Cost analysis of Tommy John surgery for Major League Baseball teams. *J Shoulder Elbow Surg*. 2020;29(1):121-125. doi:10.1016/j.jse.2019.07.019
10. Nwachukwu BU, Anthony SG, Lin KM, Wang T, Altchek DW, Allen AA. Return to play and performance after anterior cruciate ligament reconstruction in the National Basketball Association: surgeon case series and literature review. *Phys Sportsmed*. 2017;45(3):303-308. doi:10.1080/00913847.2017.1325313
11. Okoroha KR, Marfo K, Meta F, et al. Amount of minutes played does not contribute to anterior cruciate ligament injury in National Basketball Association athletes. *Orthopedics*. 2017;40(4):e658-e662. doi:10.3928/01477447-20170503-04
12. Padua DA, DiStefano LJ, Hewett TE, et al. National Athletic Trainers' Association position statement: prevention of anterior cruciate ligament injury. *J Athl Train*. 2018;53(1):5-19. doi:10.4085/1062-6050-99-16
13. Secrist ES, Bhat SB, Dodson CC. The financial and professional impact of anterior cruciate ligament injuries in National Football League athletes. *Orthop J Sports Med*. 2016;4(8):2325967116663921. doi:10.1177/2325967116663921
14. Sigler K, Compton W. NBA players' pay and performance: what counts? *Sport J*. Published August 2, 2018. Accessed May 1, 2020. https://thesportjournal.org/article/nba-players-pay-and-performance-what-counts
15. Yeh PC, Starkey C, Lombardo S, Vitti G, Kharrazi FD. Epidemiology of isolated meniscal injury and its effect on performance in athletes from the National Basketball Association. *Am J Sports Med*. 2012;40(3):589-594. doi:10.1177/0363546511428601