

# **Predictors of Quality of Life After Pediatric/Adolescent ACL Reconstruction: A Longitudinal Analysis of KOOS Subscale Recovery and Patient Acceptable Symptomatic State Achievement**

**Zachariah Samuel, BS,<sup>1</sup> Eduardo Valero-Moreno, MD,<sup>1</sup> Kaylre Greaves, MD,<sup>1</sup>  
Anisha Duvvi, BS,<sup>1</sup> Leila Mehraban Alvandi, PhD,<sup>1</sup> Edina Gjonbalaj, BS,<sup>1</sup> Jacob  
Schulz, MD,<sup>1</sup> Mauricio Drummond Jr., MD<sup>1</sup> Eric D. Fornari, MD,<sup>1</sup>**

**1 Montefiore Einstein, Department of Orthopaedic Surgery, Division of Pediatric  
Orthopaedic Surgery, Bronx-NY**

**Montefiore Einstein  
Orthopedic Surgery**

# Disclosure

- I and my co-authors have no relevant disclosures.

# Introduction

- **Anterior cruciate ligament (ACL) tears** are common in adolescents, especially in female athletes<sup>1</sup>
- Postoperative recovery often assessed using **patient reported outcomes (PROs)** such as Knee Injury and Osteoarthritis Outcome Score (KOOS) 0-100
  - Pain
  - Symptoms
  - Activities of Daily Living (ADLs)
  - Sports
  - Quality of Life (QOL)



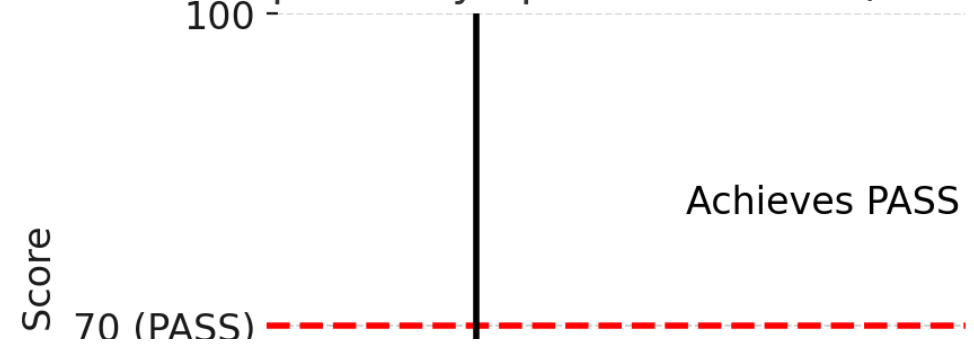
# Introduction

- **Patient Acceptable Symptomatic State (PASS):** score at which a patient is satisfied with their knee function in 1 domain

- 88.9 for pain
- 75.0 for symptoms
- 98.5 for ADLs
- 75.0 for sport
- 68.8 for QOL

- Prior literature shows KOOS-QOL lagging behind other domains, but little known about its predictors

Patient Acceptable Symptomatic State (PASS) Threshold



[J Pediatr Orthop](#). 2022 Jul 1;42(6):e641-e648. doi: 10.1097/BPO.0000000000002143.  
Epub 2022 Mar 17.

## Establishing Clinically Significant Outcomes After Anterior Cruciate Ligament Reconstruction in Pediatric Patients

Bhargavi Maheshwer <sup>1</sup>, Evan M Polce <sup>2</sup>, Kevin C Parvaresh <sup>3</sup>, Katlynn Paul <sup>4</sup>, Adam B Yanke <sup>4</sup>, Brian Forsythe <sup>4</sup>, Charles A Bush-Joseph <sup>4</sup>, Bernard R Bach <sup>4</sup>, Brian J Cole <sup>4</sup>, Nikhil N Verma <sup>4</sup>, Monica Kogan <sup>4</sup>, Jorge Chahla <sup>4</sup>

Affiliations + expand

PMID: 35297390 DOI: 10.1097/BPO.0000000000002143

[Review](#)

[Am J Sports Med](#). 2014 May;42(5):1247-55. doi: 10.1177/0363546513512774.

Epub 2013 Dec 6.

## Health-related quality of life after anterior cruciate ligament reconstruction: a systematic review

Stephanie R Filbay <sup>1</sup>, Ilana N Ackerman, Trevor G Russell, Erin M Macri, Kay M Crossley

Affiliations + expand

PMID: 24318609 DOI: 10.1177/0363546513512774

# Objectives

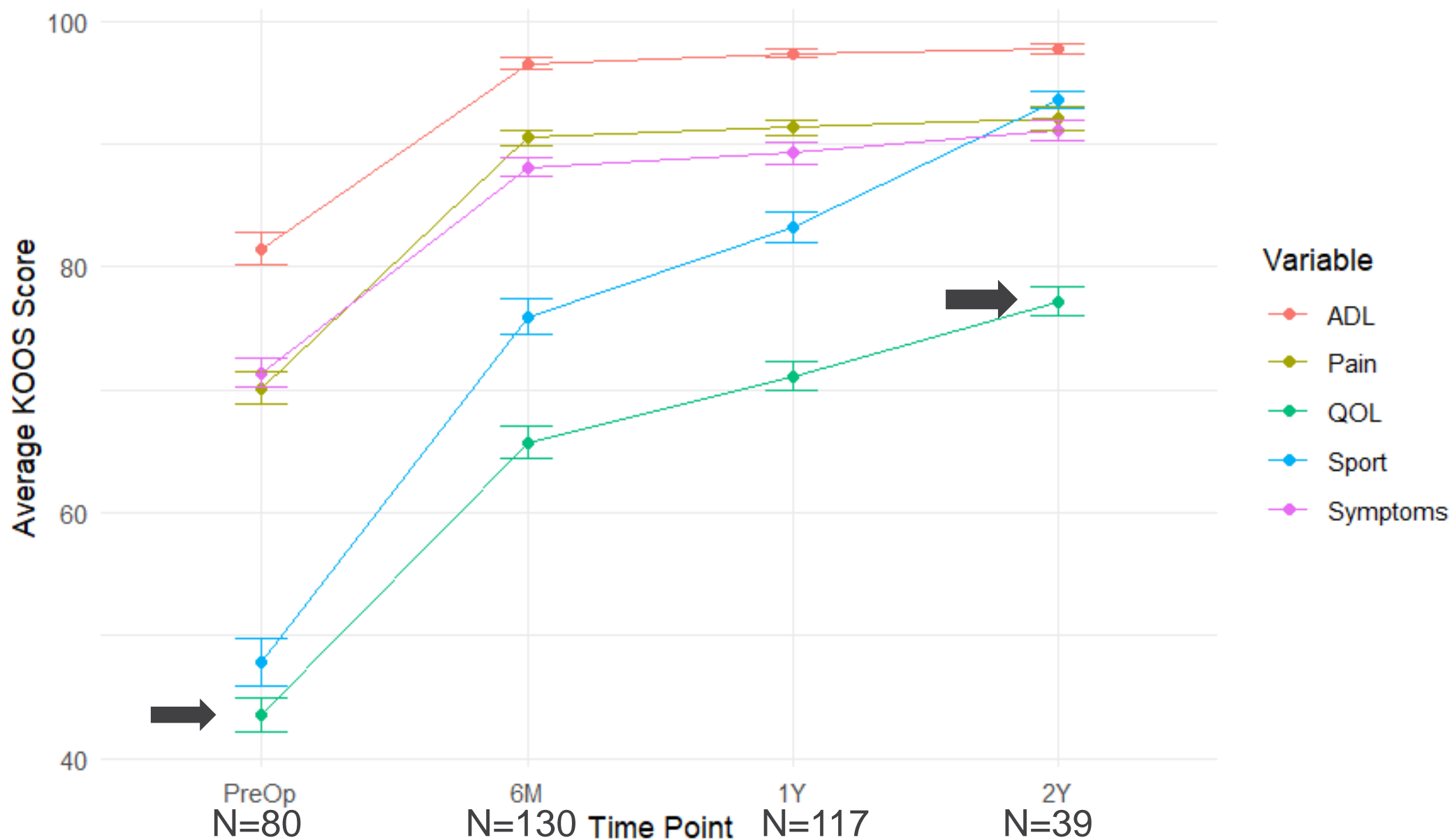
1. Compare KOOS-QOL to other subscales over time.
2. Assess PASS achievement rates for each subscale.
3. Identify predictors of achieving PASS in KOOS-QOL.
4. Examine individual KOOS-QOL questions among those who fail PASS.

# Methods

- Study Design: Retrospective cohort study (2013-2021)
- Inclusion Criteria: Pediatric ACLR patients (ages 10-21)
- Data Collected:
  - Demographics (age, sex, insurance, mental health history)
  - Clinical factors (graft type, meniscus injury, comorbidities)
  - KOOS-Child scores at preop, 6M, 1Y, 2Y
- Statistical Analysis:
  - ANOVA for KOOS trends over time
  - Logistic regression for predictors of KOOS-QOL PASS
  - Chi square for sub-analysis of KOOS-QOL questions

# Results

Figure 1  
Average KOOS Scores Over Time



- **N = 188**
- **Age** 16.4 years
- **Sex**
  - 63.3% male;
  - 36.7% female
- **Race/Ethnicity**
  - 49.5% Spanish/Hispanic/Latino;
  - 30.5% Black or African American
- **BMI** 26.8
- **Mental health diagnosis**  
28/188 (14.9%)



**Table 1.** PASS achievement rates of the cohort

PRO	Preop (%)	6 Months (%)	1 Year (%)	2 Years (%)
KOOS Pain	18.3	66.7	74.6	79.5
KOOS Symptoms	51.2	85.7	86.6	95.1
KOOS ADL	21.0	57.6	67.5	79.5
KOOS Sport	21.6	67.5	75.7	94.9
KOOS QOL	11.2	49.2	60.7	66.7

(PRO = patient-reported outcome; preop = preoperative; KOOS = Knee Injury and Osteoarthritis Outcome Score; ADL = activities of daily living; QOL = quality of life)



**Table 2.** Multivariate logistic regression for predictors of KOOS-QOL PASS

Variable	Odds Ratio (n = 139)	P value
Preop KOOS QOL	1.02 [0.96, 1.10]	0.522
Preop KOOS Pain	0.92 [0.83, 1.00]	0.086
Preop KOOS Symptoms	1.08 [0.97, 1.20]	0.163
Preop KOOS ADL	1.03 [0.94, 1.14]	0.491
Preop KOOS Sport	0.97 [0.91, 1.03]	0.363
Chondroplasty	0.15 [0.00, 3.81]	0.252
Arthrofibrosis	0.30 [0.02, 4.13]	0.359
Male Sex	<b>10.68 [1.62, 138.49]</b>	<b>0.028</b>
Age at Surgery	1.69 [0.84, 4.21]	0.192
Asian/Other Race Relative to African American	0.31 [0.02, 3.02]	0.348
White Relative to African American	2.68 [0.17, 86.63]	0.511
BMI at Surgery	1.06 [0.90, 1.26]	0.503
Public Insurance	6.58 [0.86, 77.49]	0.089
Prior Mental Health Diagnosis	<b>0.06 [0.00, 0.72]</b>	<b>0.040</b>

(Preop = preoperative; KOOS = Knee Injury and Osteoarthritis Outcome Score; QOL = quality of life; ADL = activities of daily living; BMI = body mass index)



Table 3. KOOS-QOL question responses stratified by PASS achievement at 2 year follow-up

Results

QOL Questions	No PASS at 2 Years (N=13)	PASS at 2 Years (N=26)	P value	QOL Questions (continued)	No PASS at 2 Years (N=13)	PASS at 2 Years (N=26)	P value
How often do you think about your knee problem?			0.001	Overall, how much difficulty do you have with your injured knee?			0.003
Never (%)	0 (0.0)	8 (30.8)		No difficulty (%)	3 (23.1)	19 (73.1)	
Rarely (%)	0 (0.0)	7 (26.9)		A little (%)	7 (53.8)	7 (26.9)	
Sometimes (%)	6 (46.2)	9 (34.6)		Some (%)	3 (23.1)	0 (0.0)	
Often (%)	2 (15.4)	2 (7.7)		How much difficulty have you had getting to school or walking around in school (climbing stairs, opening doors, carrying books, participating during recess) because of your injured knee?			0.01
All the time (%)	5 (38.5)	0 (0.0)		No difficulty (%)	7 (53.8)	25 (96.2)	
How much have you changed your lifestyle because of your injured knee?			<0.001	A little (%)	2 (15.4)	1 (3.8)	
Not at all (%)	1 (7.7)	12 (46.2)		Some (%)	3 (23.1)	0 (0.0)	
A little (%)	0 (0.0)	12 (46.2)		A lot (%)	1 (7.7)	0 (0.0)	
Some (%)	5 (38.5)	2 (7.7)		How much difficulty have you had to do things with friends because of your injured knee?			<0.001
A lot (%)	5 (38.5)	0 (0.0)		No difficulty (%)	3 (23.1)	24 (92.3)	
Very much (%)	2 (15.4)	0 (0.0)		A little (%)	7 (53.8)	2 (7.7)	
How much do you trust your injured knee?			0.001	Some (%)	2 (15.4)	0 (0.0)	
Completely (%)	0 (0.0)	13 (50.0)		A lot (%)	1 (7.7)	0 (0.0)	
A lot (%)	4 (30.8)	11 (42.3)					
Some (%)	5 (38.5)	1 (3.8)					
A little (%)	2 (15.4)	1 (3.8)					
Not at all (%)	2 (15.4)	0 (0.0)					

# Discussion

- Females with mental health diagnoses struggle with QOL despite good physical recovery
- Catastrophizing, fear of reinjury, and social limitations hinder QOL improvement
- Targeted interventions:
  - Psychological screening preoperatively
  - Mental health support during rehab
  - Peer mentorship & confidence-building programs

# Limitations

- Selection Bias
  - Only a subset of patients had KOOS-QOL data at 2 years
- Retrospective Design
  - Mental health diagnoses were extracted from the medical record, which may underestimate the true prevalence.
- Unmeasured Psychosocial Factors
  - Factors like family support and preoperative mental health interventions were not assessed but could impact KOOS-QOL outcomes.

## Conclusions

- KOOS-QOL trails behind each other KOOS subscale from preoperative scores to 2 years postop
- Females with prior mental health diagnoses are at higher odds of not achieving PASS
- Physical healing  $\neq$  Mental recovery. Address both for optimal outcomes.

# References

1. Bram JT, Magee LC, Mehta NN, Patel NM, Ganley TJ. Anterior Cruciate Ligament Injury Incidence in Adolescent Athletes: A Systematic Review and Meta-analysis. *Am J Sports Med*. 2021 Jun;49(7):1962-1972. doi: 10.1177/0363546520959619. Epub 2020 Oct 22. PMID: 33090889.
2. Maheshwer B, Polce EM, Parvaresh KC, Paul K, Yanke AB, Forsythe B, Bush-Joseph CA, Bach BR, Cole BJ, Verma NN, Kogan M, Chahla J. Establishing Clinically Significant Outcomes After Anterior Cruciate Ligament Reconstruction in Pediatric Patients. *J Pediatr Orthop*. 2022 Jul 1;42(6):e641-e648. doi: 10.1097/BPO.0000000000002143. Epub 2022 Mar 17. PMID: 35297390.
3. Filbay SR, Ackerman IN, Russell TG, Macri EM, Crossley KM. Health-related quality of life after anterior cruciate ligament reconstruction: a systematic review. *Am J Sports Med*. 2014 May;42(5):1247-55. doi: 10.1177/0363546513512774. Epub 2013 Dec 6. PMID: 24318609.