

Defining Novel Thresholds for Clinically Meaningful Outcomes for Pediatric Knee Injuries

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INTRODUCTION:

Minimal clinically important differences (MCID) have been established for adult questionnaires administered following anterior cruciate ligament reconstruction (ACLR) and medial patellofemoral ligament reconstruction (MPFLR), but MCID remains unquantified in pediatric-specific patient-reported outcome (PRO) instruments. This study aimed to establish MCIDs for the Hospital for Special Surgery Pediatric Functional Activity Brief Scale (HSS Pedi-FABS), pediatric International Knee Documentation Committee (Pedi-IKDC), and pediatric and parent-proxy Patient-Reported Outcomes Measurement Information System (PROMIS) pain interference (PI), mobility, and physical activity scores in pediatric patients who underwent primary knee surgery.

METHODS:

A retrospective review was conducted for patients <18 years who underwent surgery with one of two pediatric orthopedic surgeons between 2016-2023. Demographic and clinical factors were collected. Available preoperative and postoperative HSS Pedi-FABS, Pedi-IKDC, and pediatric and parent-proxy PROMIS PI, physical activity, and mobility questionnaire scores were collected.

MCID was determined using the anchor-based method: MCID was calculated as half the standard deviation of preoperative scores in patients undergoing ACLR, MPFLR, and other common procedures. The MCID for each outcome measure was also calculated for the entire cohort to serve as a standard reference for future research. Negative MCID was reported for pediatric PROMIS PI since a lower postoperative score compared to preoperative denotes an improvement in pain. A negative MCID was reported for the HSS Pedi-FABS because it measures function at the patient's healthiest, preinjury state. Therefore, a successful outcome typically reflects a return to preinjury activity levels rather than a postoperative score increase.

RESULTS:

505 patients underwent ACLR and the mean age was 14.5±2.0 years (47.1% patients were female). 253 patients underwent MPFLR and the mean age was 14.5±2.1 years (55.3% patients were female). 597 patients underwent other common pediatric sports procedures and the mean age was 13.5±2.5 (43.4% were female). Meniscus repair and osteochondritis dissecans surgeries were most common in this group (20.9% and 18.9%, respectively) (**Table 1**). For all groups, MCID was established for HSS Pedi-FABS, Pedi-IKDC, PROMIS PI, mobility, and physical activity (**Table 2**), and PROMIS Parent-proxy questionnaires (**Table 3**).

DISCUSSION AND CONCLUSION:

MCID has been reported for adult knee questionnaires. However, studies on pediatric knee injuries have used adult knee questionnaires and MCIDs calculated from adult questionnaires, which may not be appropriate for younger patients. This study establishes novel MCID values for HSS Pedi-FABS, Pedi-IKDC, and pediatric and parent-proxy PROMIS PI, physical activity, and mobility questionnaires in pediatric patients undergoing ACLR, MPFLR, and other common procedures for conditions such as meniscus injury, knee articular damage, and osteochondritis dissecans. MCID for pediatric-specific knee questionnaires provides pediatric-specific thresholds for achievement of postoperative MCID and will inform power calculations when designing prospective studies on pediatric knee injuries.

Table 3. MCID for PROMIS Parent-Proxy Questionnaires.

Questionnaire	ACLR (N)	MPFLR (N)	Disease-agnostic Common Pediatric Sports Procedures (N)	Entire Cohort (N)
PROMIS Parent-Proxy Pain	-4.3 (235)	-4.3 (85)	-4.4 (119)	-4.4 (459)
PROMIS Parent-Proxy Mobility	4.1 (235)	4.5 (105)	5.7 (117)	5.0 (459)
PROMIS Parent-Proxy Physical Activity	5.0 (233)	5.9 (105)	6.1 (118)	5.7 (456)

ACLR: anterior cruciate ligament reconstruction; MPFLR: medial patellofemoral ligament reconstruction; PROMIS: Patient-Reported Outcomes Measurement Information System

Table 1. Procedure types present in disease-agnostic common pediatric sports procedures group.

Procedure	Patient Count (%)
Meniscal Repair	125 (20.9)
Osteochondritis Dissecans Surgeries	113 (18.9)
Chondroplasty of the Knee	54 (9)
Implant Removal	47 (7.4)
Open Reduction Internal Fixation	44 (7.4)
Biopsy and Excisions	44 (7.4)
Lower Extremity Debridement or Synovectomy	38 (6.4)
Discoid Meniscus Surgeries	35 (5.9)
Ankle Arthroscopies & Arthrotomies	24 (4)
Hemi-epiphysiodesis & Epiphysiodesis	23 (3.9)
Tibial Spine Fracture	21 (3.5)
Patella & Quadriceps Tendon Repair	8 (1.3)
Closed Reduction	5 (0.8)
Miscellaneous Procedures (e.g. curettage bone cyst, bar resection, femoral osteotomy, etc.)	16 (2.7)

Table 2. MCID for HSS Pedi-FABS, Pediatric IKDC, and Pediatric PROMIS Questionnaires.

Questionnaire	ACLR (N)	MPFLR (N)	Disease-agnostic Common Pediatric Sports Procedures (N)	Entire Cohort (N)
HSS Pedi-FABS	-5.0 (233)	-5.1 (124)	-4.9 (469)	-5.0 (826)
Pedi-IKDC	8.7 (49)	9.1 (30)	10.7 (24)	9.4 (103)
PROMIS Pain	-5.2 (161)	-5.7 (122)	-6.3 (441)	-6.0 (724)
PROMIS Mobility	2.2 (46)	4.9 (13)	4.7 (86)	4.1 (145)
PROMIS Physical Activity	5.6 (116)	5.6 (59)	5.8 (275)	5.8 (450)

ACLR: anterior cruciate ligament reconstruction; MPFLR: medial patellofemoral ligament reconstruction; HSS Pedi-FABS: Hospital for Special Surgery Pediatric Functional Activity Brief Scale; Pedi-IKDC: Pediatric International Knee Documentation Committee; PROMIS: Patient-Reported Outcomes Measurement Information System