

How Can Arthroplasty Surgeons Best Use Preoperative PROMs Across Multiple Domains to Predict MCID and PASS Achievement in Medial Unicompartmental Knee Arthroplasty? Findings in 911 Procedures from a Prospectively-Maintained Multi-Institutional Arthroplasty Registry

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INTRODUCTION:

Patient-reported outcome measures (PROMs) are increasingly utilized in medial unicompartmental knee arthroplasty (UKA). PROMs can be further classified with use of threshold such as the Minimal Clinically Important Difference (MCID) – the improvement from preoperative to postoperative PROM score that a patient would associate with ‘feeling better’ – and the Patient Acceptable Symptom State (PASS) – the postoperative PROM score that a patient would associate with ‘feeling good’.

Notably, prior studies have revealed two crucial insights for preoperative PROMs in total knee arthroplasty (TKA), but which have yet to be investigated in UKA. First, previous literature has established a paradoxical relationship between preoperative joint-specific PROM scores and the likelihood of achieving PASS or MCID. Patient with higher preoperative PROM scores are more likely to reach PASS but less likely to achieve MCID. By contrast, patients with lower preoperative PROM scores are less likely to attain PASS but more likely to experience MCID. Second, previous TJA literature has shown that preoperative PROMs across multiple domains (knee physical function, general physical health, mental health, etc.) influence achievement of MCID and PASS.

Despite these informative studies in TKA, the precise utility of preoperative PROMs in medial UKA is under-explored. We investigated the impact of preoperative PROMs across multiple domains on MCID and PASS achievement in medial UKA.

METHODS:

We retrospectively sourced 911 medial UKAs from a prospectively-maintained multi-institutional arthroplasty registry. The following preoperative PROMs were recorded: 1) Knee Osteoarthritis Outcome Score-Physical Function Short Form (KOOS-PS); 2) PROMIS Physical Function-10a (PROMIS PF-10a); 3) PROMIS Global Physical; 4) PROMIS Global Mental. These PROMs measure the following domains respectively: 1) knee-specific physical function; 2) general physical function; 3) general physical health; 4) general mental health. Multivariable forward binary logistic regression models identified factors independently associated with achievement of literature-derived, anchor-based KOOS-PS thresholds for MCID and PASS.

RESULTS:

The mean 1-year improvement in KOOS-PS was $+15.9 \pm 14.7$, resulting in a mean 1-year KOOS-PS score of 74.1 ± 22.2 (**Table 1**). Among the cohort, the KOOS-PS MCID was achieved by 683 (75.0%), while the KOOS-PS PASS was achieved by 613 (67.2%).

A total of 493 (54.1%) patients experienced *both* MCID and PASS, while 753 (82.7%) experienced *either* MCID or PASS (**Table 1**). Therefore, a minority of patients ($n = 158$; 17.3%) experienced *neither* MCID nor PASS.

MCID Achievement was associated with lower preoperative KOOS-PS score ($p = 0.001$) and higher preoperative PROMIS Global Physical score ($p = 0.013$) (**Table 2**). Patients with preoperative KOOS-PS scores in the lowest quintile had the highest proportion of MCID Achievement (87.9%; $p < 0.001$). Patients in the highest quintile (Preoperative KOOS-PS Score > 68.2) had the lowest rate of MCID Achievement (58.3%; $p < 0.001$) (**Figure 1**).

PASS Achievement was associated with higher preoperative KOOS-PS score ($p < 0.001$), higher preoperative PROMIS Global Physical score ($p = 0.038$), higher preoperative PROMIS Global Mental score ($p = 0.018$), and higher preoperative PROMIS PF-10a score ($p = 0.029$) (**Table 2**). Patients with preoperative KOOS-PS scores in the highest quintile (> 68.2) had the highest proportion of PASS Achievement (91.4%; $p < 0.001$). Patients in the lowest quintile (Preoperative KOOS-PS Score < 51.5) had the lowest rate of PASS Achievement (37.9%; $p < 0.001$) (**Figure 2**).

DISCUSSION AND CONCLUSION:

Preoperative PROMs across multiple domains provide strong insights into MCID and PASS achievement in medial UKA. Patients with high preoperative KOOS-PS scores have a high likelihood of PASS, but a low likelihood of MCID. Patients

with low preoperative KOOS-PS scores have a high likelihood of MCID, but a low likelihood of PASS. Higher baseline physical functioning, physical health, and mental health were associated with increased likelihood of PASS achievement. Medial UKA patients should be evaluated with a robust set of several PROMs across multiple domains: knee-specific, general physical functioning, general physical health, general mental health. Utilizing these preoperative PROM scores, arthroplasty surgeons can partner with patients in shared decision-making and expectation management. Arthroplasty surgeons can inform patients of their possible likelihood of achieving MCID (“feeling better”) or achieving PASS (“feeling good”), with the goal of providing both. Preoperative PROM scores should not be used to restrict patient access to care.

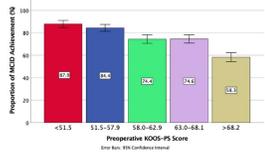


Figure 1. Minimal Clinically Important Difference (MCID) Achievement Rate by Preoperative KOOS-PS quintile. Medial unicompartment knee arthroplasty patients with the lowest preoperative KOOS-PS scores had the highest rate of MCID Achievement.

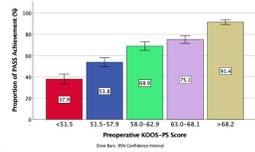


Figure 2. Patient Acceptable Symptom State (PASS) Achievement Rate by Preoperative KOOS-PS quintile. Medial unicompartment knee arthroplasty patients with the highest preoperative KOOS-PS scores had the highest rate of PASS Achievement.

Table 1. Patient Demographics, Hospital Characteristics, and of the overall Medial Unicompartmental Knee Arthroplasty cohort (N = 911)

Variable	N (%) or Mean ± SD
Age (years)	64.1 ± 9.8
Sex	
Men	454 (49.8%)
Women	457 (50.2%)
Body Mass Index (kg/m ²)	28.7 ± 4.4
Charlson Comorbidity Index	0.8 ± 1.4
Length of Stay (days)	0.7 ± 0.8
Discharge Destination	903 (99.1%)
Home	8 (0.9%)
Rehabilitation or Skilled Nursing Facility	39 (4.3%)
Preoperative PROMIS PF-10	44.2 ± 7.3
Preoperative PROMIS Global Physical	52.9 ± 8.7
Preoperative PROMIS Global Mental	58.2 ± 11.5
Preoperative KOOS-PS score	115.9 ± 14.7
1-Year Postoperative KOOS-PS	74.1 ± 22.2
KOOS-PS MCID Achievement*	683 (75.0%)
KOOS-PS PASS Achievement*	613 (67.3%)
Both KOOS-PS MCID and KOOS-PS PASS Achievement	493 (54.1%)
Either KOOS-PS MCID or KOOS-PS PASS Achievement	751 (82.7%)

KOOS-PS, Knee Disability and Other Activities Questionnaire; Physical Function Short Form; MCID, minimal clinically important difference; PASS, patient acceptable symptom state; PF-10, physical function short form 10; PROMIS, Patient-Reported Outcomes Measurement Information System.

* Literature-derived, anchor-based thresholds were utilized, with MCID defined as a KOOS-PS improvement of 7.3 or more, and PASS defined as a 1-year KOOS-PS score of 70.3 or higher.

Table 2. Results of multivariable Generalized Linear Regression, assessing factors independently correlated with MCID or PASS Achievement in the Medial Unicompartmental Knee Arthroplasty (N = 911)

Model	Variable*	Coefficient	95% CI	P-value
KOOS-PS MCID [†]	Pre-Op KOOS-PS Score (per 1-unit increase)	-0.08	(-0.09, -0.06)	<0.001
	Pre-Op PROMIS Global Physical score (per 1-unit increase)	+0.02	(0.01, 0.03)	<0.001
PASS	Pre-Op KOOS-PS Score (per 1-unit increase)	+0.04	(0.04, 0.04)	<0.001
	Pre-Op PROMIS Global Physical score (per 1-unit increase)	+0.01	(0.01, 0.02)	<0.001
Achievement	Pre-Op PROMIS Global Mental score (per 1-unit increase)	+0.01	(0.01, 0.02)	<0.001
	Pre-Op PROMIS Global Physical score (per 1-unit increase)	+0.01	(0.01, 0.02)	<0.001

CI, confidence interval; KOOS-PS, Knee Disability and Other Activities Questionnaire; Physical Function Short Form; MCID, minimal clinically important difference; PASS, patient acceptable symptom state; PROMIS, Patient-Reported Outcomes Measurement Information System.

* Literature-derived, anchor-based thresholds were utilized, with MCID defined as a KOOS-PS improvement of 7.3 or more, and PASS defined as a 1-year KOOS-PS score of 70.3 or higher. The following variables were controlled for in all models: age, sex, body mass index, Charlson Comorbidity Index, preoperative KOOS-PS, preoperative PROMIS PF-10, preoperative PROMIS Global Physical, preoperative PROMIS Global Mental, 95% confidence interval, and each main effect was tested independently, separately reported model (p < 0.05).