One Size Fits None: Why Universal Clinically Significant PROMs Thresholds Fail Total Hip Arthroplasty Patients - A PROMs Phenotype-Driven Outcome Assessment

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INTRODUCTION: Total hip arthroplasty (THA) is a highly successful surgical procedure for treating end-stage hip osteoarthritis, offering patients consistent improvements in pain, function, and quality of life. However, despite its overall success, a subset of patients report dissatisfaction after surgery. In the value-driven healthcare model, patient satisfaction is a crucial indicator of the quality of care. Recent studies have shown that preoperative patient-reported outcome measure (PROM) phenotypes can influence postoperative satisfaction. Concepts such as the minimal clinically important difference (MCID), patient acceptable symptom state (PASS), and substantial clinical benefit (SCB) have been used to evaluate meaningful improvements in PROMs. Many variables, including baseline PROMs, have been shown to affect these thresholds, and there is variability depending on the population and methodology employed. However, the impact of PROM phenotypes on these thresholds has not been thoroughly investigated. This study aimed to 1) categorize THA patients into phenotypes and calculate MCID, PASS, and SCB thresholds for each phenotype and 2) determine the percentage of patients in each phenotype that achieve or exceed the MCID, PASS, and SCB thresholds calculated specifically for their phenotype group.

METHODS: A prospective institutional cohort of 9,229 patients who underwent primary THA between January 2016 and December 2022 was included. Of these, 7,001 (75.9%) completed one-year follow-up. Demographics, comorbidities, baseline, and one-year Hip Disability and Osteoarthritis Outcome Score (HOOS) pain, physical function short form (PS), and joint replacement (JR) scores were recorded. Patients were stratified into eight phenotypes based on their preoperative HOOS pain, PS, and Veterans RAND 12-Item Health Survey Mental Component Score (VR-12 MCS) scores, with each PROM categorized as above (+) or below (-) the median score. MCIDs were estimated using a distribution-based approach (half standard deviation of the change scores). PASS values were estimated using an anchor-based approach, which corresponded to a response to a satisfaction question at one-year post-surgery. SCB was calculated using an anchor question asking patients to compare their current physical health to one year prior.

RESULTS: The MCID, PASS, and SCB thresholds varied among the PROM phenotypes (Table 1-3). The MCID values ranged from 2.67 to 5.46 for HOOS pain, 2.86 to 7.18 for HOOS PS, and 3.03 to 6.32 for HOOS JR across the phenotypes. The percentage of patients achieving the MCID ranged from 94% to 99% for HOOS pain, 83% to 98% for HOOS PS, and 93% to 99% for HOOS JR. SCB thresholds showed variability, with values ranging from 32.5 to 55.0 for HOOS pain, 23.4 to 50.8 for HOOS PS, and 20.5 to 44.2 for HOOS JR. The percentage of patients achieving SCB ranged from 60% to 83% for HOOS pain, 52% to 77% for HOOS PS, and 50% to 69% for HOOS JR. For PASS, the thresholds ranged from 72.5 to 86.1 for HOOS pain, 76.6 to 91.2 for HOOS PS, and 67.5 to 80.6 for HOOS JR. The percentage of patients achieving PASS ranged from 71% to 82% for HOOS pain, 64% to 80% for HOOS PS, and 59% to 72% for HOOS JR.

DISCUSSION AND CONCLUSION: Our findings reveal remarkable heterogeneity in outcome thresholds across THA patient phenotypes, with MCID values varying nearly 3-fold (2.67-7.18), SCB thresholds ranging 2.7-fold (20.5-55.0), and PASS values differing by up to 24 points between groups. This variability suggests that a patient requiring minimal improvement to achieve satisfaction may be fundamentally different from one needing substantial gains—yet current universal thresholds treat them identically. The clinical implications are profound: we may be inadvertently setting unrealistic expectations for some patients while underestimating meaningful progress in others. These findings challenge us to reconsider how we define surgical success and suggest that phenotype-specific thresholds could enhance both clinical decision-making and patient satisfaction in total hip arthroplasty.

Table 1. Calculated MCID thresholds for HOOS Pain, PS, JR

Variable	MCID	Pct_MCID
Pain P+PS+MCS+	5.46	96
Pain P+PS+MCS-	5.42	94
Pain P+PS-MCS+	2.67	98
Pain P+PS-MCS-	3.04	97
Pain P-PS+MCS+	3.45	99
Pain P-PS+MCS-	3.96	99
Pain P-PS-MCS+	4.77	99
Pain P-PS-MCS-	5.25	98
PS P+PS+MCS+	5.45	90
PS P+PS+MCS-	5.01	89
PS P+PS-MCS+	2.86	98
PS P+PS-MCS-	3.22	98
PS P-PS+MCS+	5.81	87
PS P-PS+MCS-	5.88	83
PS P-PS-MCS+	6.26	98
PS P-PS-MCS-	7.18	97
JR P+PS+MCS+	4.93	95
JR P+PS+MCS-	4.70	93
JR P+PS-MCS+	3.03	97
JR P+PS-MCS-	3.10	98
JR P-PS+MCS+	5.27	96
JR P-PS+MCS-	5.74	94
JR P-PS-MCS+	5.57	99
JR P-PS-MCS-	6.32	97

Table 2. Calculated SCB thresholds for HOOS Pain, PS, JR

Table 3. Calculated PASS thresholds for HOOS Pain, PS, JR