## Variability in the Value of Total Hip Arthroplasty

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INTRODUCTION: In the context of value-based care, combining patient-reported outcome measures (PROMs) with costeffectiveness analyses is essential to accurately assess the value of total hip arthroplasty (THA). Despite this need, few studies have linked PROMs with time-driven activity-based costing (TDABC) for THA. This study aims to addresses this gap by analyzing patient-level variations and identifying value drivers in THA to optimize value in orthopedic care.

METHODS: We performed a retrospective analysis of 2,200 patients who underwent primary THA between 2019 and 2022. To determine value, we divided the 1-year postoperative Hip Injury Osteoarthritis Outcome Score Short Form (HOOS-PS) scores by the facility costs calculated using TDABC and then multiplied by a constant to set a minimum value score of 100. Multivariable regression was employed to identify the factors contributing to variations in the calculated value.

RESULTS: The value of THA ranged from 100 to 692, indicating a variation of 692%. Notably, THA performed with the posterior approach had higher value than those performed anteriorly (401.0 vs 354.0, P<0.001) or laterally (401.0 vs 297.0, P<0.001) (Table 1). Preoperative PROMIS Global Mental score was associated with increased value (1-point increase per 1-unit; P=0.031; partial  $R^2$ =0.002) (Table 2). Conversely, higher body mass index was associated with decreased value (2-point decrease per 1-unit increase; P<.001; partial  $R^2$ =0.025). Notably, THA performed with posterior approach was associated with increased value (55-point increase; P<.001; partial  $R^2$ =0.094). DISCUSSION AND CONCLUSION:

Using TDABC and PROMs, the present study highlights the substantial variation in THA value and identifies value drivers. These findings highlight the importance of considering patient-specific and surgical factors to enhance the value of THA in orthopedic care. Integrating these insights can guide strategies to improve outcomes and optimize resource allocation in THA procedures.

Variable	Value	P-value	
Sex		0.002	
Men	$378.9 \pm 80.9$		
Women	$389.8 \pm 85.8$		
ASA score		0.413	
≤ 2	$385.7 \pm 83.7$		
≥ 3	$382.4 \pm 84.0$		
Comorbid conditions			
Smoking status	$374.1 \pm 90.0$	0.089	
Depression	$382.3 \pm 86.1$	0.596	
Surgical approach		< 0.001	
Posterior	$401.0 \pm 78.8$		
Anterior	$354.0 \pm 82.9$		
Lateral	$297.0 \pm 65.8$		
Posterior vs Anterior		< 0.001	
Posterior vs Lateral		< 0.001	
Anterior vs Lateral		< 0.001	
Correlation (r) with value			
Age (year)	0.048	0.024	
BMI (kg/m <sup>2</sup> )	-0.145	<0.001	
CCI	-0.013	0.532	
Preoperative PROMIS Global Physical score	0.009	0.684	
Preoperative PROMIS Global Mental score	0.047	0.030	
Preoperative HOOS-PS score	-0.016	0.466	

Table 2. Multivariable linear regression: Which factors account for the variation in the value of Total Hip Arthroplasty?								
Variables	Adjusted Mean Difference	95% CI		Partial R <sup>2</sup>	P value	$\mathbb{R}^2$		
-	In value*	Lower	Upper					
Male sex (vs. female sex)	-5.26	-12.21	1.70	0.001	0.138	0.118		
$ASA \ge 3$ (vs. $\le 2$ )	-0.94	-9.28	7.41	< 0.001	0.826			
Smoking status	-11.82	-24.67	1.02	0.002	0.071			
Depression	1.37	-8.96	11.70	< 0.001	0.794			
Age, per 1-year increase	0.16	-0.19	0.51	< 0.001	0.363			
BMI, per 1-unit increase	-2.43	-3.08	-1.79	0.025	<0.001			
CCI, per 1-unit increase	-1.35	-3.86	1.17	< 0.001	0.294			
Posterior approach (vs. anterior + lateral)	55.35	48.09	62.60	0.094	<0.001			
Preoperative PROMIS Global Physical score, per 1-unit increase	0.54	0.05	1.03	0.002	0.031			
Preoperative PROMIS Global Mental score, per 1-unit increase	-0.21	-0.90	0.48	< 0.001	0.552			
Preoperative HOOS-PS, per 1-unit increase	-0.10	-0.37	0.16	<0.001	0.433			

ASA, American Society of Anesthesiologists: BMI, body mass index; CCI, Charlson Comorbidity Index; PROMIS, CI, confidence interval; HOOS-PS, Hip Disability and Osteoarthritis Outcome Score-Physical Function Short Form; PF-10a, physical function short form 10a, PROMIS, Patient-Reported Outcomes Measurement Information System. Bold values are statistically significant with p < 0.05.

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