Hospital Bed Capacity Influences Patient Charges in Outpatient Robotic Total Knee Arthroplasty: A Propensity-Matched Study

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INTRODUCTION: The rise of robotic-assisted total knee arthroplasty (RA-TKA) surgeries has correlated with a rise in outpatient procedures, with an aim of improving surgical efficiency and patient outcomes. However, patient charges can vary, which is a pressing concern. Payer and reimbursement structures, as well as postoperative resource utilization, can impact charges. Additionally, RA-TKA incurs higher supply charges due to specialized disposables and preoperative imaging. However, little is known about the impact of institutional characteristics, specifically hospital bed capacity, limiting our ability to fully understand charge variability and to develop effective cost-control strategies. Therefore, this study aims to examine whether hospital size affects patient charges for RA-TKA, focusing on 1) total charges and 2) operating room (OR) charges.

METHODS: Patients undergoing outpatient RA-TKA between January 1, 2017, and December 31, 2021, were identified from a national database. Hospitals were categorized by bed capacity: < 300 beds and > 300 or more beds. To isolate the effect of hospital size, we performed a 1:1 propensity score match, controlling for demographic factors, clinical characteristics, and insurance status, resulting in 464 patients per group. We analyzed total patient charges and OR (anesthesia, OR block time, and post-anesthesia care unit) charges. Statistical analyses used Chi-square tests for categorical variables and independent t-tests for continuous variables. A P-value < 0.05 was considered statistically significant.

RESULTS: Hospitals with ≥ 300 beds showed significantly higher mean total charges ($65,315.6) compared to hospitals with < 300 beds ($53,427.5) (P < 0.001). Mean OR charges were also elevated in larger hospitals ($30,637.2) versus smaller hospitals ($26,000.0) (P < 0.001).

DISCUSSION AND CONCLUSION: Larger hospitals were associated with significantly higher total and OR patient charges for robotic RA-THA, even after matching for clinical and insurance-related factors. These findings suggest that hospital size may be associated with variation in charge profiles beyond patient and payer characteristics.

Table 1. Patient Demographics

SD: Standard Deviation; BMI: Body Mass Index; AA: Alcohol Abuse; TU: Tobacco Use.

	Pre-Match			Post-Match		
	< 300 Beds (n = 588)	≥ 300 Beds (n = 621)		< 300 Beds (n = 464)	≥ 300 Beds (n = 464)	
	N (%)	N (%)	P-value	N (%)	N (%)	P-value
Age in years (SD)	66 (9.5)	63 (9.0)	<0.001	65 (9.4)	65.2 (9.1)	0.756
BMI ≥ 40	54 (9.2)	55 (8.8)	0.915	40 (8.6)	46 (9.9)	0.571
AA	4 (0.7)	1 (0.2)	0.337	1 (0.2)	1 (0.2)	1.000
TU	167 (28.4)	245 (39.4)	<0.001	153 (33.0)	158 (34.1)	0.781
Diabetes (Complicated)	40 (6.8)	43 (6.9)	1.000	25 (5.4)	28 (6.0)	0.777
Cemented Fixation	380 (64.6)	249 (40.0)	<0.001	258 (55.6)	247 (53.2)	0.510
Men	210 (35.7)	274 (44.1)	0.004	190 (40.9)	190 (40.9)	1.000
Commercial Insurance	103 (17.5)	110 (17.7)	0.999	91 (19.6)	88 (19.0)	0.868
Medicaid	152 (25.9)	238 (38.3)	<0.001	145 (31.2)	128 (27.6)	0.249
Medicare	321 (54.6)	257 (41.3)	<0.001	216 (46.6)	233 (50.2)	0.293
Other Insurance	12 (2.0)	17 (2.7)	0.549	12 (2.6)	15 (3.2)	0.696

Table 2. Total and Operating Room Patient Charges by Hospital Size

SD: Standard Deviation

	< 300 Beds (n = 464)	≥ 300 Beds (n = 464)	
	x̄ (SD)	x̄ (SD)	P-value
Total Charges	$53,427.5 (26,729.4)	$65,315.6 (22,775.1)	<0.001
Operating Room Charges	$26,000.0 (14,646.2)	$30,637.2 (13,060.8)	<0.001