

# Is It Getting More Expensive to Treat Patients with High Comorbidities? Financial Trends in Total Knee Arthroplasty from 2013 to 2021

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**INTRODUCTION:** The utilization of total knee arthroplasty (TKA) continues to rise in patients with a high comorbidity burden (HCB). With changes in reimbursement models over the past decade, it is essential to assess the financial impact of HCB TKA on healthcare systems. This study aimed to examine trends in revenue and costs associated with TKA in HCB patients over time.

**METHODS:** Of 14,978 TKA performed between 2013 and 2021, we retrospectively analyzed HCB patients (Charlson comorbidity index [CCI]  $\geq 5$  and American Society of Anesthesiology [ASA] scores of 3 or 4). A total of 1,156 HCB TKA patients with complete financial data were identified. Patient demographics, perioperative data, revenue, costs, and contribution margin (CM) were collected per patient. Changes in these financial values over time, as a percentage of 2013 values, were analyzed. Linear regression was performed with a trend analysis to determine significance.

**RESULTS:** From 2013 to 2021, the percentage of HCB TKAs per year increased from 4.2% in 2013 to 16.5% in 2021 ( $p < 0.001$ ). The revenue of TKA in HCB patients remained steady ( $P = 0.093$ ). Direct costs increased significantly (32%;  $P = 0.015$ ), resulting in a decline of CM to a low of 82.3% of the 2013 values, although not statistically significant ( $P = 0.130$ ). There was no significant change in rates of 90-day complications or home discharge following HCB TKA during the study period.

**DISCUSSION AND CONCLUSION:** The results of this study indicate a significant rise in cost for TKA among HCB patients, without a corresponding rise in revenue. As more patients with HCB become candidates for TKA, the negative financial impact on institutions should be considered. Payments to institutions do not adequately reflect patient complexity. Reevaluation of institutional payments for medically complex TKA patients is warranted to maintain patient access to these procedures.

	Cohort (n=1,156)
Sex, n (%)	
Male	395 (34.2)
Female	761 (65.8)
Mean Age (years) [range]	73 [45 to 94]
Race, n (%)	
White	695 (60.1)
African American	191 (16.5)
Asian	48 (4.2)
Other	222 (19.2)
Smoking Status, n (%)	
Current	575 (49.7)
Former	534 (46.2)
Never	47 (4.1)
Insurance Status, n (%)	
Medicare	903 (78.1)
Medicaid	60 (5.2)
Commercial	193 (16.7)
ASA score, n (%)	
3	1,057 (91.4)
4	99 (8.6)
Mean BMI [range]	33.1 [18.5 to 57.8]
Mean CCI $\pm$ SD	6.5 $\pm$ 2.0
ASA, American Society of Anesthesiology; BMI, Body Mass Index; CCI, Charlson Comorbidity Index; SD, Standard deviation.	

Year	Patient Revenue %, mean (SD)
2013	100.0 (52.1)
2014	104.6 (54.5)
2015	113.0 (68.4)
2016	113.0 (97.1)
2017	113.7 (72.8)
2018	108.0 (65.9)
2019	112.2 (67.0)
2020	115.7 (73.5)
2021	115.5 (54.2)
<b>Total Cost, mean (SD)</b>	
2013	100.0 (25.9)
2014	114.2 (52.4)
2015	108.9 (39.1)
2016	114.9 (50.6)
2017	114.6 (38.3)
2018	106.1 (43.0)
2019	115.4 (48.8)
2020	128.7 (141.6)
2021	113.6 (35.2)
<b>Direct Cost, mean (SD)</b>	
2013	100.0 (26.3)
2014	115.7 (48.5)
2015	111.9 (39.3)
2016	117.8 (49.2)
2017	120.2 (38.9)
2018	116.6 (43.2)
2019	124.0 (48.2)
2020	143.7 (140.8)
2021	132.4 (41.9)
<b>Contribution Margin, mean (SD)</b>	
2013	100.0 (165.6)
2014	82.9 (173.6)
2015	115.0 (206.2)
2016	103.4 (252.1)
2017	100.8 (212.4)
2018	91.2 (205.3)
2019	89.2 (224.5)
2020	60.4 (243.5)
2021	82.3 (194.0)

	Pearson's (P)	Unstandardized $\beta$	95% CI	P Value
Patient Revenue	0.600	0.95	(-0.27, 2.18)	0.093
Total Cost	0.150	1.64	(1.44, 3.52)	0.015
Direct Cost	0.054	3.46	(0.95, 5.98)	0.014
Contribution Margin	0.318	-3.92	(-9.39, 1.56)	0.130

	Pearson's (P)	Unstandardized $\beta$	95% CI	P Value
90 Day Readmissions	0.381	0.69	(-1.56, 0.92)	0.103
90 Day Revisions	0.264	-0.17	(-0.51, 0.17)	0.263
Home Discharge	0.339	1.78	(-0.76, 4.73)	0.130