

Technology Use in Primary TKA and Procedure Costs

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INTRODUCTION: The use of enabling technologies, including computer navigation and robotics, in primary total knee arthroplasty (TKA) has risen markedly over the past decade. While these tools aim to improve surgical precision and outcomes, their economic impact remains unclear. This study evaluated standardized episode-of-care costs for technology-assisted versus manual TKAs, including index hospitalization and 90-day perioperative costs.

METHODS: We identified 304 primary TKAs with enabling technologies (handheld navigation, imageless robotics, and image-based robotics) from our institutional total joint registry from 2019 to 2023. Cases were propensity-score matched 1:1 to manual TKAs, controlling for age, sex, BMI, femoral component design and brand, bearing surface type, and radiographic preoperative coronal alignment. Fourteen patients required reoperation within the 90-day postoperative period, of which 9 (64%) were technology-assisted. Standardized costs included hospital charges (adjusted using Medicare cost-to-charge ratios) and professional fees (calculated using Medicare reimbursement rates). Capital acquisition and service fees for enabling technologies were not included.

RESULTS: Mean procedure costs were higher with enabling technologies (\$16,366 vs. \$14,581; $p < 0.001$). Though postoperative 90-day costs were not significantly different (\$2,421 vs. \$1,962; $p = 0.824$), total episode-of-care costs were higher for technology-assisted TKAs (\$18,786 vs. \$16,543; $p < 0.001$). Compared to matched manual TKAs, which averaged between \$14,465 and 14,721, all enabling technologies had higher mean procedure costs including \$17,000 for handheld navigation, \$16,837 for image-based robotics, and \$15,718 for imageless robotics. Each enabling technology was also associated with higher total episode-of-care costs compared to their matched manual groups.

DISCUSSION AND CONCLUSION: Technology-assisted TKA was associated with slightly increased procedure costs compared to manual TKA. Importantly, this analysis did not account for capital acquisition costs or ongoing service fees associated with enabling technologies, which may further impact cost-effectiveness. As adoption of enabling technologies grows, comprehensive evaluation of both clinical outcomes and total costs, including implementation and maintenance, is essential to guide value-based care strategies.