

Defining Value in Orthopedics: A Comprehensive Review and Framework for Developing Quality and Cost Metrics

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INTRODUCTION: The rising cost of orthopedic care has heightened the need for standardized methods to measure value, defined broadly as the relationship between quality and cost. Although the equation $Value = Quality / Cost$ is frequently cited, its implementation across orthopedic surgery remains variable, and no universally accepted framework currently guides its application. Existing indices—often developed in the context of specific technologies or payment models—differ in their structure, underlying metrics, and alignment with stakeholder priorities. This study provides a comprehensive review of existing value indices in orthopedic surgery, synthesizes quality and cost metrics across the literature, and identifies critical gaps that must be addressed to develop more robust and generalizable value assessment tools moving forward.

METHODS: A structured literature review was performed in April 2024 using three electronic databases: PubMed, Google Scholar, and Embase to identify published methodologies used to quantify value in orthopedic surgery. The following keywords were used in the context of orthopedic surgery: value-based care, surgical innovation, time-driven activity-based costing (TDABC), healthcare cost analysis, quality metrics, procedure value index, operative value index, risk adjustment, surgical economics, and outcome measurement. Studies were grouped into domains of quality and cost, with a particular emphasis on disease-specific outcomes, patient-reported measures, and cost accounting frameworks such as time-driven activity-based costing (TDABC). Findings were analyzed across key stakeholder groups, including patients, providers, hospitals, payers, and regulators.

RESULTS: Between 2015 and 2025, we identified four distinct value indices proposed across shoulder arthroplasty, hip and knee arthroplasty, and spine surgery that quantitatively integrate quality and cost components. These include the Procedure Value Index (PVI), Operative Value Index (OVI), surgeon scorecard frameworks, and TDABC-based models. Each index uniquely measures value using different metrics of quality and cost. The PVI measured value as the proportion of patients achieving the minimum clinically important difference (MCID) per dollar spent. The OVI calculated value as quality-adjusted life years (QALYs) gained per \$1,000 of cost. Surgeon scorecard frameworks quantified value at the provider level using composite metrics grouped into five domains: patient demographics, clinical outcomes, patient experience, financial metrics, and operational efficiency. TDABC-based models provided a novel method to measure cost by mapping resource utilization across the surgical episode.

DISCUSSION AND CONCLUSION: While each of the identified value indices offer foundational frameworks in quantifying value of orthopedic care, our review highlights a lack of consensus in value measurement frameworks. A key takeaway of this review is that high-value care cannot be assessed using one-size-fits-all metrics such as QALYs or overall cost sums. Within the value equation, quality measures such as patient reported outcome measures (PROMs) must be specific to the disease state and surgical intervention performed and be contextualized by baseline function to enable appropriate risk adjustment. As per the cost variable, costs must include not only direct expenses, but also opportunity costs, workflow impact, and long-term resource use as seen in TDABC. There is a critical need for procedure-specific value indices that integrate risk-adjusted quality outcomes and granular cost data. As such, the authors advocate for the development of unique value indices for procedural interventions that incorporate risk-adjusted disease state specific outcomes, surgical appropriateness, and long-term cost-benefit profiles.