

# Improving Total Joint Replacement with Continuous Quality Improvement Methods and Tools



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## KEYWORDS

- Total joint arthroplasty • Total knee arthroplasty • Total hip arthroplasty • Quality improvement
- Lean six sigma • Clinical pathways • BPCI

## KEY POINTS

- Applying quality improvement techniques from other industries can provide a legitimate template for improving the health care system.
- Standardization and simplification are feasible adjustments that can drastically improve outcomes for patients.
- Eliminating inefficiencies in the delivery of total joint arthroplasty in the context of novel compensation models can decrease cost and increase value for all stakeholders while maintaining quality for patients.
- There are multiple studies that have established a foundation for less-experienced health care institutions to draw upon to aid the transition to high-quality, economically efficient protocols.

## INTRODUCTION

Total joint arthroplasty (TJA) is frequently indicated in patients with severe degenerative osteoarthritis. As the population continues to age, the demand for these surgeries will continue to rise. It is estimated that by 2030, the number of annual total hip arthroplasties (THAs) and total knee arthroplasties (TKAs) in the United States could reach 572,000 and 3.48 million, respectively.<sup>1</sup>

Studies have reported that joint arthroplasty surgeries are cost-effective. Cost-effectiveness can be portrayed as a comparison of the cost

of a surgical or medical intervention with the gain of quality-adjusted life years (QALYs). The threshold value for cost-effectiveness has not been standardized on a large scale, but there have been recommendations for thresholds of \$50,000 to \$200,000 per QALY, or 2 to 3 times the per capita gross income.<sup>2</sup> There have been several studies on TJA that report cost-effectiveness well below these numbers. For example, Chang and colleagues<sup>3</sup> reported a \$4600 cost per QALY gained in THAs. Similarly, for TKA, Losina and colleagues<sup>4</sup> found a cost-effectiveness to QALY ratio ranging from

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\$9700 to \$21,700 for low- and high-risk patients, respectively. The cost per QALY for TJA is well below the previously mentioned thresholds, suggesting that TJA is an economically efficient way to improve a patient's quality of life.

Although cost-effective, TJA is highly variable in its delivery, which presents many opportunities for quality improvement. Tomek and colleagues<sup>5</sup> collected data from several health care systems to identify differences in TKA delivery. They found variations in each system and identified characteristics such as having a dedicated TKA operating team and multispecialty involvement in perioperative care as factors associated with improved patient and hospital outcomes. Studies have shown there are also fluctuating costs for TKA and THA within and between hospitals. Bozic and colleagues<sup>6</sup> compiled data on patients admitted for TKA or THA from 61 hospitals. They noted that the cost of a knee and hip implant displayed high degrees of variability, ranging from \$1797 to \$12,093 USD and \$2392 to \$12,651 USD respectively. Even including this wide range of implant costs, there was still a significant portion of variability unaccounted for. As economic pressures to decrease cost continue to rise, standardization of TJA delivery will become increasingly critical to reduce waste, eliminate inefficiencies, and ultimately improve the quality of TJA.

Lean six sigma (LSS) and the use of standard clinical pathways are quality improvement methodologies that have shown promise. LSS is a quality improvement system that was originally implemented in manufacturing industries, but has been applied to the health care field over the past 20 years.<sup>7,8</sup> The purpose of LSS is to use systematic and analytical approaches to identify inefficiencies and improve them. Clinical pathways, on the other hand, are evidence-based changes to homogenize perioperative protocols to minimize variation with the goal of improving efficiency and quality.

As the population in the United States continues to age, the demand for these TJA will only continue to rise. Evaluating and implementing novel cost-cutting procedures can be difficult for any organization. The purpose of this article is to analyze current quality improvement techniques and provide a framework of feasible changes that institutions can draw from to facilitate the transition to value-based health care.

## BENCHMARKING

Setting internal benchmarks that are in accordance to external benchmarks set by national

regulatory committees can lead to direct improvements on quality. Benditz and colleagues<sup>9</sup> demonstrated that using a system of benchmarking with feedback mechanisms led to a decrease in pain after THA, increase in patient satisfaction, and an improvement of quality. Benditz and colleagues assembled a multidisciplinary team to establish and implement a regular system of data analysis and internal benchmarking. Some of the parameters that were benchmarked included mean numerical rating score (NRS), maximum pain, minimum pain, and patient satisfaction. The health care team was then informed of the data and feedback reported from patients. Constant communication and suggestions for improvement among patient, nurses, and physicians were encouraged. After implementation of the continuous benchmarking and feedback program, patients reported decreased mean maximal pain scores and increased satisfaction scores. Through consistent benchmarking, feedback, and communication, the researchers were able to improve the quality of THA. Benditz and colleagues<sup>10</sup> then applied this benchmarking with a direct feedback process to TKA and noted similar improvements in pain score and patient satisfaction. In larger health care systems where implementation of any standard protocol can be complex and difficult, benchmarking can be a simple yet effective technique to improve patient outcomes.

In addition to internal benchmarks, hospitals must ensure that the benchmarks they set either meet or exceed the standards set by the Agency for Healthcare Research and Quality and other national health care quality evaluators.

## LEAN SIX SIGMA

LSS is similar to benchmarking, but there are some differences. LSS is a methodology originally implemented in manufacturing industries to use systematic and reproducible approaches to improve quality. There are several management techniques described as LSS tools that may aid in effective quality improvement implementation. Perhaps the most fundamental roadmap in LSS methodology is the DMAIC process. In practice, this means defining a goal, measuring current performance, analyzing the root of the defect, improving and/or eliminating the defect, and controlling future process performance. During the measure phase, a SIPOC (suppliers, inputs, process, outputs, customer) diagram is frequently used to help identify waste (Box 1) in a process.

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