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Contents lists available at ScienceDirect

The Journal of Arthroplasty

journal homepage: www.arthroplastyjournal.org

Health Policy & Economics

Preparing for an Era of Episode-Based Care in Total Joint Arthroplasty

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ARTICLE INFO

Article history:

Received 16 June 2020

Received in revised form

14 August 2020

Accepted 18 September 2020

Available online 22 September 2020

Keywords:

care delivery redesign
 value-based surgical care
 value-based care
 episode-based care
 patient-centric design
 surgical care redesign

ABSTRACT

With a history of steadily rising healthcare costs, the United States faces an unprecedented set of health and financial challenges. The COVID-19 pandemic will only exacerbate these challenges, and it is of paramount importance to reform and refine health systems to maximize the value of care delivered to the patient. Recent developments related to value improvement in total joint arthroplasty suggest that episode-based payment is likely to become standard practice given the current healthcare environment. Consequently, developing episode-based care models for total joint arthroplasty is in the best interests of surgeons, health systems, and patients. In this article, we review important developments related to value-based care in total joint arthroplasty and present an episode-based framework for delivering high-value, patient-centric care. We examine each phase of a total joint arthroplasty episode—preoperative, acute, post-acute, and follow up—and present several ideas with developing bodies of evidence that can improve the value of care delivered to the patient.

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With the rising healthcare costs observed over the last decade along with our illustrative experiences with healthcare financing during the COVID-19 pandemic, it is important to reflect on what we have learned and where we may be headed with respect to value improvement in elective surgical care. There have been a number of recent transitions in value-based payment and delivery models, and these are likely to accelerate in the wake of the pandemic. Total joint arthroplasty (TJA) remains an ideal case study to examine the impact of value-based payment models on outcomes and costs, as the clinical burden of disease is high and there is a steadily rising procedure volume across geographies.

One or more of the authors of this paper have disclosed potential or pertinent conflicts of interest, which may include receipt of payment, either direct or indirect, institutional support, or association with an entity in the biomedical field which may be perceived to have potential conflict of interest with this work. For full disclosure statements refer to <https://doi.org/10.1016/j.arth.2020.09.028>.

Conflict of interest statement: TDS has no conflicts of interest to report. KJB serves as a consultant for the Centers for Medicare and Medicaid Services and the Harvard Business School Institute for Strategy and Competitiveness, owns stock or stock options in Carrum Health, and is a member of the Board of Directors for the American Joint Replacement Registry.

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<https://doi.org/10.1016/j.arth.2020.09.028>

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There have been several impactful studies related to the value of care in TJA. Large database studies have shown that preoperative comorbidities are associated with greater inpatient costs and resource utilization in TJA patients [1,2]. These studies have given us a better account of the marginal cost associated with specific preoperative comorbidities. They have also helped inform more accurate risk adjustment modeling for predicting outcomes and resource utilization associated with TJA. Furthermore, we have learned how arthroplasty implant costs contribute greatly to total episode cost [3]. This realization prompted institution-level quality improvement efforts to make costs associated with clinical decisions more transparent to surgeons, leading to value improvement interventions to increase price transparency. Early evidence suggests that scorecards are associated with reductions in cost variation and median cost in TJA [4], suggesting that direct provider feedback on costs can lead to higher value clinical decision making.

Rising healthcare costs are placing greater pressure on large employers, government agencies, and private payers, giving them stronger incentives to understand and optimize the value provided by surgical procedures and to develop interventions to influence patient choice. Many large employers have begun to direct patients toward perceived higher value surgeons and institutions through an innovative approach to contracting and benefit design known as a centers-of-excellence model [5]. Reference pricing—in which patients are liable for any costs related to a given procedure above a

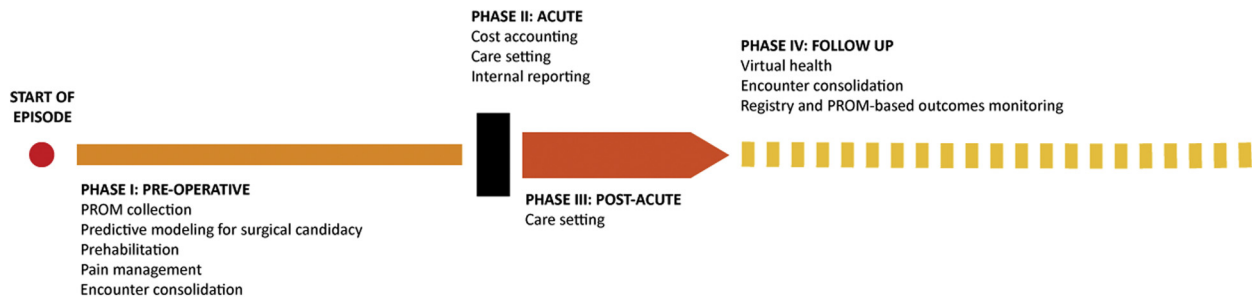


Fig. 1. An episode-based framework for TJA care delivery. PROM, patient-reported outcome measure; TJA, total joint arthroplasty.

defined threshold—has been utilized by large payers to successfully reduce aggregate costs in TJA without sacrificing outcomes [6]. Although these models were already being deployed over the last decade, their adoption is likely to accelerate due to the COVID-19 pandemic. Conservative modeling estimates suggest that there will be \$163.4 billion in direct medical costs incurred from COVID-19-related patient care [7]. As the COVID-19 pandemic continues, employers face greater pressure to reduce healthcare spending while private payers look to recuperate the unexpected expenses stemming from pandemic-related patient care expenses. Furthermore, as highlighted in a Kaiser Family Foundation actuarial brief, more healthcare costs are likely to be shifted onto the individual through higher deductibles and higher out-of-pocket limits providing a patient-level incentive to seek out high-value care [8].

The Centers for Medicare and Medicaid Services (CMS) has promoted policy interventions like the Comprehensive Care for Joint Replacement model (CJR) as an episode-based payment model to curb rising costs in TJA. Studies examining results from CJR have demonstrated some downward pressure on overall cost per episode, and a notable decrease in spending on implants and post-acute care [9–11]. Some questions remain with episode-based payment models—such as the impact episode-based payment models have on financing for skilled nursing facilities and the added burden of post-acute care on the families of patients [10]—and they will have to be addressed as these models are implemented in a more widespread manner. However, given an environment of increasing healthcare costs, a sizable federal fiscal deficit, and a pandemic that exacerbates both, CMS and private payers are likely to promote and maintain episode-based payment models for TJA given the early evidence of their effectiveness in reducing overall costs without compromising outcomes.

Although there are significant costs and efforts associated with refining established care delivery models, we maintain that it is in the best interests of TJA surgeons, providers, health systems, and their patients to develop an episode-based care delivery infrastructure. Moreover, as we empower patients and embrace shared decision making, it is essential that any episode-based care model is patient-centric in its application. In this article, we discuss several ideas for high-value care under an episode-based framework for TJA.

An Episode-Based Approach to Total Joint Arthroplasty Care Delivery

In this section, we present an episode-based framework for TJA, highlighting several ideas with developing bodies of evidence for each phase of a TJA episode. We believe that each of these ideas supports high-value and patient-centric care in an episode-based model. Figure 1 depicts the care episode of TJA, its component phases, and care delivery priorities for each phase: preoperative, acute, post-acute, and follow up.

Phase I: Preoperative

The preoperative phase of a TJA episode includes the period of time where it is decided that conservative management of a patient's hip or knee arthritis has failed and that TJA is the most appropriate treatment option. Important elements of this phase include shared decision making around TJA, and optimization of the patient for TJA if that is the agreed upon treatment option.

Patient-Reported Outcome Measure Collection

The preoperative phase provides an opportunity to assess patient-reported outcome measures (PROMs). PROMs acknowledge the importance of the patient perspective and represent an axis of value that is not captured completely by traditional clinical outcome measures such as length of stay, readmission, or mortality. The use of PROMs starting in the preoperative phase of TJA has been linked to better communication and expectation setting, both important components of patient experience in surgical care [12]. PROMs also hold clinical importance, as we have learned that patients with certain preoperative PROM values are either more or less likely to see meaningful clinical improvement from total hip or knee arthroplasty [13,14]. Over the last decade, PROMs have steadily transitioned from a topic of academic discussion into TJA patient care and clinical decision making. However, PROM collection is still not routinely incorporated into standard clinical practice, collection is not at peak efficiency, and nonresponsiveness to PROM collection instruments has been identified as a barrier to efficiently utilizing PROMs [15–17]. As implementation challenges—such as efficient workflow integration; patient, provider, and staff attitudes; and barriers to patient completion of PROM surveys—are studied in more depth, we should see a steady increase in PROM collection in TJA care. There remain important questions around whether PROMs have sufficient reliability to be utilized in reimbursement models and care improvement efforts; the answers to these questions should be clearer as we gain experience with PROMs in the standard of care. Nonetheless, the intention of meaningfully incorporating the patient perspective at the beginning of the TJA episode into discussions on surgical decision making and prognosis remains integral to shared decision making and value improvement in TJA.

Predictive Modeling for Surgical Candidacy

With more accountability for longitudinal outcomes and costs in an episode-based care model, providers and health systems will have greater incentive to convey the marginal costs and marginal benefits of TJA to the patient. Thus, balancing objective decision making surrounding surgical appropriateness with subjective decision making pertinent to patient values and preferences is particularly important in the preoperative phase of an episode-based care model. Predictive modeling has the potential to evolve evidence-based medicine into a more personalized application.

Larger clinical and administrative claims databases, along with registries, have provided robust training datasets that allow for the development of machine learning-based predictive models. These predictive models in turn allow for personalized risk stratification and surgical planning [18]. Early evidence shows that such models informing patient-specific decisions on procedure value can be developed with accuracy for TJA patients [19].

Importantly, there are some limitations with existing administrative coding database accuracy that limit the utility of these databases as training datasets for machine learning-based predictive models. Until there are significant improvements in administrative database accuracy, the limitations of predictive models in their clinical application should be acknowledged. In spite of these limitations, predictive modeling of surgical outcomes presents a notable opportunity to promote shared decision making in discussions on surgical candidacy. With more robust registry data and a cultural shift favoring the adoption of machine learning-based predictive modeling, these personalized risk stratification models can be incorporated into the standard of care.

If PROMs are fully integrated into TJA registries to help inform these models, there is an opportunity to present patients with a personalized benefits calculator in parallel with their risk calculator. Predictive modeling applied to prognostication can help patients and surgeons have a more informed discussion about individualized risks and benefits from surgical intervention, thus mitigating information asymmetry and making for a patient-physician interaction that is more aligned with true shared decision making [13,14].

Prehabilitation

As comprehensive arthritis care models gain more consideration in an episode-based environment, the utilization of evidence-based nutrition and exercise programs is being debated. Such programs provide a supervised, evidence-based environment for preoperative optimization of nutritional and metabolic status to prepare a patient for their surgical course and postoperative course with a lower extremity implant. The effectiveness of these “prehabilitation” programs is still being studied, but there is early evidence suggesting an association with reduced complication rates and improved functional and clinical outcomes after TJA [20]. If these programs are found to reliably reduce complication rates, it stands to reason that they can be self-financed through the cost savings they generate. As more studies yield results on prehabilitation program effectiveness, health systems can consider adopting similar nonsurgical interventions for outcomes improvement in their episode-based approaches to TJA care delivery.

Pain Management

Another important component of preoperative TJA care is pain management. With the ongoing challenge of opioid abuse and greater attention to patient-specific opioid utilization, surgical services are increasingly considering multimodal pain management. This will only grow under episode-based models where there is greater accountability for medication utilization and long-term outcomes. With evidence showing improved postoperative patient outcomes, postoperative opioid tapering is steadily gaining adoption into the standard of care for elective orthopaedic procedures [21].

The preoperative phase is also increasingly being seen as a period for intervention, as long-term and preoperative opioid use is associated with increased complication risk in TJA [22,23]. Preoperative weaning protocols and regional anesthesia are being investigated as potential chronic pain management alternatives along with known multimodal pain control regimens [21,24,25]. In the next decade, we should see more standardized tapering

protocols in both the preoperative and postoperative periods, and opioid-sparing multimodal pain regimens as the standard of care for TJA, particularly in episode-based care models. Although still far from the standard of care, personalized pain management—an approach that takes into account patient-level pharmacodynamics—may be implemented in an investigational manner in arthritis care.

Phase II: Acute

The acute care phase includes the surgical and perioperative experience of a TJA episode. Consequently, it is also the most costly phase of a care episode. Under an episode-based care model, the following elements will be of particular importance during the acute phase: cost accounting, care setting, and internal reporting.

Cost Accounting

In recent years, greater attention has been given to the costs of services provided inside the hospital. This push for increased price transparency has yielded significant progress, but there remains plenty of desire and scope for greater transparency in an era of reference pricing and episode-based payment. Important tools that have been implemented in limited settings include time-driven activity-based costing (TDABC) and cost-effectiveness analyses. TDABC methodology allows for cost accounting that more accurately reflects the resources allocated to a particular activity [26]. This methodology has only recently been applied to hospital costs, and presents an opportunity to organize hospital resources and promote value-based decision making and clinical pathway design in TJA [27]. Using the cost accounting of TDABC, cost-effectiveness analyses comparing various treatment modalities—ranging from implant type to rehabilitation regimen—can inform clinical decision making during the acute phase and throughout the TJA episode. Harnessing TDABC and cost-effectiveness analyses in conjunction has the potential to improve aggregate value through a series of previously impossible incremental advances coordinated throughout the full care episode. In this case, providers and health systems are empowered to make more informed clinical decisions and deliver greater value to TJA patients.

Care Setting

Another important factor related to TJA acute care costs is the facility in which the procedure takes place. Recently, an increasing proportion of TJA procedures are shifting to ambulatory surgical centers (ASCs) as CMS has removed both total knee arthroplasty and total hip arthroplasty from the inpatient-only list, and commercial payers have increasingly denied inpatient admissions for routine primary TJA procedures. With some early data to show noninferior outcomes in selected patients, this practice is increasing in frequency [28,29]. In November 2019, CMS approved payments for lower extremity TJA conducted at an ASC [30]. In their payment system for ASCs, CMS is utilizing a hospital market basket as a benchmark, suggesting that there are likely to be significant cost savings for TJA conducted in the less resource-intensive ASC. Although data are sparse on the impact this ruling will have on the value and equity of TJA, moving select lower-risk cases from the hospital to the ASC does present significant opportunity for cost reduction while maintaining favorable outcomes, particularly in an episode-based care model.

An important implication of this ruling for care equity is that it creates a disincentive in episode-based payment models to operate on higher-risk TJA patients. This disincentive was highlighted during CJR implementation, as TJA patients tended to be younger and diagnosis-related groups with major complication or comorbidity decreased [31]. In the interest of care equity, multiple types

of TJA payment episodes, better adjusted for patient risk profile and facility, will need to be defined as hospital-based cases will have significantly different outcomes and resource utilization than cases performed in the ambulatory setting. Another related concern is the added incentive to expand indications of primary joint arthroplasty to patients with degenerative joint disease that has not yet progressed to the traditional threshold that would warrant surgical intervention. Health systems and orthopaedic professional societies should be aware of this potentially perverse incentive and consider whether there is a need for clinical practice guidelines on equity and surgical candidacy in an episode-based care model.

Internal Reporting

Data reporting is an important tool for performance improvement, and reporting on outcomes and costs is particularly important in the higher accountability setting of episode-based care. Although public reporting of surgeon-specific outcomes data remains controversial, scorecards, which represent direct data collection and internal reporting on individualized performance, may present a more popular alternative. Scorecards have been suggested for surgical care as they provide surgeons with direct quantitative feedback on their clinical, financial, and operational performance and can inform higher-value clinical decision making [32]. There are some data to suggest that scorecard use in TJA is associated with moderate improvement in clinical outcomes such as length of stay and a reduction in direct costs of care, such as implant costs [4]. However, additional data on whether scorecards more broadly impact clinical outcomes or patient-reported outcomes remain to be seen as institutions gain experience with standardized surgical scorecards. Furthermore, there are important considerations with respect to data privacy and workplace culture that should be taken into account prior to a decision to implement unblinded scorecards highlighting an individual's performance. Whether the actual mechanism is using scorecards or another tool, internal reporting remains a valuable component of sustained outcomes improvement while monitoring costs under an episode-based care model.

Phase III: Post-Acute

The post-acute care phase involves rehabilitation immediately following the inpatient admission for surgery. This can take place in the inpatient setting, at a skilled nursing facility, or at home with or without home health services. The setting largely depends on the patient's risk profile and can be influenced by a number of social factors.

Care Setting

The setting for post-acute care, which varies based on the patient and case, is the main determinant of the total cost of post-acute care [33]. CMS's CJR resulted in reduced utilization of more costly inpatient rehabilitation and greater utilization of lower-cost options like a skilled nursing facility or home [33]. These findings highlighted how episode-based payment models enable the shedding of unnecessary costs and resource utilization related to the post-acute care setting. The expanded accountability for episode costs may prompt health systems to develop quality monitoring of post-acute care facilities and develop networks for their preferred high-performance facilities. Careful attention should be given to the parameters used for skilled nursing facility outcomes monitoring to ensure they are impactful measures in patient care.

There are several important implications of this expanded accountability for post-acute care. The first is an incentive for consolidation, as systems with sufficient patient volume seeking

greater control over resource allocation may establish their own post-acute care services. Another implication, especially in leaner models of care comprising of primarily healthy patients, is the added incentive to develop robust home-based rehabilitation programs that can deliver comparable outcomes to more costly post-acute care settings. Finally, skilled nursing facilities will likely observe decreased patient volumes and smaller profit margins as a result of robust quality monitoring, post-acute care setting consolidation, and expanded home health services. Although this may be considered an unfortunate consequence of episode-based care, it may also be seen as an opportunity to reward skilled nursing facilities that deliver better outcomes for patients.

Phase IV: Follow Up

The follow up care phase involves all encounters related to postoperative monitoring and rehabilitation outside the post-acute phase. This phase generally involves serial follow up visits to examine surgical wounds, pain, and joint function. Technological solutions and structural changes to in-person visits present opportunities to improve the value of care delivered in this phase of the TJA episode. Documentation using national TJA registries during this phase remains an important facet of patient safety and our understanding of long-term implant outcomes.

Virtual Health

Virtual health approaches have become increasingly popular during the COVID-19 pandemic. With their potential to extend care capacity and improve patient experience, they are a promising tool in the follow up period of a TJA episode. One important virtual health tool is the video visit. When used in appropriately selected cases, video visits can relieve clinical resources by reducing the need for in-person follow up visits and enable more efficient information exchange through mobile follow up encounters [34]. Video visits can also extend postoperative monitoring capabilities, potentially improving sensitivity to complications and improving outcomes [35]. Another important set of tools is wearable technology, which can be considered for supplementary postoperative complication monitoring. Devices like portable patch-based electrocardiographic monitors are already regularly utilized to monitor cardiac rhythms while portable pulse oximetry presents great promise in monitoring the patient's cardiopulmonary status. Prior to implementation, health systems will have to address the integration of wearable technology with their electronic medical record platform. Although there are additional costs incurred by implementing video visits and wearable technology-based postoperative monitoring, the extended monitoring capability possible with these approaches may help patients avoid emergent readmissions, thereby improving outcomes and reducing net episode costs.

Although evidence supporting the effectiveness of such applications in improving or providing comparable outcomes is pending, they may be implemented in wider fashion as they allow for more efficient allocation of healthcare resources. As TJA providers and health systems gain more experience incorporating video visits and wearable technology into standard clinical encounters, we will begin to see guidance on best practices specific to TJA and their utility in episode-based care models.

Encounter Consolidation

The downward pressure on costs created by episode-based payment models will prompt provider organizations to consolidate in-person clinical encounters, particularly during the follow up phase of an episode as there is already familiarity with the patient. This type of encounter consolidation can also be utilized in the preoperative phase to provide a convenient, comprehensive

evaluation to an arthritis patient. Examples of clinical encounter consolidation are the integrated practice units currently being utilized by institutions like UT Health Austin and the Navy, in which a single clinic visit may allow the patient to have encounters with an orthopaedic surgeon, physical therapist, mental health specialist, and nutritionist [36,37]. This streamlined model—theorized to reduce aggregate costs by limiting low value, fragmented care—has the potential to improve patient experience, as care is delivered in a more cohesive and convenient manner. As UT Health Austin and the Navy see greater volume with the integrated practice unit model, we will have some data highlighting whether such a model is effective in delivering greater value to patients with arthritis and therefore can be spread nationwide.

Outcomes Monitoring Based on Registries and Patient-Reported Outcome Measures

The regular use of patient outcome registries throughout the follow up phase of an episode can help improve patient safety and inform orthopaedic clinical practice. Initially restricted to local geographies, joint replacement registries have now become national, allowing for higher-powered studies with greater relevance in policymaking. Registries that are specifically designed for joint replacement patients provide a level of granularity that is often not possible with general clinical or administrative databases. This granularity informs specific orthopaedic clinical decisions, all without losing the increased study power from the large sample sizes characteristic of traditional databases. Various studies involving registry data have provided valuable information on topics like projected demand for joint arthroplasty [38], hip and knee arthroplasty failure rates and associated mortality [39,40], and cup positioning in hip arthroplasty [41]. The use of registries through the follow up phase allows for long-term surveillance and study of important details such as implant longevity and failure mechanisms. Furthermore, the case has been made for registries to increase their focus on PROMs, allowing for large-scale collection and study of the TJA patient perspective [42]. Incorporating PROMs into these registries enables inquiry into how the patient experience evolves throughout the follow up phase and how it relates to the details of their TJA. PROM incorporation into registries can give them greater clinical relevance and an important role in clinical decisions regarding the timing and appropriateness of surgery, implant type, and other efforts to optimize care quality. As national TJA registries such as the American Joint Replacement Registry play a larger role for outcomes monitoring throughout the follow up phase of a TJA episode, the use of PROMs in these registries can enable more patient-centric care.

Conclusion

Healthcare costs in the United States have been steadily increasing for several decades, prompting reform efforts aimed at improving the value of care delivered to patients, particularly in TJA. As a consequence of the COVID-19 pandemic, the United States is facing an unprecedented set of health and financial challenges that have prompted more active discussion around healthcare delivery redesign and value improvement. Government agencies and payers are incurring higher than anticipated healthcare costs and greater pressure to promote higher-value care. Individuals, who are likely to incur higher out-of-pocket healthcare costs, are likely to have stronger incentives to seek out patient care that is of high value. Given the results of early value improvement initiatives, episode-based payment models are likely to be the new normal for TJA care. Surgeons and health systems can harness the impetus and energy around episode-based TJA models to increase the value of care delivered to TJA patients.

We reviewed relevant literature and presented several ideas for increasing value through an episode-based framework for TJA. We recognize that each of the ideas discussed has its own associated costs of development, implementation, and maintenance. However, based on the developing body of evidence for each idea, we believe the costs are either relatively transient or worth the improved outcomes that may result. Subsequent research endeavors should begin to more rigorously explore the cost-effectiveness of various interventions in an episode-based payment model.

We hope that our thoughts and discussion can help inform care delivery and payment redesign efforts. Between the concepts discussed and those yet to be explored, the coming years present many exciting opportunities to deliver high-value, patient-centric care in total joint arthroplasty.

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