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Bundled Payments in Total Joint Replacement: Keeping Our Care Affordable and High in Quality

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Abstract
Purpose of review The purpose of this review was to evaluate the literature regarding bundle payment reimbursement models for total joint arthroplasty (TJA).
Recent findings From an economic standpoint, TJA are cost-effective, but they represent a substantial expense to the Centers for Medicare & Medicaid Services (CMS). Historically, fee-for-service payment models resulted in highly variable cost and quality. CMS introduced Bundled Payments for Care Improvement (BPCI) in 2012 and subsequently the Comprehensive Care for Joint Replacement (CJR) reimbursement model in 2016 to improve the value of TJA from the perspectives of both CMS and patients, by improving quality via cost control.
Summary Early results of bundled payments are promising, but preserving access to care for patients with high comorbidity burdens and those requiring more complex care is a lingering concern. Hospitals, regardless of current participation in bundled payments, should develop care pathways for TJA to maximize efficiency and patient safety.

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Introduction

Lower extremity total joint arthroplasty (TJA), including total knee arthroplasty (TKA) and total hip arthroplasty (THA), is one of the most frequently performed procedures in the USA, with nearly 1,000,000 performed annually [1, 2]. The incidence of these procedures is projected to rise to over 4,000,000 per year within the next two decades [3, 4]. Despite being cost-effective [5, 6] and reliable for regaining lower extremity joint function and improving quality of life [7], TJAs represented over seven billion dollars in cost to the Centers for Medicare & Medicaid Services (CMS) in 2014 [8], and they currently account for more Medicare expense than any other inpatient procedure [9]. As such, any increase in the number of TJAs performed annually threatens to impose an enormous economic burden on the US healthcare system.

Traditional fee-for-service (FFS) reimbursement models incentivize healthcare providers based on volume, rather than value of care delivered, leading to excessive use of services and increased expenditures [10]. A FFS model does little to incentivize resource stewardship or coordination across providers, since separate and unique payment systems exist for hospitals (medical severity adjusted diagnosis related group [MS-DRG]), physicians (current procedural terminology code [CPT]), and post-acute care providers, even when related to a single episode of care. Consequently, the quality and cost of care for TJA varies greatly among providers under FFS models [11, 12].

Several strategies have arisen to combat rising health care costs, and they are collectively referred to as alternative

payment models, or APMs. Bundle payment models are a type of APM. Bundled payments incentivize providers to use a coordinated, multidisciplinary healthcare approach to enhance the quality and efficiency of care and improve patient satisfaction, while controlling cost [13•]. Paying a group of providers a single contracted price for all services provided within a defined episode of care [14, 15••], rather than separate piecemeal payments to individual providers, creates incentives to work collaboratively to improve quality and eliminate unnecessary services [16•]. Bundled payment initiatives in TJA have been shown to reduce costs while maintaining or even improving the quality of care provided [11, 17, 18]. Accordingly, multiple payer organizations have adopted bundled payment schemes for TJA [16•]. However, joint replacement surgeons and their representative advocacy groups have expressed reservations about their implementation, including perceived disincentives to care for high-risk patients and uncertainties around gain sharing [19•]. This article explores the history of bundled payment initiatives in TJA, their current form, and how this payment strategy can be utilized to provide value through affordable, high quality care.

The Evolution of Bundled Payment Models

Prior to the 1980s, hospitals were reimbursed retrospectively based on hospital costs incurred during a patient's stay along a fee-for-service model. In 1983, CMS introduced the Inpatient Prospective Payment System (IPPS), which used Medicare Severity-Diagnosis Related Group (MS-DRG) payments to reimburse Medicare Part A services, inpatient hospital care, under a single price [20]. While hospitals received a single prospective per-discharge payment that included all of the facility costs, such as room and board, nursing, and costs associated with specialized care and ancillary services, orthopedic surgeons, and other medical professionals continued to receive separate fees for surgery and other services. Overall, the initiation of IPPS slowed the rate of increase in Medicare spending [21, 22], hospital resource utilization, and led to a decrease in the duration of lengths of stay [23]. However, the quality of inpatient care including mortality and readmission rates remained unchanged [24]. Though IPPS was a significant step toward bundling of medical services, it only focused on inpatient services, and payments for physician services, post-acute care, and readmissions were not included.

In 2009, CMS expanded IPPS by adding physician professional fees through the Acute Care Episode (ACE) demonstration program, in which physician-hospital organizations negotiated a prospective payment to cover both the inpatient facility, or Part A, and inpatient physician, or Part B, costs for patients undergoing seven orthopedic and cardiovascular episodes of care, including TJA, in five hospitals [25]. Though limited to facilities in the Southwestern USA, participating centers reported lower costs with no notable impact on patient outcomes [14, 26].

The Bundled Payment for Care Improvement (BPCI) initiative was developed by CMS in 2012 [13•]. Originally, a 3-year program, BPCI, was extended an additional 2 years until September 30, 2018 allowing participants to select from 48 episodes or DRG families, four program reimbursement models (three retrospective and one prospective), three levels of risk, and even define their own quality measures [14]. Unintentionally, the leniency of BPCI created a participation bias, because target prices and bonuses were predominantly based on a hospital's improvement over its own past performance. BPCI attracted organizations with high-cost and/or low-performance histories, because it offered them the greatest opportunity for improvement. However, hospitals with low-cost and high-performance histories considered BPCI an unattractive option, because there was little room for improvement in their performance and thus little opportunity to offset their operational costs after the mandatory 2-3% discount to CMS.

In 2015, CMS announced the comprehensive care for joint replacement (CJR) model [8]. Implemented on April 1, 2016, CJR mandated the participation of nearly 800 hospitals in 67 Metropolitan Statistical Areas (MSAs), including hospitals in diverse settings such as academic and community, small and large, rural and urban. Modeled after BPCI, CJR differs in terms of participation, pricing, and risk. The CJR model covers all related items and services utilized within a 90-day episode of care. The episode of care is initiated with an admission to a participant hospital of a Medicare beneficiary who is ultimately discharged under MS-DRG 469 (major joint replacement with major complications or comorbidities) or 470 (major joint replacement without major complications or comorbidities). This is called the "anchor hospitalization". The episode ends 90-days post-discharge. The episode of care includes all related items and services including the following: physician services, inpatient hospital services (including readmissions), inpatient psychiatric facility services, long-term care hospital services, inpatient rehabilitation facility services, skilled nursing facility services, home health agency services, hospital outpatient services, independent outpatient therapy services, clinical laboratory services, durable medical equipment, drugs, and hospice. Unrelated services excluded from the episode costs include acute clinical conditions not arising from existing episode-related chronic clinical conditions or complications of surgery and chronic conditions that are generally not affected by the procedure or post-surgical care [8].

The CJR model is a retrospective bundled payment model, meaning that participant hospitals retrospectively receive payment for all costs associated with an episode of care for each case. Participant hospitals are paid a "target price" for an episode. Target prices are stratified by MS-DRG (469 or 470) and the presence or absence of hip fracture, thus there are four target prices. Target prices are defined for each hospital and

MSA based on historical average costs, less a 1.5–3% discount based on quality metrics. In years 1 and 2 of the model, two-thirds of the target price is derived from a hospital's 2012 through 2014 claims data, with the remaining one-third coming from regional claims data. In year three, one-third of the target price will be derived from a hospital's 2014 through 2016 claims data, with the remaining two-thirds coming from regional claims data. The mix then shifts to 100% regional claims data thereafter. Instead of competing against one's own prior performance, CJR's pricing creates regional competition. At the end of the performance year, hospitals that achieve spending below the target price and meet quality performance thresholds on three required quality measures are eligible to earn a reconciliation payment for the difference between the target price and actual episode spending, up to a specified cap ("stop-gain limit"). In contrast, hospitals with spending that exceeds the target price are financially responsible for the difference between the target price and actual episode spending, up to a specified repayment limit ("stop-loss limit") which will increase from 5 to 20% between performance year 2 to 4 [8].

In addition to spending less than the target price, three quality measures must be met to qualify for a reconciliation payment. The first is national quality forum (NQF) #1550, the hospital-level risk-standardized complication rate (RSCR) [27]. This measure utilizes Medicare claims data to identify complications occurring from the date of admission to 90 days post-discharge. The RSCR is calculated as the ratio of the number of "predicted" to the number of "expected" admissions with a complication, multiplied by a national unadjusted complication rate. The denominator is the number of admissions with a complication expected based on the nation's performance with that hospital's case-mix. The numerator is a dichotomous (yes/no) outcome and includes the following: acute myocardial infarction, pneumonia, and sepsis within 7 days from the date of admission; death, surgical site bleeding, and pulmonary embolism within 30 days of admission; and mechanical complications and periprosthetic joint infection within 90 days of admission. The second quality measure is NQF #1551, which is the hospital-level 30-day risk-standardized readmission rate (RSRR) [28]. This outcome is defined as an unplanned readmission for any cause within 30 days of the discharge date. A specified set of planned readmissions does not count, including things like obstetrical delivery, transplant surgery, and maintenance chemotherapy, though admissions for acute illness or complications of care are never planned. The final quality measure is NQF #0166 or the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAPS) survey [29], which is a 27-item survey with seven domain level composites that patients complete to rate their hospital experience. A final method for adding points to a hospitals CJR composite score has recently been introduced and involves submitting voluntary patient-reported outcomes including the following: Veterans Rand 12 (VR-12), Patient Reported Outcomes Measurement Information System (PROMIS) 10-Global, the Hip disability and Osteoarthritis Outcomes Survey (HOOS), JR. and Knee injury and Osteoarthritis Outcome Score (KOOS), JR., or the full HOOS and KOOS subscales, on a predefined percentage of their cases.

Impact of Comorbidities and Complications on Cost

The immediate area of focus for hospitals participating in CJR is lowering episode costs. In addition to providing patients with a more complete informed consent, understanding the risk of 90-day postoperative complications is essential to anticipating potential postoperative care requirements, which directly correlate to profitability under the bundle. Although complication rates following TJA are low [30], the cost of complications can be staggering. For example, thromboembolic disease is associated with significantly increased cost [31], estimated at $18,000 when identified during the index hospitalization and nearly $6000 when diagnosed after discharge and stimulating a readmission [32]. Similarly, the economic burden of periprosthetic joint infection is astounding, with an average cost of $116,383 per episode [33•] and a total projected annual cost to the US healthcare system exceeding $1.62 billion by 2020 [34].

The cost of comorbidities has been repeatedly demonstrated. Bozic et al. [15••] evaluated all payments to Medicare providers up to 30 days postoperatively and found mean episode-of-care payments ranged from $25,568 for primary TJA in patients with no comorbidities to $50,648 for revision TJA in patients with major comorbidities or complications. They noted significant variance for each of the means. Other comorbidities have also been associated with increased postoperative complications (e.g., congestive heart failure, valvular heart disease, and chronic obstructive pulmonary disease) and cost (e.g., coagulopathy, congestive heart failure, and electrolyte imbalance) following TJA [35•]. Considering the influence of comorbidities on overall cost, it is not surprising that 94% of AAHKS members express concerns regarding the financial disincentive of operating on high-risk patients [19•]. Future research should focus on whether preoperative optimization of these chronic medical conditions can reduce postoperative complication rates and whether this reduces episode costs.

Lastly, risk factors can be classified as either modifiable or non-modifiable. It has been demonstrated that certain non-modifiable risk factors are associated with worse outcomes after TJA. For example, even after the introduction of a system-wide readmission reduction initiative, Keeney et al. found that minority patients and those with low socioeconomic status experienced higher 30-day readmission rates [36•, 37•]. These data underscore the notion that certain vulnerable populations may face access to care issues for joint

replacement under bundled payment models, if there is not appropriate risk adjustment for these non-modifiable factors.

Current risk adjustment in the CJR is crude, such that target prices are anchored either to MS-DRG 469 or 470 and then modified only based upon the presence or absence of an acute hip fracture. Risk adjustment should be based on a wide number of relevant variables, including patient-related and procedure-related factors, to create well-functioning bundled payment models. If bundled payments are not appropriately risk-adjusted for case complexity and expected resource utilization, "cherry picking" (providing care to low-risk patients) and "lemon dropping" (denying care to high-risk patients) will occur, potentially restricting TJA access to at-risk patient populations and/or concentrating their care in a few number of safety net hospitals. Thus, future research should identify relevant variables for risk adjustment to optimize resource allocation and incentivize care for all TJA patients.

Optimizing Quality and Reducing Cost

To determine where potential cost savings may come from, multiple studies have evaluated the impact of preoperative, intraoperative, and postoperative care on overall spending in TJA. The best opportunity to lower episode costs appears to be in the post-acute care (PAC) setting, where the greatest cost variation exists. In 2014, Bozic et al. [15••] demonstrated that post-discharge care accounted for 70% of the total episode payment and varied significantly between patients and procedures. This is similar to a report by Navathe et al. [38••] who found 49% of savings under ACE and BPCI programs came from PAC spending reductions on skilled care facilities post-discharge. Slover et al. [39•] performed a cost analysis study to evaluate strategies for minimizing post-discharge costs following TJA. They concluded that the cost of additional acute care hospital days was relatively small compared to an extended post-acute inpatient rehabilitation facility stay and that keeping patients in the hospital a few extra days and then discharging them directly to home may result in an overall lower cost than discharge after a shorter hospital stay to an expensive skilled care facility. While the ideal inpatient length of stay (LOS) remains unclear, skilled care facilities probably represent low value to patients, as it has been demonstrated that discharge to these facilities versus to home is associated with higher complications for THA [40•] and TKA [41•] with no associated functional benefit [42•, 43].

Readmissions are also a major cost driver. Bosco et al. [44] found that the 30-day readmission cost burden ranged from 3% for TKA to 12% for revision TKA. To cover episode costs related to readmissions, profit margins would have to exceed 4.3% for primary THA, 8.3% for revision THA, and nearly 12% for revision TKA. Similarly, Clair et al. [45] reported that medical- and procedural-related readmissions cost, on average, $11,682 and $27,979, respectively. Kurtz et al. [46] also identified readmission as a primary cost driver and concluded that nearly half of the total annual economic burden in the USA for readmissions following TJA was for a medical reason and unrelated to the joint replacement procedure. This underscores the importance of hospitals and doctors preoperatively optimizing, to the extent possible, patients with modifiable risk factors. In the same study, the authors identified infection, dislocation, and periprosthetic fractures as the most costly types of procedurally related readmissions, leading to the conclusion that prevention of these complications and readmissions will have the greatest impact on the overall economic burden [46].

The next best opportunity for episode of care savings appears to be implant cost, which remains highly variable and accounts for between 13% and 60% of hospital reimbursements [47–49]. The cost of primary TKA implants ranges from $1797 to $12,093, and the cost of primary THA implants ranges from $2392 to $12,651 [50]. Consequently, strategies for lowering implant costs should be a focus, especially considering many higher-cost prostheses frequently have unproven clinical benefit. An overall decrease in the variability and reduction in the cost of implants is possible through the creation of implant selection protocols and resource use committees, giving hospitals improved negotiating power with device manufacturers [5]. This was found to be true in a Canadian model in which higher-volume hospitals were able to minimize costs more effectively than low-volume hospitals through negotiating power [51]. Hospital-based strategies to reduce the cost of implants have been effectively demonstrated by Scranton [52] and Zuckerman et al. [53], who reported a 23% reduction in implant costs over 1 year. Alternatively, or in addition, some surgeons have proposed patient-cost sharing, which would allow patients to contribute directly toward covering the cost of their implants. This is a particularly intriguing response to direct-to-consumer marketing. Previous studies have demonstrated that patients in the USA are willing to pay for implants [54–56], although no current pathway exists for patients to share the cost of TJA implants.

A crucial step toward reducing the cost of implants nationally, while simultaneously improving the evidence of their efficacy, is the American Joint Replacement Registry [57]. Expansion of US national arthroplasty registry will facilitate comparative studies to evaluate the cost and performance of different prostheses and bearing surfaces, and it will aid identifying early implant complications and failures. It has been speculated that Sweden's long-standing national registry for THA has improved Swedish surgeons' selection of implants and surgical techniques, resulting in a revision rate for THA that is more than half of that for THA in the USA [58, 59].

Finally, as regional competition hastens, hospitals will likely be forced to focus on internal costs of care delivery, addressing surgeon productivity as well as hospital and operating room efficiency. The creation of multidisciplinary clinical

pathways for perioperative care has been shown to improve quality and reduce cost by nearly 20% [60]. Accelerated rehabilitation protocols are another strategy to reduce cost and improve outcomes during the inpatient period. These protocols can reduce LOS, improve outcomes, and are estimated to save approximately $4000 per patient [61, 62]. A 2008 Cochrane review supports implementation of multidisciplinary clinical pathways, including early postoperative rehabilitation [63]. In terms of productivity, a study by Wilson et al. [64•] defined TKA volume thresholds associated with adverse outcomes for surgeons and hospitals. The authors found surgeons performing greater than 146 TKAs per year had significantly lower 90-day complication rates and 2-year revision rates than those surgeons performing fewer TKAs. Similarly, hospitals supplying more than 645 TKAs per year had significantly lower 90-day complication and 90-day mortality rates than lower volume hospitals [64•]. Thus, higher-volume surgeons and facilities appear to be both less costly and safer for patients and should improve the value of TJA.

Early Evidence for Bundled Payment Models

It remains to be seen whether the CJR model will improve the quality and decrease the cost of TJA in a manner similar to that observed following initiation of the BPCI, which some reports show decreased Medicare episode payments between $1166–$2443 with no change in claims-based quality outcome measures [38••, 65••]. The impact of CJR on overall utilization of TJA nationally is also uncertain, as ultra-high performing centers may take advantage of the margins early in the program, initially increasing overall expenditures. Additionally, the expense of managing bundled payments is also indeterminate and may make offering TJA cost prohibitive for smaller institutions. While these changes will most directly and immediately impact the 800 CJR participant hospitals, representing approximately 25% of lower extremity joint replacements performed annually in the USA, they will likely have a national effect as the program is extended.

Early results of bundled payments are promising, demonstrating a reduction in cost and an improvement in quality. In a study of 271 patient episodes [66], the creation of a "complete care" program resulted in decreased LOS (3.4 to 2.7 days), a reduction in catheter-associated urinary tract infections (5.2 per 1000 to 0), and a reduction in 30-day readmissions (5.0 to 1.6%). The frequency of discharge to home increased from 39 to 75%. The group also improved their HCAHPS (9 or 10) from a baseline of 74 to 88%. Within the first year of their program, they reduced the total cost of care and showed financial value creation of $522,389 (9.8%) for the hospital system [66].

Froemke et al. [16•] reported their approach to standardizing a care pathway for TJA, incentivized by a gain sharing opportunity, that brought together best-practices for quality care and patient engagement across the entire episode of care from preoperative planning through patient discharge. Coordinating care among providers resulted in an 18% reduction in average LOS and a shift from home health and skilled facility discharge to home self-care (54.1 to 63.7%), which resulted in a 6% reduction in cost over the study period. Similarly, in 2016 another large academic institution reported its results after implementing hospital wide changes following the adoption of a bundled payment model [67]. The authors reported a decrease in the average hospital LOS from 4.27 to 3.58 days and discharges to skilled care facilities decreased from 71 to 44%. The same authors showed that over the same period, there was a decrease in the average episode of care cost from $34,249 to $27,541, with the largest decrease in cost resulting from a reduction in PAC costs per episode, from $6228 at baseline to $742 [68]. A follow-up study 3 years after the project began reported a continued decrease in LOS from 3.58 to 2.96 days, and the rate of discharge to skilled care facilities also decreased from 44 to 28% [69•]. All-cause readmission rates at 30, 60, and 90 days decreased from 7 to 5%, 11 to 6%, and 13 to 8%, respectively. Finally, the authors reported a 20% decrease in 90-day cost over the 3-year study period [69•].

Practical Strategies for Success Under Bundled Payment Models

Successfully managing bundled payments will require hospitals to invest in new or enhanced capabilities, including improved data collection and analysis, technology upgrades, and care coordination resources. Thus, there will be incremental costs necessary to manage a 90-day episode of care in the face of declining target prices for the episode. As a result, TJA may become impractical and unaffordable for low-volume hospitals, resulting in consolidation or closure of low-volume programs. Those hospitals not participating in CJR should begin building the infrastructure necessary to manage bundled payments, as it will likely be difficult to adapt to the bundled payment model once regional competitors have overcome their own inefficiencies.

Van Citters et al. [70•] described their recommendations for developing a pathway for high-value, patient-centered TJA care through quantitative and qualitative methods, which may be generalizable to hospitals seeking a strategy to prepare for bundled payments. Specific factors essential for success in managing bundled payments include engaging physicians from all involved specialties to be a part of designing the care pathway. Creating a care coordinator position, as the point of contact for patients throughout the episode, can reduce costly emergency room visits and readmissions. The hospital and care providers should also invest in patient education strategies to set and manage expectations, particularly focusing on what to expect after surgery and how to increase discharge to home and

prevent readmissions. Incentives to improve operating room and hospital efficiency are also target areas.

Conclusions

Alternative payment models, including bundled payments, represent a major change in the reimbursement landscape for TJA, departing from traditional fee-for-service paradigms. Early results of bundled payments are promising. Hospitals, regardless of current participation in bundled payments, should develop care pathways for TJA to maximize efficiency and patient safety. Appreciating the fact that post-acute care and readmissions are associated with the greatest variance in episode costs for TJA, initial efforts under bundled payments should focus on encouraging discharge to home and devoting resources toward preventing readmissions, including creation of care coordinators and optimizing modifiable preoperative risk factors. As bundled payments move toward regional pricing, preserving access to care for patients with high comorbidity burdens and those requiring more complex care is a lingering concern. Risk-adjusted pricing will become an even more important feature for these models to protect access to TJA for all patients.

Compliance with Ethical Standards

Conflict of Interest Both authors declare that they have no conflict of interest.

Human and Animal Rights and Informed Consent This article does not contain any studies with human or animal subjects performed by any of the authors.

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