Feasibility of Episode-Based Bundled Payment for a Pediatric Surgical Condition: Posterior Spinal Fusion

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ABSTRACT
Introduction: Episode-based bundled payment (EBBP) is an alternative model of health-care payment that aims to align providers’ and hospitals’ incentives toward delivery of more coordinated, higher quality, and lower cost care. EBBP programs have been studied for numerous adult conditions over the past decade, yet there have been no studies exploring the use of EBBP in pediatric conditions. Methods: This article explores the feasibility of EBBP for a relatively common, costly, pediatric surgical procedure: spinal fusion for adolescent idiopathic scoliosis. We begin with a review of successful EBBP programs in the United States. We then apply American College of Surgeons criteria for bundled payment episode selection to identify benefits and challenges of using EBBP for this condition. Results: We identify several features of pediatric spinal fusion that make it an attractive EBBP target: high variability in costs with multiple distinct targets for cost reduction, high variability in quality across hospitals, and proven methods for improvement via application of standardized, evidence based pathways. We find that challenges to EBBP may arise due to the relatively low incidence of the procedure, which limits overall savings to the health-care community. Conclusions: Our results suggest that spinal fusion for adolescent idiopathic scoliosis is an attractive pediatric target for EBBP, with potential benefits to patients, providers, health systems, and payers if limitations in procedure volume and administrative expense are overcome. The framework presented may also be useful for analyzing feasibility of EBBP for other pediatric conditions. (Pediatr Qual Saf 2017;2:e028; doi: 10.1097/pq9.0000000000000028; Published online June 12, 2017.)

INTRODUCTION
The United States is now experiencing a crisis due to the unsustainable rise in health-care spending, fueled in part by the traditional payment model of fee-for-service. Fee-for-service tends to reward quantity, rather than quality of health care delivered.1 Episode-based bundled payment (EBBP) has been offered as an alternative model of payment to realign providers’ incentives toward delivery of more coordinated, higher quality care at lower cost.2 By definition, EBBP is a single payment delivered to 1 entity for the entire episode of care. It requires distribution of the payment to the providers involved during the episode. In theory, EBBP can better align the financial incentives of physicians and hospitals to help produce better, lower cost care.3 A particular promise of EBBP is decreasing care fragmentation by explicitly encouraging providers across the continuum of care to work together to reduce costs, increase quality, and potentially share in the financial rewards of doing so.1,3

The Centers for Medicare and Medicaid Services (CMS) and other private sector organizations have conducted multiple studies of EBBP over the last decade.4,5 These studies indicate promise for this approach, although selection of the “right” kind of care episodes is a key to success.4 To date, EBBP studies have not included pediatric conditions or surgeries. This article explores the feasibility of a bundled payment model for a common and costly pediatric surgical procedure: spinal fusion surgery for adolescent idiopathic scoliosis.

REVIEW OF EXISTING EPISODE-BASED BUNDLED PAYMENT PROGRAMS
No Institutional Review Board review was necessary for this discussion of existing literature.
CMS implemented the congressionally mandated Acute Care Episode (ACE) Demonstration program from 2009 to 2012. This program administered single payments to participating physician-hospital organizations that provided specific orthopedic or cardiothoracic surgical procedures (hip/knee replacement or revision surgery, coronary artery bypass graft surgery, cardiac pacemaker, or cardiac stent replacement). The goals of the demonstration were 3-fold: to improve the quality of care, to increase collaboration among providers and health systems, and to reduce Medicare expenditures. This program did not include any pediatric conditions.

A formal evaluation of the ACE Demonstration program in 2013 found that overall quality benchmarks in participating sites were not quantitatively improved compared with secular trends at nonparticipating hospitals. However, several qualitative measures indicated improved coordination and standardization of processes and materials at the ACE hospitals. The orthopedic service line experienced most success with standardization due to the prescheduled nature of hip and knee surgeries, as opposed to the cardiovascular procedures that are often performed emergently. Importantly, case mix did not change among the participating hospitals, indicating that the hospitals did not deliberately exclude higher risk patients. Finally, at some participating hospitals, quality innovations for the bundled care episodes spread to other conditions that were not included as part of the demonstration.

Costs per episode were reduced in the demonstration hospitals, with the largest savings coming from the orthopedic procedures, driven primarily by negotiations with vendors to reduce the price of implants. There were also savings related to decreased personnel and supply costs. The authors noted that the effect of negotiated cost reductions with vendors of materials and implants waned over time and suggested that potential future areas of savings could include increases in patient volume and reduced length of stay. During the 3-year demonstration, patient volume did not increase as hoped; evaluators attributed this to a lack of dedicated marketing efforts to patients or referring physicians to drive volume.

CMS Bundled Payments for Care Improvement Initiative

The Center for Medicare and Medicaid Innovation is currently conducting another, broader test of bundled payments, titled the Bundled Payments for Care Improvement Initiative. Within this program, CMS and applicant providers agree to a target payment amount for a defined episode of care. Providers propose a condition and type and length of episode that are covered by 1 of 4 different models. The models differ in terms of length of episode and type of care (acute care only, acute care plus postdischarge care, and so on). This program is currently being implemented.

Geisinger Health ProvenCare

The private sector has also explored EBBP. Geisinger Health Plan instituted ProvenCare, a bundled payment program for nonemergency coronary artery bypass graft procedures in 2006, with a goal of increasing quality and value of care. The bundle encompassed all care beginning at the preoperative evaluation and extending 90 days after surgery. The program was a strong success, achieving decreased length of stay, readmission rates, complications, and hospital charges. Based on this success, Geisinger expanded the program to include additional surgical procedures and nonsurgical conditions, including bariatric surgery, chest pain, newborn care, and perinatal care.

Organ Transplant

A final example of successful bundled payment is organ transplantation. For the last 20 years, payment for transplants has been bundled; the single payment typically covers all hospital, physician, and ancillary services for all phases of the defined transplant episode, which includes evaluation, procurement, hospital admission for the transplant, readmissions, and follow-up care. The length of a defined transplant episode can vary from 30 to 365 days. Payers typically do not adjust payment for patient severity beyond the severity included in the Medicare diagnosis-related group. However, payers do include some protections for providers such as outlier provisions.

There are several unique features of transplant surgery that make this type of surgery ideal for bundled payment. Transplants are high-cost procedures, resulting in potential for increased cost savings; they have clearly defined start and end points; they have standardized care protocols and transparent, well-defined quality benchmarks. Transplant surgery outcomes are also highly team-dependent, reflecting the quality and coordination of care across multiple providers, including surgical and nonsurgical physicians and ancillary providers, and sites of care, hospital, and outpatient. Outcomes are transparently reported by transplant center, emphasizing the importance of this team approach. If outcomes fall below CMS standards, CMS will remove certification and commercial payers will drop the center from their networks. Thus, transplant is a remarkable success story in terms of EBBP, achieving high-quality outcomes, coordination, and cost savings.

APPLICATION OF THE AMERICAN COLLEGE OF SURGEONS’ CRITERIA FOR BUNDLED PAYMENT EPISODE SELECTION

As we consider application of the EBBP model to a pediatric surgical condition, it is helpful to consider what type of pediatric condition/surgery and what definition of a care episode would be most likely to fulfill the promise of EBBP in terms of cost savings and improvements in
quality and care coordination. In 2013, the American College of Surgeons (ACS) published a guide to assist surgeons in developing a bundle or deciding to participate in a bundled payment program.4 We will use the components in the ACS guide to consider appropriateness of pediatric spinal fusion surgery for EBBP (Table 1).

1. Clearly identified center of the bundle. A bundle can be formed around a condition (diagnosis) or a particular surgical procedure; either way, a clear definition is essential. Although either can work well, a third alternative may offer the best of both—a condition-specific procedure bundle. This hybrid bundle type is preferred by the ACS because it helps align codes between hospital- and physician-based coding systems to ease the determination of what services would be included in the bundle.4 In considering pediatric spinal fusion surgery, it makes sense to define the condition—adolescent idiopathic scoliosis—and the procedure (posterior spinal fusion). Recent studies have successfully identified this hybrid surgery/condition via International Classification of Diseases-9 (ICD-9) and Current Procedural Terminology codes.7,8

2. Type of surgery/condition. The ACE demonstration project achieved greatest cost reductions in orthopedic surgery procedures. This was attributed to the nonemergency nature of the procedures, successes in standardization of care delivery process, and reduction in implant costs.5 Posterior spinal fusion (PSF) for adolescent idiopathic scoliosis fits these criteria perfectly: it is performed on an elective basis, care standardization can be achieved7,8 and it requires multiple implants (rods and screws), allowing for cost savings through vendor negotiations.

3. Other ideal qualities in a candidate surgery are high volume and high expenditure per procedure. PSF is the most common spinal surgery among healthy adolescents, with an average of 5,000 Adolescent Idiopathic Scoliosis (AIS) spine fusions performed in North America per year.8 Although this volume is quite low compared with adult total joint arthroplasty (TJA), it is among the most common orthopedic procedures performed in children.9 In terms of expenditures, costs for PSF are substantial: the projected total 30-day health-care cost for a PSF without complications or comorbidities is $43,363.9 Adding comorbidities or complications increased this average to $65,124.9

4. Procedures performed across the country (not isolated to certain institutions). In the ACE demonstration, several centers successfully implemented EBBP for TJA with volumes around 50 surgeries per year. At least 20 pediatric spine centers perform at least these many PSF procedures for AIS each year.

5, 6. High variability in resource use; opportunity for cost savings. Despite a relatively healthy patient population and advances in surgical technique over the last decade, the average published length of stay for AIS PSF is 5–6 days, with high variability. Some pediatric spine centers have recently reported drastic decreases in length of stay to just over 2 days without deterioration in quality. In addition to variation in length of stay, there is substantial variation in cost: although mean cost is $43,363 per encounter, there is an SD of $26,483, indicating a high potential for cost savings by adapting knowledge from the best-performing centers.7,8 Multiple targets for reducing costs have been identified, including selecting less expensive types of fixation, negotiating among implant suppliers, reducing operative time, reducing payments to providers, and reducing hospital length of stay.10,11 In addition, many centers successfully care for routine AIS–PSF patients on the acute care unit, avoiding the intensive care unit. Thus, centers that routinely utilize the intensive care unit postoperatively could achieve additional savings by modifying this practice.8,11

7. Availability of evidence-based practices. Centers achieving low length of stay after pediatric spinal fusion have done so with standardized care pathways based on best available evidence. They have also demonstrated similar or better quality with standardized pathway implementation.7,8 Our center recently implemented a standardized care pathway and was able to achieve a 20% reduction in length of stay, without decreasing quality.12 These evidence-based pathways contain general principles of care that may apply broadly (e.g., early mobilization), although actual implementation may require some individualization based on local resources.

8. Availability of relevant data for analysis. For providers to redesign care to meet efficiency and quality goals,
it is essential that data be available to support measurement against appropriate process and outcome measures. Before embarking on EBBP, centers must examine their infrastructure and expertise to determine if they can support the intense data analysis required for a successful program. One way to assess this capability is to conduct an analysis of historical data, then determine what support is available for ongoing measurement.

9. Established process and outcome measures. Two recent studies have established process and outcome measures of quality for PSF, including operative time, estimated blood loss, postoperative pain scores, length of stay, and readmission and wound complication rates.7,8 Compared with adult surgical conditions included in bundled payment programs, these measures are much less well established, although they are a start.

10. 11. Defined services to be included, and involvement of multiple providers in delivery of care. As we consider PSF, the typical providers that could be part of a bundle include the surgeon, anesthesiologist, pediatric hospitalist providing medical comanagement,13,14 physical therapist, respiratory therapist,15 and dietician. Providers included in the bundle should have well-delineated expectations so that they know what they must contribute to achieve successful outcomes (quality, efficient care). Additionally, these providers would join with nursing staff, care managers, and hospital administrators to form an integrated care team, responsible for refining and implementing the care pathway.

12. Reasonable predictability of costs. A particular advantage of PSF care, in contrast to TJA,4 is that the majority of care occurs in the inpatient environment. Indeed, in 1 study of spinal fusion, just 3% of cost was attributed to postdischarge care.8 The clustering of expenditure for PSF patients in the inpatient environment, under control of hospital-based providers, can work to mitigate the financial risk to the providers.

13. Homogeneity of population or ability to appropriately risk-adjust. Children with AIS are a typically healthy and thus a relatively homogeneous population.16 This contrasts with other pediatric conditions requiring spinal surgery (such as neuromuscular scoliosis or congenital scoliosis) that vary considerably in terms of underlying severity and associated comorbidities.7 For instances of complications, providers should classify them according to preventability. This exercise will help inform whether services related to certain complications should be included in the bundle or not. This analysis can also inform what types of stop-loss provisions are reasonable.4 For example, predictable and/or preventable complications such as bleeding requiring transfusion, surgical-site infection,17 postoperative venous thromboembolism, and postoperative pneumonia15 would likely be included, whereas rare, nonpreventable complications may be excluded and thus subject to a stop-loss provision.

**Timeframe of Bundle**
A typical timeframe for episode bundles is 3 days preadmission through 30 days postdischarge. The timeframe should be chosen so as to capture typical care for the condition/surgery. Longer timeframes increase risk to providers.4 The data analysis described above can help inform a choice of timeframe.

For posterior spinal fusion surgery, a recent analysis suggests that a 30-day bundle would likely work well, although this estimate is based on a dataset including adult patients and could be better refined with an analysis of the target pediatric population.9 From our experience, most AIS/PSF patients are recovered by 30 days postdischarge, and common postoperative complications are usually detected during this time period. Further, the relatively healthy adolescent patients who undergo PSF generally do not require rehabilitation or other types of extensive postdischarge care. Indeed, even in the spine surgery study including adults, just 3% of cost was attributed to postdischarge care.9 The clustering of expenditure for AIS/PSF patients in the inpatient environment, under control of hospital-based providers, can work to mitigate the financial risk to the providers.

This situation is a striking contrast to TJA in adults, a procedure that is an attractive target for EBBP by payors such as Centers for Medicare and Medicaid.18 A published analysis of historical data by TJA surgeons demonstrated that over one-third of total payments related to TJA go toward postdischarge care; postdischarge care also accounted for a large amount of the variability in cost across patients and procedures, thus driving a large amount of financial risk.3

**Pursuing Ebbp: Practical Considerations**

**Data and Analysis Needs**
Before entering into a bundle program, providers must have an accurate idea of the financial risk associated with participating. To assess this risk, analysis of historical data is essential; this analysis should focus on historical utilization and payments associated with the target condition/surgery. This analysis should allow assessment of the historical amount of variation.4 Although some data applicable to PSF have been published,9 centers should evaluate their own data to assess financial risk.

**Administrator of the Bundle**
In most EBBP programs, a central entity holds the bundled payment and distributes it to providers. The administering unit must be capable of handling information related to pricing, payments, providers, contracts, bundling rules, and quality data such as length of stay. Bundle participants should understand that the administering entity designates payments to each provider and manages all the cost calculations related to the bundle. In centers where all relevant providers are employees of the hospital, a hospital financial department would be a logical administrative center.4
**Gainsharing Arrangements**

Bundled payment programs often include the concept of gainsharing. Gainsharing is an arrangement in which the savings generated by achieving cost and quality goals are shared with the providers, as a reward. In some bundled payment programs, costs exceeding the payment amount may also result in a loss shared among providers. Gainsharing offers an opportunity to align financial incentives of providers with those of hospitals, and thus can drive the improvements in quality, efficiency, and coordination of care. In the PSF example, gainsharing may offer a financial incentive for surgeons to standardize individual practice around types of implants used for fixation and thus enable volume-based negotiation with suppliers to reduce costs overall. Gainsharing, if structured appropriately, could also help motivate other providers on the care team (e.g., physical therapist) to effectively achieve postoperative care targets such as early mobilization.

It is important to know that federal laws known as the Civil Monetary penalties, Antikickback, and Physician Self-Referral statutes prohibit certain gainsharing arrangements. However, bundled payment programs administered via CMS provide a waiver of fraud and abuse to allow gainsharing. In pursuing a new EBBP program, providers must ensure that any gainsharing arrangements are protected.©

**CONCLUSIONS**

Application of the American College of Surgeons’ criteria to posterior spinal fusion for adolescent idiopathic scoliosis demonstrates that this condition-specific procedure is a potentially attractive pediatric target for EBBP. The biggest area of concern is whether the relatively low volume of the procedure is sufficient to justify the cost of structuring and administering a bundled payment program. If a pediatric medical center were willing to undertake such a program, it might determine that several ancillary benefits made the expense worthwhile. In addition to reaping the financial rewards from improving quality and efficiency of care around the specific care episode of AIS/PSF, the center might find that innovations related to AIS/PSF care drive improvements to care of other conditions, such as occurred during the ACE Demonstration project. In addition, with appropriate marketing, the program might drive new volume to the center.

**ACKNOWLEDGMENTS**

The authors wish to acknowledge Melissa Gray for technical assistance with the article.

**DISCLOSURE**

Dr. Shaughnessy and Dr. Sitzman have nothing to disclose. Dr. Sturm reports personal fees from Depuy Spine, personal fees from Nuvasive, personal fees from Medtronic, outside the submitted work.

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