



Hip and Knee Arthroplasty Bundle Experience at the University of Pennsylvania, Department of Orthopaedic Surgery



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Introduction

Hip and knee arthroplasty are superbly successful surgical procedures¹. However, with increasing numbers of arthroplasties come increasing burden of failures. The cost of hip and knee arthroplasty is already a major expense for the Center for Medicare Services (CMS). In 2014, Medicare spent more than \$7B on 400,000 arthroplasty patient hospitalizations alone. Kurtz *et al* predicts a large increase of number of hip and knee arthroplasty and revisions between 2005 and 2030². The number of total hip arthroplasties will grow 174% to approximately 272,000 per year by 2030, and total knee arthroplasty will grow 673% to 3.4 million procedures per year by 2030. Hip revisions are predicted to double by 2026 and knee revisions to double by 2015.

Hip and knee arthroplasty cost is a major focus for CMS to evaluate payment models to improve quality and to limit costs. CMS describes the variability of arthroplasty care provided in the U.S. as measured by 1) the rate of complications such as infection or reoperation, 2) the threefold readmission rate variation and 3) expenditures ranging from \$16,500 to \$33,000 across regions.

Reduced variability should improve value. Value is a measure of higher quality and lower cost. Within the present bundle models, the goal is a lower rate of readmission for complications and a lower rate of post-acute care in expensive locations. Lower readmission rates will lower CMS value based purchasing penalties to UPHS. The major focus for successful bundles under CMS in the Comprehensive Care for Joint Replacement Model (CJR) is to send patients home safely. Home care will lower post-acute care costs and safely lower readmission rates.

Background

UPHS started the Bundled Payment for Care Improvement Initiative (BPCI) on January 1, 2014. Figure A shows our present involvement. Our awardee convener is Remedy Partners, who provides support, data aggregation and reconciliation for the UPHS system. The convener shares risk and benefit with the system; they offer some protection against the cost of failure and share the benefit when the bundles are successful.

In BPCI Model 2, actual expenditures from the day of surgery to 90 days postoperatively are reconciled against a target price. The target price is an adjusted average of the

• CMS Bundled Payment Care Initiative (BPCI)

- Fractures of Hip, Femur or Pelvis – PPMC, PAH
- Hip & Femur procedures except major joint - PPMC
- Major Joint Replacement of lower extremity – PPMC, PAH
- Revision of hip or knee – PPMC, PAH

• Horizon Blue Cross NJ

- Major Joint Replacement of the Knee – PPMC, PAH
- Knee Arthroscopy – PPMC, PAH

• Independence Blue Cross Orthopedic Bundled Payment and Shared Savings Program

- Hip and Knee Replacement – PPMC, PAH

Figure A. UPHS orthopaedic surgery bundles.

cost history of reimbursement for the hospital system. The CMS definition of actual pricing of any single bundle at any single hospital changes from quarter to quarter with two basic adjustments compared to the historic baseline October 2009 - September 2012. CMS looks at the national trend of non-BPCI participating hospitals in order to avoid penalizing/rewarding BPCI hospitals for broader changes in the care of patients. This cost trend should reflect technology/implant changes and other broadly applicable changes. As each bundle contains multiple diagnosis related groups (DRG) (e.g. with and without complications), the pricing is updated every quarter for the current hospital-specific trend in the changing mix of DRGs within the bundle. CMS.gov/BPCI describes the active BPCI locations. As of January 1, 2016, there are 1574 participants in Phase 2 including 409 acute care hospitals and 288 physician group practices.

To be successful, physicians, clinical colleagues, and administrative planners must be actively involved in managing patient preparation before admission, during the hospital stay, and for 90 days after discharge from the acute care hospital. This collaboration occurs within the UPHS system and with preferred providers outside the system. Our internists risk stratify and recommend care before the patient is admitted. Social workers, clinical resource management, and the home health care team support patients to be identified for safe discharge to home. Collaboration with Skilled Nursing Facilities (SNF) and Inpatient Rehab Facilitates (IRF) benefit the patient who needs inpatient rehabilitation.

Our Risk Stratification experience started January 1, 2012 for acute care hospital postoperative safety. Based on the characteristics of the intensive care unit (ICU) patient, we generated a preadmission risk tool to predict unplanned ICU need. As planned, risk stratification successfully lowered the rate of rapid responses, unplanned ICU admissions and mortality. We have observed that the risk stratification tool also predicted risk for readmission. The goal is to develop actionable guidelines that will impact readmission rate directly.

Value

Because the value equation is higher quality at a lower cost, we can impact value by improving either parameter or both. One key strategy is reducing variability. Improvement can be evaluated by process metrics. The realization of cost savings awaits cost collection and reconciliation available long after the process metrics predict the cost outcome. Therefore the process metrics are important to manage care that can be validated only when cost data becomes available.

Pre-acute:

The surgical decision between the physician and the patient is based on risk benefit perception. Some disease risk can be mitigated by preoperative guidelines. Tobacco addiction is a modifiable disease. Smokers have clear risk for poor wound healing, increased risk of venous thromboembolism, and long-term health problems. Smoking cessation should be a part of the preoperative preparation and is reinforced by our internal medicine consultants and arthroplasty class. Diabetes is also a modifiable disease. All diabetics are at higher risk of infection and perioperative complication, but the poorly controlled patients are at the highest risk. We delay surgery for a hemoglobin A1C of 10% or greater and refer to an endocrinologist. For an A1C between 8% and 10%, patients are contacted by a pharmacist for individual education. We delay surgery if fasting blood sugar is >200mg/dL on the day of surgery. Body Mass Index (BMI) above 40 increases risk of wound and other complications. While it is reasonable for a surgical procedure for a patient of a BMI above 40 to be delayed pending bariatric care, many patients are unable to significantly change their BMI. Patients should understand that BMI is a modifiable risk. Weight loss not only lowers surgery risk, but also lowers long term risk for heart disease, hypertension, and diabetes. Poor nutrition increases surgical risk. Albumin can reflect nutritional status but we have found that low albumin often predicts chronic disease such as liver disease, renal disease, and others. Hypoalbuminemia of chronic disease is not correctable but is a marker of risk perioperative infection and complication.

Chronic diseases may not be modifiable. An accurate description of risk for patients with chronic renal disease and chronic liver disease continues to be elusive. A patient with a low creatinine clearance or a high MELD score should be counseled about the risk of their underlying disease as best as possible. In patients with CKD stage 3 or greater, we avoid use of nonsteroidal anti-inflammatory medicine and hold all

potentially nephrotoxic medications, including ACE inhibitors, angiotensin receptor blockers and diuretics. Low albumin and coagulopathy of liver disease are important markers of surgical risk. Patients who have a successful renal transplant appear to have an improved preoperative risk over the patients who are being chronically dialyzed. Chronic viral infection patients should have disease markers and viral loads evaluated. Patients on biological therapy for autoimmune disease are counseled to stop them under the supervision of their rheumatologist.

If a patient with a chronic disease is well-managed, the patient's decision to proceed with elective surgery has always been based on the patient's perceived risk/benefit ratio. Considering the bottom line cost for above high risk disease burden, physicians or systems will increasingly be put in the role of gate-keeper in the decision for access to elective surgery for risky patients. Is there a threshold of risk that would appropriately deny elective surgical procedure outside the patients' willingness to accept risk? This answer may come from our society's willingness to accept the excess cost of health care for the high risk patient.

Acute Care:

Hospital programs must be in place to manage the patients based on pre-acute planning and also based on postoperative inpatient progress. The Risk Assessment and Prediction Tool (RAPT) may predict home discharge but hospital preparation must support the predicted plan. The inpatient work of the nurse and physical/occupational therapists can be amplified by a robust collaborative mobility plan. Daily processes and benchmarks are set and monitored for compliance. If processes are met, we expect lower length of stay and increased rate of discharge home safely, lower SNF discharge rates and lower readmission rates. Medical co-management discharge planning can be developed around risk predictors for higher readmission rate. Handoffs to post-acute care are an important component. Iorio *et al* published their acute care pathway with detail³.

Post-acute care for 90 days postop:

Our post-acute location-of-care cost data suggests where to find value (Figure B). The home environment with physical therapy and occupational therapy and skilled nursing as needed provides both decreased cost and improvement in quality for appropriate patients. Our rate of discharge to home is lowering the regional and national averages. For MSKR BPCI bundles, our SNF average has a cost just under four times higher than our home health care average. Work with Penn Center for Continuing Care (PCCC) shows the benefit of active collaboration. PCCC, compared to the average MSKR BPCI for all SNFs, is half the cost, largely due to almost half the length of stay but also a lower readmission rate.

The IRF offers value for the patient with acute care needs. For our MSKR BPCI average, the inpatient rehab facility cost is about 50% higher than the average SNF stay with a readmission rate equal to SNF. Inpatient rehab facilities offer value for the patient need higher level of care (Figure C).



Source: Centers for Medicare & Medicaid Services

Figure B. CJR sites, as of January 1st, 2011.

Post Acute Provider	Number of Episodes	HHA Cost Per Episode	Avg # of Visits	Episodes with a Readmission
HHA average	199	\$3,298	15.1	10.05%
Penn Care At Home	111	\$3,400	15.4	9.91%
Post Acute Provider	Number of Episodes	SNF Cost Per Episode	Average Length of SNF Stay	Episodes with a Readmission
SNF average	370	\$13,247	21.6	20.00%
PPCCC	135	\$6,130	12.7	17.78%
Post Acute Provider	Number of Episodes	IRF Cost Per Episode	Average Length of IRF Stay	Episodes with a Readmission
IRF average	69	\$18,376	12.6	21.74%
Penn Rehab Unit	28	\$16,530	13.5	17.86%

Figure C. Remedy Partners reported CMS PPMC MSK Q4 2013—Q3 2015 Post-acute location of care.

To predict safe home discharge, RAPT score predicts SNF need. Prehab PT visits are also potentially important so patients are better prepared for surgery physically and better prepared about the home. Literature for the prehab demonstrates its potential usefulness⁴.

Readmissions are a marker of low value: both low quality and high cost. Readmission rate from home is lower than the readmission rate from an inpatient post-acute facility. Higher readmission rate from SNF's and inpatient rehab facilities is partially related to higher risk patients. Our experience is that increased rate of discharge to home has maintained unchanged readmission rate from home.

Clinical guidelines for evaluation before readmission, such as the hot joint protocol for septic arthritis, or SIRS and VTE guidelines have lowered "unnecessary" readmission. Workups can be done as an outpatient or in the emergency room.

Process metrics can show variability that may or may not be of benefit. The quality improvement/process improvement is iterative. Metrics should be **SMART**: Specific—target a specific area for improvement, Measurable—quantify or at least suggest an indicator of progress, Assignable—specify who will do it, Realistic—state what results can realistically be achieved, given available resources, Time-related—specify when the result can be achieved. Quality improvement with process metrics is well-documented in the industry and has become accepted within medicine and should be useful in medicine to lead to improved outcomes.

The antidote to the "NEVER" event are "ALWAYS" events. The goal to never have postoperative infections is appropriate, but unreachable. Focus on the "always" events supports active reduction of variability. Always do best-practice skin preparation before surgery, always give the right antibiotics at the right time and always provide appropriate wound care after surgery. "ALWAYS" processes should be SMART.

Conclusion

The home safely idea has recently become a central concept in total joint arthroplasty. Prepare the patient before admission for surgery, prepare for discharge to the best value post-acute care location while in the hospital, and collaborate with the post-acute care based on the value metrics of both quality and cost. The safety component has been the evaluation of unnecessary readmissions. Programs such as our Hot Joint Program were developed when we recognized that some patients admitted for infection were unnecessarily admitted for an infection workup. Careful review of readmissions for opportunity should be a central activity.

Our bundle work has been driven by value. Quality and cost improvements often overlap. Reduce variability and always apply best practices to improve patient quality and safety. Savings will reward successful implementation. Participation in bundles, initially driven by cost, has led to important improvement in quality and safety.

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