Bundled Care Management

Nicole A. Zelenski, MD, Blair S. Ashley, MD, Tyler R. Morris, MD, Alexander L. Neuwirth, MD, Eric L. Hume, MD

In 2011, the Center for Medicare and Medicaid Innovation announced the use of "bundled payments" for a care improvement initiative, where a price is determined and charged for a set of services to a patient. The goal is to reward successful clinical performance rather than the use of health care resources in fee-for-service models.

There are four bundle models, based on the encounter type and the hospital implementing the program. In the **first model** payments are bundled for hospital and physician services during each individual hospitalization. In the **second model** payments are bundled for an initial hospitalization and all post-acute care services for up to 90 days after discharge. In the **third model** payments are bundled for post-acute care services after hospitalization, excluding the hospital stay. The **fourth model** sets fixed prospective payment for all services during hospitalization plus re-admissions within 30 days.[1]

For the first three models there is no fixed price; a discounted target price is set for the episode of care based on historical spending. Providers charge fee-for-service, and the Center for Medicare and Medicaid Services assesses whether actual spending is above or below target.[1] The hospital is rewarded if they are under the target spending price, but penalized if they are over. For the fourth model, the fixed price is determined based on prior average cost at a particular institution, with a discount.

The goal of bundled payments is to mitigate unnecessary spending while encouraging quality care, thereby improving value. The principle is based on variation of cost of treatment of certain conditions. An analysis showed regional variation in medical costs without improved outcomes.[1] Cost-analysis simulations for costs above the 25th percentile, when reduced to the 25th percentile, yielded a savings for the top 17 conditions of $10 billion annually. Thus, a bundle with a fixed cost at the 25th percentile would result in significant healthcare savings. Because cost and quality do not correlate, this saving may well occur without a quality penalty.

However, there are difficulties with implementing a bundled system of care. Institutions often do not have a fundamental understanding of the costs associated with the course of care. They cannot control cost at out-of-network care providers. Smaller institutions are at high risk when high year-to-year variation translates to large variations in the profits of the hospital.[1] Charging a set price, regardless of the complexity, encourages facilities to refer complex care patients. Less complex patients require fewer services, resulting in increased profit. "Cherry picking" of such patients is a risk. Outliers can break a well-run bundle. Features such as stop-loss protection for high-cost cases and an ability to exclude cases with high-cost diagnosis may protect hospital systems, but the concern over "pricier" patients still remains because the protection is incomplete.

Post-acute costs, including readmission rates and the discharge of patients to rehabilitation facilities, are included in model two. Our initial focus will be identifying risk factors that can be mitigated to avoid readmissions in the 90-day period after surgery, and lowering the rate of admission post-discharge to skilled nursing facilities, inpatient rehabilitation facilities, and the other acute-care inpatient facilities.

Bundled care management has helped us understand and develop processes aimed at both lowering cost and improving patient safety. At present, our most active bundle is the CMS Bundled Payments for Care Improvement (BPCI) for patients having revision hip and knee surgery since January 1, 2014. Figure 1 shows the most recent CMS data from 2010 and 2011 for Presbyterian Medical Center, which uses a type 2 bundle. In a type 2 bundle, the major part of the pie diagram cannot be impacted directly; however, the post-acute costs do have the potential for mitigation. Approximately two-thirds of the post-acute costs are related to skilled nursing facilities (SNFs) and inpatient rehabilitation facility costs, and the other third of the post-acute cost is for readmissions. This finding gives us two areas of focus to lower cost.

Readmission Management Program

Readmission management aims to identify and mitigate risks that predict readmission, both patient factors and process factors. Mitigation can occur prior to admission, during the inpatient stay, and in the post-acute period. Preadmission hospital prevention aims to manage modifiable disease. Our Risk Stratification Program has been effective in identifying patient risk factors that may lead to ICU admission and rapid response in care issues; we have also learned that it predicts readmission rates. We have been able to develop programs that improve the hospital safety record, with an ongoing goal to expand the Pre-Hospital Risk Program to address readmission risk issues.

The second time period is inpatient hospital care, during which communication with the outpatient provider is established and medical co-morbidities are managed prior to discharge to reduce readmission rates. The third time period involves management during the post-acute 90 days with clinical guidelines designed to manage common clinical presentations. The "Hot Joint Protocol" illustrates a successful algorithm for addressing painful TKAs.

A. Preadmission Management of Modifiable Diseases

Modifiable diseases include common, well-defined conditions of varying complexity and prevalence. As a pilot in the PPMC population, we propose to mitigate the effects of these diseases and have identified several potential targets for preoperative disease modification including malnutrition, obesity, diabetes, and anemia.

Low albumin has long been shown in surgical literature to be associated with wound complications. Poor nutrition is thought to impair fibroblast proliferation resulting in impaired collagen synthesis, leading to higher rates of wound complications and surgical site infections.[1,2,3] Interestingly, high levels of preoperative albumin are thought to prevent complications with higher levels being independently associated with lower risk of readmission.[1] Hypoalbuminemia also appears to prevent subsequent healing after infection. In a retrospective review of almost 12,000 cases of lower extremity arthroplasty, of those who became infected, initial irrigation and debridement were less successful in the malnourished population.[1] Research at this institution corroborates this data, as recent work shows that the overall hypoalbuminemia correlates with higher rates of unplanned ICU admissions.[1]

At present, our effort is focused on understanding the etiology of low albumin in our patients, as malnutrition represents only one factor causing serum albumin less than or equal to 3.5g/dL. We found that 16% of all our patients have an albumin level less than or equal to this cutoff. Chronic liver disease is also an important contributor to many patients' hypoalbuminemia. Paradoxically, obese patients often suffer from low albumin. Approximately 25% of our patients who have a BMI greater than 38 have a level of albumin less than or equal to 3.5g/dL. Courtney *et al* found malnutrition (with an albumin $<$ 3.5g/dL), but not obesity, to be an independent risk factor for complications.[1] We are developing a pilot to identify and evaluate patients with low albumin and to identify resources available for nutritional support.

Similar data exist for patients with diabetes mellitus. It is important to note that hyperglycemia has also been shown to be an independent predictor of morbidity and mortality in surgical patients. Kremers found that there was an increased risk of developing prosthetic joint infections in patients with perioperative hyperglycemia >180 within one week of surgery.[1] Iorio found the rate of overall infections, including superficial and deep surgical site infections, to be higher in diabetics: 3.4% compared with 0.84% in non-diabetics.[1] Particularly germane to the discussion of evaluating diabetes control in the setting of bundled payments is that there is a significant difference in the length of hospital stay and overall hospital cost between non-diabetic, controlled diabetic, and uncontrolled diabetic patients. Marchant *et al* showed that the mean length of stay in uncontrolled diabetics was 6.2 days, compared with 4.6 days in controlled diabetics. The median cost of admission is also statistically significant, with the difference between normoglycemia and uncontrolled diabetes in excess of $2,000.[1] Perioperative complications including cerebrovascular accidents, urinary tract infections, ileus, pneumonia, postoperative hemorrhage/shock, and need for blood transfusion were significantly increased in uncontrolled diabetics compared with non-diabetic and controlled diabetic patients.[1] These data suggest that good preoperative control of blood sugar may be a modifiable risk factor for total joint infection.

A further modifiable risk factor to be taken into consideration for implementation of bundled payments is preoperative anemia. Risk factors for requiring transfusion during total joint arthroplasty include age, preoperative hematocrit, BMI of $<$ 30 kg/m^2, female sex, and ASA class of $>$ 2.[1] A review by Monsef *et al* showed there was a significantly significant increase in mean length of stay with a preoperative Hb $<$ 12: 4.2 compared with 3.7 days.[1] Overall, patient hemoglobin levels preoperatively until two days after the procedure were found to be inversely related to length of stay and also a barrier to discharge in fast-track hospital stays.[1,2]

B. Hospital Management and Discharge Preparation for Patients

The co-management process with the PPMC hospitalists has been an effective part of lowering morbidity and mortality of our patient population. Involvement of the hospitalists with inpatient care and with pharmacy reconciliation has resulted in better prepared patients. Additionally, the hospitalist providers are involved in communication with outpatient care providers, thereby optimizing transition of care.

Penn Chart Acute Transfer Tool (PCATT) is an electronic document we have developed to enhance communication with post-acute providers. This EMR-based program facilitates transition of care by providing inpatient data, physical therapy goals, and discharge plans to outpatient teams.

C. Post-Acute Care Interventions

Two major efforts are being pursued. The first is the nurse navigator who can support the transition of care, and to enhance compliance with the care plan. We expect to lower unnecessary emergency room (ER) visits, to decrease

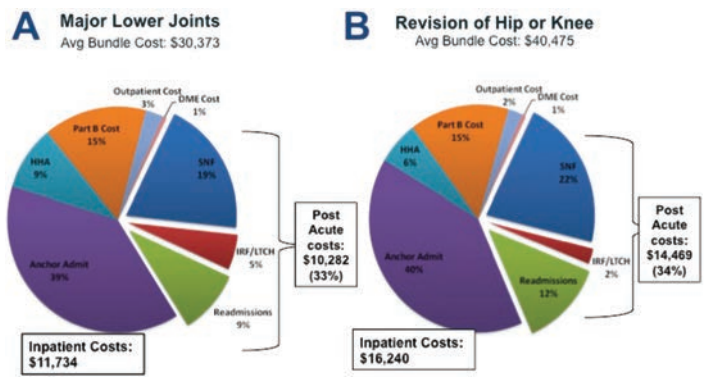

Figure 1. CMS data 2010-2011 at PPMC for (A) primary hip and knee arthroplasty and (B) revision hip and knee arthroplasty. The highest contribution to care is the initial visit; however, discharges to SNF make up the second largest contribution (~20%). Readmissions are a major source of cost contributing up to 12% and are potentially modifiable.

readmission rates, and to decrease leakage rate of readmissions to non-UPHS hospitals. By reaching out to the patient and providing appropriate recommendations, nurse navigators can effectively guide patient care after discharge.

The post-acute management through the patient office has also been bolstered, by providing office access to post-surgical care within a half-day of any acute occurrences. Improved phone access and same-day/next day office visits support this effort. Additionally, patients with medical emergencies are encouraged to come to one of the UPHS ER s, where there are pathways to evaluate and care for our patients.

Our first care pathway effort was aimed at the patient who presents to the emergency department or office with the concern that a total knee arthroplasty may be infected. In the six months from July to December of 2013 we had 16 readmissions to Presbyterian Medical Center with a diagnosis of wound infection; of those 16, only one had a proven wound infection. This finding suggested that the evaluation of the "hot joint" as an outpatient would likely result in lowering unnecessary readmissions rates. The Hot Joint Pathway was developed based on the AAOS/AAHKS guidelines for periprosthetic infection. The pathway starts with the CRP, a highly sensitive test in identifying prosthetic joint infections. If the CRP is normal, the patient is safely discharged home with office follow-up. This protocol has been successful as illustrated by the decreased readmission rate in the six months following implementation (Figure 2).

D. Post-Acute Care and Location of Care

Our rate of SNF and inpatient rehabilitation transfers exceed the state and national averages, resulting in increased costs. Identification of patients who need SNF placement is an important modifiable factor of care. We are in the process of examining preoperative and inpatient indicators suggestive of discharge to SNF and correlating these findings with readmission risk. The four preoperative components of this assessment are a preadmission PT session we call prehab, social work assessment, joint class, and risk stratification. For an inpatient, the metrics such as distance walked and the number of physical therapy sessions may predict discharge to home.

The following components make up our Home Safely Pathway. The Home Safely Program evaluates motivated patients for the likelihood of success, and then plans hospital and post-acute care to support the decision for safe discharge to home. Figure 3 outlines the levels of the Home Safely Pathway. Approval from the orthopaedic social worker is based on home support, family, home environment, insurance coverage to support the program, prehab outpatient PT visits designed to address function capabilities and any barriers to postoperative discharge to home, and the risk stratification process. The Post-Acute Pathway includes the Penn Home Health Agency, which integrates the components of the care plan at home within 24 hours of discharge.

Summary

In summary, the opportunity to focus on the efficiency of care has allowed us to improve the safety of our patients. We are evaluating readmission, modifiable readmission risk, and safe discharge planning, with the goal of a more complete readmission risk evaluation within the UPHS system, using CMS or prior patient data.

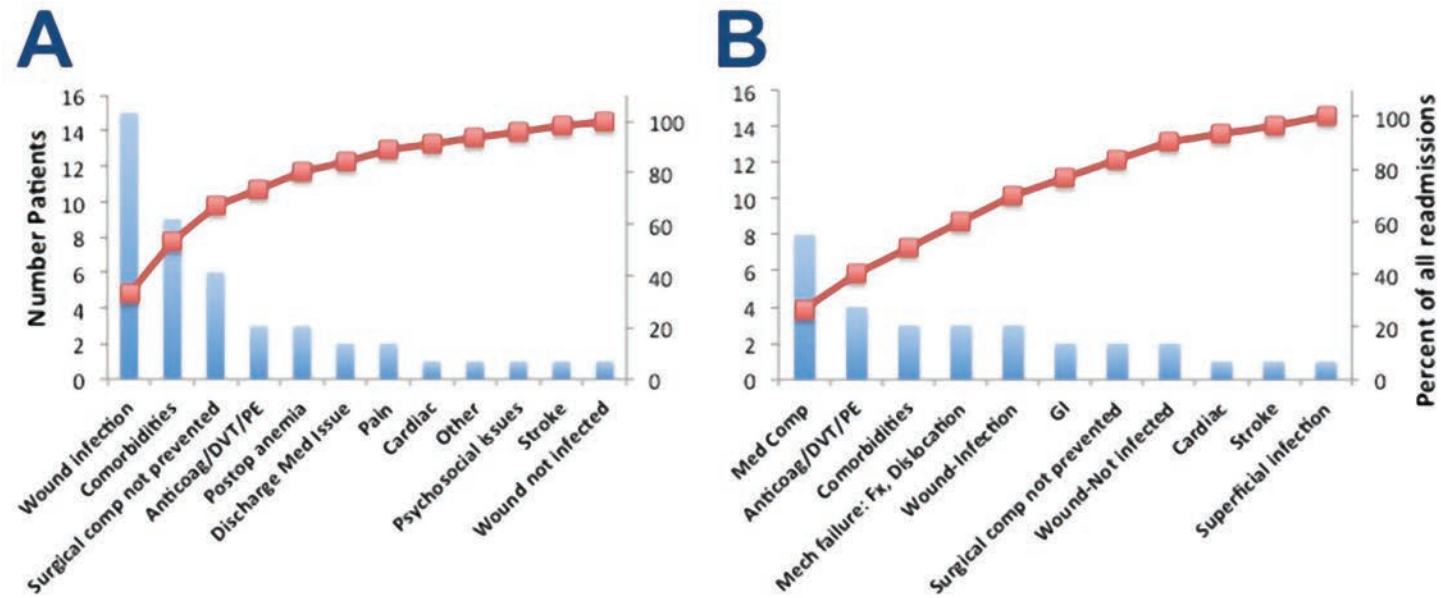

Figure 2. Percent of all patients readmitted and cause (A) prior to "hot joint" pathway and (B) post-implementation of "hot joint" pathway.

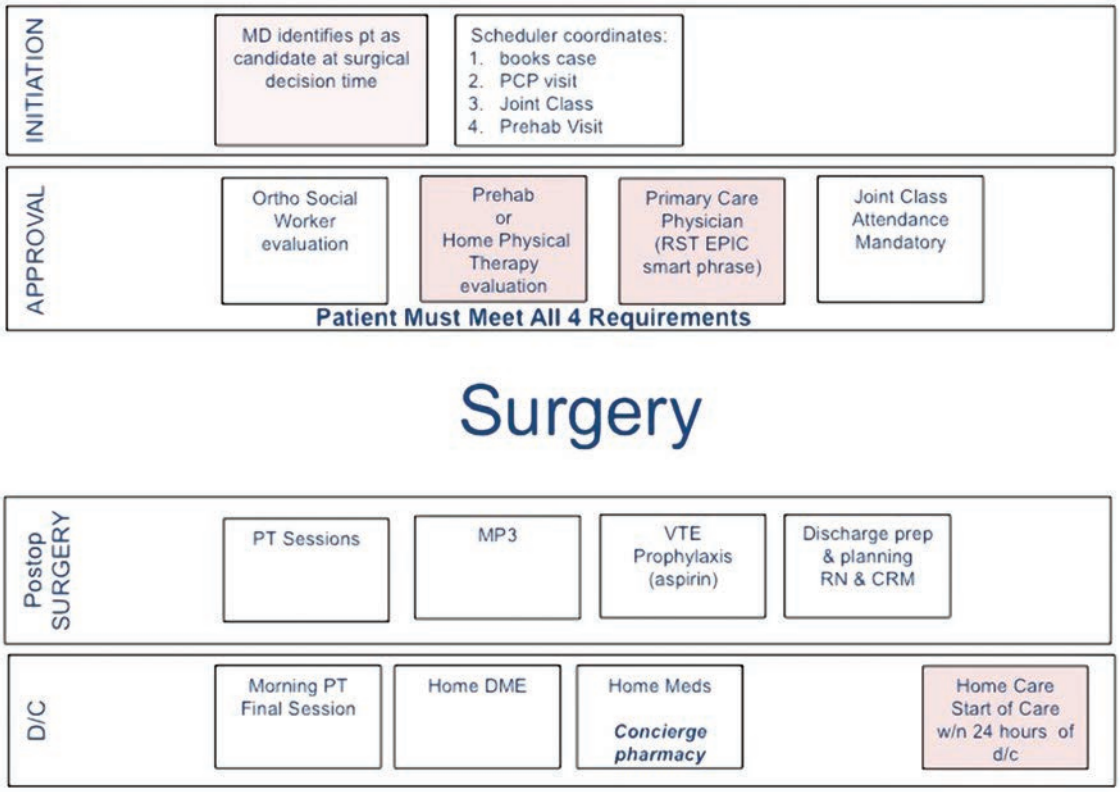

Figure 3. Home Safely Pathway. The four levels of home assessment start with patient identification and scheduling in the initiation phase, continue with the approval phase and postoperative surgical care, and conclude with the discharge planning and execution.

The readmission pilot that we are currently evaluating is the low albumin malnutrition process. Our hospital co-management with the hospitalist team focuses on pre-discharge evaluation, medicine reconciliation, and transition of care. The post-hospital process has focused on the "nurse navigator" and improved office access. Successful algorithms such as the Hot Joint Protocol are aimed at common reasons for readmission.

In an effort to lower the rate of SNFs or inpatient rehabilitation discharges, we have considered several measures. The Home Safely Program uses pre-surgery social and home factors to plan hospital and post-acute care to support the decision for patients to return home safely. We are actively evaluating the metrics of hospital activity and distance walked when planning home discharge, which may support a mobility tech. By addressing all these issues, we hope to be successful for BPCI Hip and Knee Arthroplasty service and to improve patient safety.

References

1. Mechanic R. Post-acute care--the next frontier for controlling Medicare spending. *N Engl J Med* 370: 692-694 (2014).

2. Newhouse JP, Garber AM. Geographic variation in health care spending in the United States: insights from an Institute of Medicine report. *JAMA* 310: 1227-1228 (2013).

3. Cross MB, et al. Evaluation of malnutrition in orthopaedic surgery. J Am Acad Orthop Surg 22: 193-199 (2014).

4. Seibert DJ . Pathophysiology of surgical site infection in total hip arthroplasty. Am J Infect Control 27: 536-542 (1999).

5. Beiner JM, et al. Postoperative wound infections of the spine. Neurosurg Focus 15: E14 (2003).

6. Mednick RE, et al. Factors Affecting Readmission Rates Following Primary Total Hip Arthroplasty. J Bone Joint Surg Am 96: 1201-1209 (2014).

7. Jaberi FM, et al. Procrastination of wound drainage and malnutrition affect the outcome of joint arthroplasty. Clin Orthop Relat Res 466: 1368-1371 (2008).

8. Kamath A. Malnutrition in Joint Arthroplasty: Prospective Study Indicates Risk of Unplanned ICU Admission. Presented at the AAHKS Annual Meeting (2014).

9. Courtney PM. The Effect of Malnutrition and Morbid Obesity on Complication Rates Following Primary Total Joint Arthroplasty. Presented at the AAHKS Annual Meeting (2014).

10. Maradit Kremers H, et al. Diabetes Mellitus, Hyperglycemia, Hemoglobin A1C and the Risk of Prosthetic Joint Infections in Total Hip and Knee Arthroplasty. J Arthroplasty 30: 439 443 (2015).

11. Iorio R, et al. Diabetes mellitus, hemoglobin A1C, and the incidence of total joint arthroplasty infection. J Arthroplasty 27: 726-729 e721 (2012).

12. Marchant MH, et al. The impact of glycemic control and diabetes mellitus on perioperative outcomes after total joint arthroplasty. J Bone Joint Surg Am 91: 1621-1629 (2009).

13. Hart A, et al. Blood transfusion in primary total hip and knee arthroplasty. Incidence, risk factors, and thirty-day complication rates. J Bone Joint Surg Am 96: 1945-1951 (2014).

14. Monsef JB, et al. The impact of blood management on length of stay after primary total knee arthroplasty. Open Orthop J 8: 108-113 (2014)

15. Browne JA, et al. Transfusion rates are increasing following total hip arthroplasty: risk factors and outcomes. J Arthroplasty 28: 34-37 (2013).