

Medicare Payment Bundling: Insights from Claims Data and Policy Implications

Analyses of Episode-based Payment

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American Hospital Association (AHA) and
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Executive Summary

Purpose and Study Objectives

Fee-for-service, the predominant Medicare program payment system, has been identified as a major factor contributing to the accelerating growth of health care costs in the United States.¹ This form of payment financially rewards the volume of services delivered by physicians, hospitals, and other providers over the quality of care received by patients or their outcomes. The prospective payment systems implemented for acute care hospitals in 1983 and post-acute care providers in the late 1990s were an attempt by the federal government to slow rising health care costs. In order to further control costs, there has been growing interest over the past several years in the concept of payment bundling, whereby services for physicians, hospitals, post-acute care providers and others would be “bundled” together into one payment covering an episode of care over a specified period of time.

Payment bundling represents a significant deviation from the current volume-driven, fee-for-service payment system. If successful, payment bundling has the potential to transition the United States health care system from its current state to a more population-based model that better serves patients. Through a single payment for an entire episode of care, payment bundling offers providers the flexibility and financial incentives to redesign care delivery to better avoid preventable complications and readmissions, and encourages cost-effective and high-quality care delivery.

The American Hospital Association (AHA) and Association of American Medical Colleges (AAMC) commissioned Dobson DaVanzo & Associates, LLC (Dobson | DaVanzo) to conduct a series of quantitative analyses of different episode-based payment bundles.

The purpose of this report is to highlight considerations for policymakers and providers using descriptive statistics and multivariate regression analyses, supplemented with findings from the literature and select interviews.

Payment bundling is a logical next step toward a more comprehensive system of population health management with the potential to increase quality and reduce costs.

Analyses of Medicare claims data will inform policymakers and providers as they work to design and implement a successful national payment bundling program.

¹ Hackbarth G, Reischauer R, Mutti A. (2008). Collective accountability for medical care – toward bundled Medicare payments. *New England Journal of Medicine* 359: 3-5.

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Background on Payment Bundling and Study Research Questions

According to the Medicare Payment Advisory Commission (MedPAC), fee-for-service payments accounted for more than two-thirds of total Medicare expenditures in 2008 (\$313.0 billion).² Episodes of acute and post-acute care that include an “index” hospitalization and all of the care provided in the 15 days following hospital discharge account for 40 percent of Medicare fee-for-service payments, while more than one-half of Medicare fee-for-service payments (54.5 percent) occur within 90 days following hospital discharge (see Exhibit 3.1).³ Given the substantial amount of spending represented by these episodes of care, bundled payments for acute and post-acute care could have a large impact on overall Medicare expenditures.

Under Section 3023 of the Affordable Care Act, Medicare payment bundles are to be implemented in a national pilot beginning in January 2013. Although the Centers for Medicare & Medicaid Services (CMS) has delayed the implementation of this pilot, the Center for Medicare & Medicaid Innovation (CMMI) began a parallel initiative in August 2011 known as the Bundled Payments for Care Improvement (BPCI) initiative (see Appendix A).⁴ The BPCI initiative is testing four different payment models that combine hospital, physician, and post-acute care in various ways. The BPCI initiative is far more flexible and provider-driven than a national pilot would likely be. It uses provider-specific historical benchmarks to set bundled payment rates rather than a national rate, as would likely be the case in a broader program. Nonetheless, findings from the program evaluation will inform CMS’s future efforts to implement a national bundling program and other payment reforms more generally.

Within a bundled payment system, the behavior of providers is influenced by three overriding incentives. First, providers are incentivized to improve processes of care that are necessary and evidence-based, as well as to use lower-cost care when clinically appropriate. Second, there is a strong incentive to better manage care across the continuum as well as reduce the utilization of providers outside of the affiliated network formed to deliver care under the bundled payment. Third, hospitals and physicians have an incentive to reduce internal hospital costs (supplies, drugs, medical devices, consults) as well as post-hospital costs because gainsharing can allow physicians to share in the savings.

In addition to these incentives, bundled payments have three major risks for providers. The first risk is the size of the discount that CMS might require of providers. Second, conveners (third parties that take on financial risk and/or provide administrative and technical support for an affiliated network of providers under payment bundling) are liable for services provided across the continuum, including any services rendered by providers outside of the affiliated network. Third, providers are at risk for patient characteristics and health status

² Medicare Payment Advisory Commission (2009). A Databook: Healthcare spending and the Medicare program. (Washington, DC: MedPAC).

³ The one-half of Medicare fee-for-service payments not captured within 90-day episodes following an index hospitalization include dialysis and other services for end-stage renal disease (ESRD) patients; other physician, ambulatory surgical center, and outpatient procedures; and community-referred home health episodes.

⁴ Center for Medicare and Medicaid Innovation. (2011, August 23). Bundled payments for care improvement initiative: Frequently asked questions [Last updated June 26, 2012]. Available online at: <http://innovations.cms.gov/Files/x/BundledPaymentsFAQ.pdf>

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factors that may increase the intensity of care required and are not captured by payment risk adjustment processes.

Based on the incentives and challenges posed by payment bundling, AHA and AAMC developed a list of research questions for consideration by policymakers and providers during the pilot phase and before a national program is implemented (Exhibit ES-1).

Exhibit ES-1: Research Questions

Defining the Bundle

- What are the characteristics of conditions that make attractive options for bundling? Which conditions meet those characteristics?
- Should episode length be uniform across bundles, or vary based on the service or condition?
- Which services and provider types should be included? Should this vary by type of service or patient?
- Should certain patient types be excluded? If so, which patients?

Pricing the Bundle

- How should the bundle be priced? How should add-on payments be addressed?
- What factors should be considered for risk adjustment?
- How should the outlier policy be determined?

Managing the Bundle

- What is the impact of patient pathways on episode payments?
- How do hospital readmissions affect the payment bundle?
- What is the role of the first post-acute care setting to which a patient is admitted post-discharge?
- What capabilities should organizations accepting payment bundles have (or develop)?

Other Program Design Issues for Policymakers

- What protections can be built in to guard against stinting, over-utilization of bundles, and adverse selection? How should regional variation in practice patterns be addressed?
- Should there be a minimum volume requirement?
- What are appropriate (episode-specific) quality measures?
- What evaluation criteria should be met before a pilot program is expanded nationally?

Methods in Brief

The episodes of care analyzed in this report were created based on specific assumptions developed and agreed upon by Dobson | DaVanzo and staff of both AHA and AAMC throughout the project. Using beneficiary-level Medicare claims files for a 5 percent sample of beneficiaries for three years linked across time and care settings, we analyzed the effects of bundled payments on different categories of hospitals and specific patient populations. The analyses presented in this report include both descriptive statistics and multivariate regression models. We explore numerous aspects of bundled payment, such as the definition and structure of episodes; the impact of patient demographic and clinical characteristics, facility characteristics, and other factors on bundled payments; risk adjustment strategies; provider capabilities; hospital readmissions; and care transition management. We supplemented our quantitative analyses with a targeted review of recent literature on bundled payments and select interviews with prospective BPCI applicants.

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Defining the Bundle

In determining how to define the bundle, there are several issues to consider, including the clinical conditions that are the most appropriate for bundled payments, how long the episode should be, which types of providers and services could be included in the bundled payment, and which types of patients could be excluded or included with explicit risk adjustment.

CHARACTERISTICS OF CLINICAL CONDITIONS

We have identified four characteristics that determine whether a clinical condition is well-suited to payment bundling:

- 1) Adequate prevalence, with sufficient sample size to predict costs and show the effect of clinical interventions;
- 2) Significant resource consumption for the Medicare program, either on a per-episode basis or because of high case volume;
- 3) Appropriate amount of variation in Medicare payment to achieve efficiency gains, but not so much that the risk of multiple outlier cases outweighs the reward; and
- 4) Presence of clear, evidence-based clinical care guidelines.

These criteria are consistent with prior research conducted by the Government Accountability Office (GAO) on private-sector initiatives to bundle payment,⁵ as well as previous Medicare payment bundling demonstrations and our interviews with prospective BPCI applicants. For example, major joint replacement or reattachment of lower extremity (MS-DRGs 469 and 470) is the most prevalent condition in the Medicare population (4.7 percent of episodes) and accounts for the highest total Medicare episode payments (6.3 percent) (see Exhibit 3.2). There is considerable variation across episode payments due to beneficiary characteristics and the mix of providers in the episode.

However, as a “surgical” condition, major joint replacement has less variation in payments than “medical” episodes and has a more well-defined start and end point. The coefficient of variation (CV)⁶ for episode payments—a measure of “relative variability”—is quite low (0.42), which suggests that Medicare episode payments for major joint replacement are relatively consistent and the costs can be managed by providers.

Defining the Bundle

- **Conditions well-suited to payment bundling are prevalent and/or expensive to the Medicare program, have limited variation in episode payments, and have evidence-based clinical care guidelines**
- **Optimal episode length is linked to the nature of the clinical condition, and balances risk to providers with opportunity for clinical intervention and efficiency gains**
- **Optimal services to include are clinically appropriate ones that lead to an acceptable level of payment variation**
- **Medicare Advantage (MA) and end-stage renal disease (ESRD) patients could be excluded; cancer and hospice patients, transfers, deaths, and dual eligibles could be excluded or included with explicit risk adjustment**

⁵ Cosgrove JC (2011, January 31). Medicare: Private sector initiatives to bundle hospital and physician payments for an episode of care [GAO-11-126R]. (Washington, DC: GAO).

⁶ The CV is equal to the standard deviation of a distribution divided by its mean, and is a measure of variability. Values above 1.0 are considered highly variable.

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On the other hand, the CV of Medicare episode payments for heart failure and shock (MS-DRGs 291-293) is 0.80, twice as high as for major joint replacement, which suggests greater variability in payment but also greater opportunity for clinical intervention and gains in efficiency (see Exhibit 3.2).

Exhibit ES-2 shows which of these four criteria are met by 16 select MS-DRG families. MS-DRGs 469 and 470 meet all four of the criteria listed above; MS-DRGs 291-293 meet three of the four criteria (high total *or* high average Medicare episode payments are considered one criterion).

Exhibit ES-2: Select MS-DRG Families by Criteria for Payment Bundling

MS-DRG Family	Prevalent in Medicare Population (> 1% of Episodes)	High Total Episode Payments (> 2% of Total Payments)	High Average Episode Payments (> \$20,000)	Low Variance in Episode Payments (CV < 0.50)	Clear Evidence-Based Practice Guidelines*
Acute ischemic stroke w use of thrombolytic agent (61, 62, 63)			X		X
Intracranial hemorrhage or cerebral infarction (64, 65, 66)	X	X			X
Nonspecific cva & precerebral occlusion w/o infarct (67,68)					X
Chronic obstructive pulmonary disease (190, 191, 192)	X	X			X
Simple pneumonia & pleurisy (193, 194, 195)	X	X			X
Cardiac valve & oth maj cardiothoracic proc w card cath (216, 217, 218)			X	X	X
Cardiac valve & oth maj cardiothoracic proc w/o card cath (219, 220, 221)			X	X	X
Coronary bypass w ptca (231, 232)			X	X	X
Coronary bypass w cardiac cath (233, 234)			X	X	X
Coronary bypass w/o cardiac cath (235, 236)			X	X	X
Perc cardiovasc proc w drug-eluting stent (247)	X		X	X	X
Heart failure & shock (291, 292, 293)	X	X			X
Bilateral or multiple major joint procedures of lower extremity (461, 462)			X	X	X
Revision of hip or knee replacement (466, 467, 468)			X	X	X
Major joint replacement or reattachment of lower extremity (469, 470)	X	X		X	X
Hip & femur procedures except major joint (480, 481, 482)	X	X	X	X	X

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

* Maintained by the American Academy of Orthopaedic Surgeons (AAOS) or included in the National Guideline Clearinghouse (NGC) maintained by the Agency for Healthcare Research and Quality (AHRQ). For inclusion criteria, see Appendix B, Exhibits B.9 and B.10.

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EPISODE LENGTH

Episode length is an important policy lever for expanding provider accountability for patient care. There are several factors that should be considered in determining the length of the episode: the nature of the index hospitalization (surgical or medical), the amount of variation in Medicare episode payments as episode length increases, the relative proportion of episode payments represented by the index hospitalization, and the ability of providers to control downstream post-acute care costs.

There is an approximately 30 percent increase in average Medicare episode payments as the episode length increases from seven to 90 days for MS-DRG 247 (percutaneous cardiovascular procedure with drug-eluting stent w/ MCC), but for MS-DRG 291 (heart failure and shock w/ MCC) this increase is more than 130 percent (see Exhibit 3.4 and Appendix C, Exhibit C.2). There may be greater opportunity to manage costs within longer medical episodes; however, the index hospitalization represents a decreasing proportion of Medicare payments as episode length increases. Longer episodes also have greater risk to providers in terms of payment variation (especially for medical episodes).

INCLUSION OF SERVICES AND PROVIDER TYPES

Whether or not a service or type of provider is included in the bundle depends on: a) whether the service or type of provider is clinically related to the episode; and b) whether inclusion of the service or provider results in a manageable degree of variation in Medicare payments (or financial risk to providers).

Exclusions should be considered carefully, as their ability to mitigate financial risk to providers may be limited and exclusions can create incentives for providers to shift services, costs, and responsibility for the patient to providers and service types that are outside of the bundle.

For example, hospice services have been excluded from the BPCI. Hospice services tend to have an unclear start and end point and are generally associated with more costly episodes of care (see Exhibit 3.6). Additionally, hospice patients are clinically different from other patients in that they are receiving medical services that focus on palliative rather than restorative care. Because hospice can be a longer-term benefit, it may make sense to initially exclude this care from some payment bundles. End-of-life care, however, will be important to consider in future payment bundling systems, especially for medical conditions that have high rates of mortality (such as heart failure).

EXCLUSION OF OR ADJUSTMENT FOR PATIENTS

While the majority of Medicare patients can be included in a bundled payment system, there are several types of patients that merit either exclusion or explicit risk adjustment. These patients have a clinical condition or characteristic that either distinguishes them from other beneficiaries or markedly changes the average Medicare episode payment. Exclusions could

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include beneficiaries enrolled in the Medicare Advantage (MA) program and patients with end-stage renal disease (ESRD). Other types of patients may not merit exclusion, but could require explicit risk adjustment in order to include them in a bundled payment system. These include patients dually eligible for both Medicare and Medicaid, as well as patients with cancer, acute care hospital transfer patients, and patients who die during the episode (see Exhibit 3.6).

Pricing the Bundle

Our descriptive statistics identify numerous beneficiary and provider characteristics that drive Medicare episode payments and should be considered for risk adjustment (see Exhibits 4.1-4.9):

- Beneficiary demographic characteristics, such as age and sex, and clinical characteristics, such as chronic conditions and functional ability;
- MS-DRG and number of comorbid conditions (measured by Hierarchical Condition Category [HCC]);
- Hospital characteristics, such as the percent of Indirect Medical Education (IME) and Disproportionate Share Hospital (DSH) payments received; and
- The first post-acute care setting following discharge from the index hospital.

The MA payment system, using HCCs, explicitly risk-adjusts payments for beneficiary clinical characteristics; the Inpatient Prospective Payment System (IPPS), using MS-DRGs and add-on payments, explicitly risk-adjusts payments for clinical conditions and facility characteristics. To determine the relative impact of each of these factors on Medicare episode payments, we developed a series of exploratory multivariate regression models using these and other variables to predict Medicare episode payments.

RISK ADJUSTMENT AND OUTLIERS

Our regression payment models create an analytic framework under which to consider developing a bundled payment system for episodes of care. This approach could be used to reduce financial risk to providers by risk-adjusting payments based on patient case-mix, facility characteristics, and other factors. The relationship between the payment predicted by our regression models and the actual Medicare payment (the predictive ratio) suggests how well the payment system is covering providers for delivering all of the care during the episode.

We found that, controlling for MS-DRG, beneficiary demographic and clinical characteristics, and facility characteristics, we are able to predict the average Medicare

Pricing the Bundle

- ***Risk adjustment for beneficiary demographic and clinical characteristics, facility characteristics, and outliers improves episode payment accuracy***
- ***Robust risk adjustment will be required in any national bundled payment system to prevent widespread financial dislocation among providers and protect patient access to care***

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episode payment with relative consistency. Our predictive payment model incorporates an outlier payment model similar to that used in the IPPS, which reduces the potential for extremely expensive cases to be underpaid. On the issue of whether post-acute care settings should receive different payments, the regression results show that the first post-acute care setting following discharge from the index hospitalization has a major impact on episode payments, and that all episodes beginning in a long-term care hospital (LTCH) meet the outlier criteria.

Exhibit ES-3 shows the progression in the R^2 of three regression models using different sets of independent variables. Model A focuses on beneficiary demographics and health status as well as facility characteristics. Model B adds additional variables including region, rural/urban status, bed size, and number of physicians seen by the patient. Model C includes all prior model variables and the first-setting of post-acute care. The R^2 measures the proportion of the variation in the observed payment that can be explained by the variables included in the model. Using all MS-DRGs, Model A, the model that incorporates basic adjustments used in other payment systems such as Medicare Advantage or IPPS, explains 66.9 percent of the variation in episode payments (an R^2 of 0.669).

As these regression models are based on Medicare *payments* rather than provider *costs*, the findings should be considered exploratory and interpreted with some caution. Nevertheless, our results have major policy implications. As the variables included in our regression models explain the vast majority of variation in episode payments, these characteristics should be considered for risk adjustment under a national payment bundling program.

Exhibit ES-3: Progression of R^2 Value with Addition of Variables in Model A, Model B, and Model C

All MS-DRGs (Number of Observations = 1,292,352)		
Regression Model	Variables	Cumulative R^{2*}
Model A	MS-DRG	0.511
	Age, Sex, Race	0.514
	Chronic Conditions	0.528
	HCC Count	0.534
	Functional Ability and Live Alone	0.647
	Dual Eligibility	0.647
	IME, DSH, Index Outlier Payment	0.669
Model B	Look Back CCU, ICU, and Episode Death	0.669
	Region	0.669
	Rural	0.669
	Bed Size	0.670
Model C	Unique Physician Count	0.762
	First PAC	0.781

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars.

* The adjusted- R^2 , which accounts for degrees of freedom, was nearly identical to the R^2 values presented and follows the same trend.

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The financial impact at the provider level estimated by our regression models further indicates the importance of robust risk adjustment and outlier payments. Model A estimates that the ratio of predicted payment to actual payment would be between 0.95 and 1.05 for roughly one-half of all providers, and between 0.90 and 1.10 for almost 80 percent of providers (see Exhibit 4.21).

These results suggest that, even after controlling for select beneficiary and facility characteristics, accounting for outliers, and using payments rather than costs, our model predicts that 80 percent of providers would experience a gain or loss of up to 10 percent. The remaining 20 percent of providers would experience an even greater predicted gain or loss. The development of a national payment system for bundling should, therefore, proceed with caution in order to mitigate risk for patients and providers. For example, if IME and DSH payments are not appropriately incorporated, the financial risk of payment bundling may fall disproportionately on teaching and safety-net hospitals. These providers would have costs that are not adequately captured by the payment system, especially in the case of hospital readmissions (in which add-on payments represent a substantial proportion).

Managing the Bundle

Beyond the specific episode characteristics that should be considered for risk adjustment under a bundled payment system, there are several important components of episodes that need to be managed by providers in order to control costs within the bundle.

PATIENT PATHWAYS

Analyses of patient pathways—the sequence of care settings through which a beneficiary transitions during an episode of care—offers opportunities for care redesign. Given the discontinuity of cost and utilization data across settings, the interrelationship of care services across time and setting has not been well understood.

The most common patient pathway across MS-DRGs—representing approximately one-half of all episodes—includes an inpatient hospital admission, followed by community care (such as physician and hospital outpatient services). Other common pathways include discharge from the hospital to a post-acute care provider, such as a skilled nursing facility (SNF) or home health agency (HHA), and also can include readmissions and other services. Patient pathways

Managing the Bundle

- *Patient pathways are a powerful way of thinking about the continuity of patient care and where to target clinical interventions*
- *Hospital readmissions double the average Medicare episode payment across MS-DRGs, but risk of readmission differs based on clinical condition and setting of post-hospital care*
- *The first post-acute care setting to which a beneficiary is discharged from the hospital has a major impact on Medicare episode payment*
- *Understanding the distribution of Medicare episode payments across settings will help providers better target care management efforts*
- *Providers need to consider issues such as designation of a single entity to accept the payment bundle, risk management, clinical and administrative processes, network formation, and data capabilities in preparing for payment bundling*

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differ markedly across MS-DRGs. Generally, episode payments are higher when there are more “stops” (number of individual care settings) in the care pathway in facility-based care settings, such as hospital readmissions, SNFs, IRFs, and LTCHs (see Exhibits 5.2 and 5.3). Variation in the number of “stops” and in Medicare episode payments increases with episode length, suggesting that interventions that impact patient pathways present a greater opportunity for care redesign in longer episodes. The ability of providers to manage patient pathways in terms of common patterns of utilization, cost variation, and outcome quality will be a necessity under bundled payment.

READMISSIONS

The presence of a readmission within an episode more than doubles the average Medicare episode payment; this rate varies across MS-DRGs, with medical MS-DRG episodes considerably more affected by readmissions than surgical conditions (see Exhibit 5.7). Patient demographic characteristics also impact readmissions, having a large effect within some MS-DRGs and very little within others. For example, in MS-DRG 470 (major joint replacement or reattachment of lower extremity w/o MCC) beneficiaries age 85 and older have a readmission rate nearly twice the average, while in MS-DRG 291 (heart failure and shock w MCC) the readmission rate for these elderly beneficiaries is close to the average (see Exhibits 5.10 and 5.11). In order to effectively manage costs during the episode, providers under a bundled payment will need to reduce readmissions and target interventions differentially across patients and types of providers.

FIRST POST-ACUTE CARE SETTING

In addition to readmissions, the first post-acute care setting after discharge has a large effect on Medicare episode payments. Medicare episode payment by first-setting is the most variable aspect of payment within the episode: average Medicare episode payments to the first-setting can represent more than one-half of the total average Medicare episode payment (see Appendix E, Exhibits E.3 and E.4). Across MS-DRGs, episodes with facility-based care as the first post-acute care setting tend to result in higher episode payments (see Exhibit 4.9 and Appendix D, Exhibit D.10). Providers will need to manage costs within the bundle by discharging patients to the most clinically appropriate setting after the hospitalization and more efficiently using downstream post-acute care.⁷ Policymakers will need to monitor quality and patient outcomes to ensure that is occurring.

DISTRIBUTION OF COSTS ACROSS SERVICE TYPES

Nearly one-third (32.6 percent) of average Medicare episode payment was for post-acute care in MS-DRG 470 (major joint replacement or reattachment of lower extremity w/o MCC) episodes in comparison to 17.2 percent of average Medicare episode payment for post-acute care for MS-DRG 291 (heart failure and shock w/ MCC) (see Exhibit 5.12). Understanding how costs are distributed within the episode for different services will help providers target care management efforts.

⁷ We did not compare differences in quality or patient outcomes across post-acute care settings and do not suggest current levels of service use are inappropriate.

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CAPABILITIES REQUIRED BY ORGANIZATIONS MANAGING THE BUNDLE

Organizations will need to have a variety of operational capabilities in order to effectively manage costs and other challenges that will arise under payment bundling. These were identified in the literature and interviews with prospective BPCI applicants.

Designation of a single responsible entity. MedPAC and GAO both recommend that Medicare reimburse a single provider entity (comprising a hospital and affiliated physicians) for the care provided during a hospitalization episode.^{8,9} Other entities, such as a risk-bearing third-party convener, also could be considered. The September 2012 MedPAC meeting suggested that payment bundles could include only the post-acute care immediately following a hospitalization.¹⁰ The BPCI initiative's four models also indicate that there are a number of different entities that could be responsible for different bundles.

Risk management. Under a bundled payment system, individual providers will transition from being a revenue center under fee-for-service payment to being a cost center within the bundle and will need the capacity to be responsible for managing and mitigating risk.¹¹

Clinical and administrative processes. Redesigned clinical and administrative processes are central to improving quality, eliminating unnecessary care, and increasing the efficient use of resources under a bundled payment. Most providers currently lack the level of administrative, clinical, and data integration necessary to accept and distribute bundled payments.¹² Leadership and physician engagement also have been highlighted as being necessary in order for organizations to succeed under bundled payments.¹³ Development of this infrastructure will require considerable investment in most cases.

Network formation. Providers will need to develop new, innovative business and clinical models and form strong networks with other providers in order to transition to a bundled payment system that imposes risk for the costs and services delivered by a wide range of providers (may not be either affiliated or integrated).

Data capabilities. In order to understand and manage costs under a bundled payment system, providers will need ongoing access to real-time data and the necessary capabilities—including information technology systems and personnel—to store, manage, and analyze the underlying financial and clinical data, including predictive modeling capacity to identify high risk patients.¹⁴

⁸ Medicare Payment Advisory Commission (2008, June). Report to the Congress: Reforming the delivery system. (Washington, DC: MedPAC).

⁹ Cosgrove JC (2011, January 31). Medicare: Private sector initiatives to bundle hospital and physician payments for an episode of care [GAO-11-126R]. (Washington, DC: GAO).

¹⁰ Medicare Payment Advisory Commission (2012, September 6). Approaches to bundling post-acute care [Transcript]. Available online at: http://www.medpac.gov/transcripts/092012_transcript.pdf

¹¹ MITRE Corporation (2011). Contracting for bundled payment. Prepared for the Centers for Medicare & Medicaid Services. (McLean, VA: MITRE Corporation).

¹² Volk G, Petterson J. (2011). Global and episodic bundling: An overview and considerations for Medicaid. Prepared for the State Coverage Initiatives by Navigant Consulting, LLC. (Princeton, NJ: Robert Wood Johnson Foundation). Available online at: <http://www.rwjf.org/files/research/72272globalbundling201104.pdf>

¹³ Mechanic RE, Santos P, Landon BE, Chernew ME. (2011). Medical group responses to global payment: Early lessons from the 'Alternative Quality Contract' in Massachusetts. *Health Affairs* 30(9): 1734-1742.

¹⁴ MITRE Corporation (2011). Information technology for bundled payment. Prepared for the Centers for Medicare & Medicaid Services. (McLean, VA: MITRE Corporation).

Other Program Design Issues for Policymakers

In addition to the issues explored through the data analyses discussed above, the design and implementation of a national payment bundling program raises a number of other issues for policymakers. These issues, also identified primarily in the literature and interviews with prospective BPCI applicants, include: a) how to protect against stinting (or the under-provision of care), adverse selection, and over-utilization; b) whether to set a minimum volume threshold; c) how to measure quality; d) how to address regional variation in practice patterns; e) waivers to current Medicare fee-for-service requirements; and f) what criteria should be used to evaluate a pilot or initiative before implementing a national payment bundling program.

STINTING, ADVERSE SELECTION, AND OVER-UTILIZATION

Risks to patients that demand mitigation under bundling scenarios include the incentive for hospitals and providers to reduce necessary clinical care for patients and to minimize investments in resources associated with safer care or better long-term outcomes, both of which would result in cost reduction within the payment bundle. Protections against these potential unintended consequences include risk adjustment, outlier payments, phase-in/transition, quality and outcomes monitoring, patient assessment tools that cross the care continuum, and gainsharing. Policies to prevent providers from shifting care outside of the payment bundle also will need to be implemented. Our regression models show that MS-DRGs, facility and beneficiary characteristics, and outlier payments to risk-adjust bundled payments could be used to increase payment accuracy. The approaches discussed above have been used in transitions to other prospective payment systems in the past.

VOLUME

The volume of procedures performed by a provider is an important component of financial risk. As the volume of procedures increases, the ability of a given provider to spread risk among individual procedures and reduce the risk of outlier cases increases. We found that 42.9 percent of providers had more than 250 episodes of major joint replacement (MS-DRGs 469 and 470), while only 1.6 percent of providers had more than 250 episodes for coronary bypass with cardiac catheterization (MS-DRGs 233 and 234) (see Exhibit 6.3). There is enormous variability in episode volume across providers, and the number of providers with fewer than 100 episodes is large for many MS-DRG families. A national bundled payment system could pose a substantial financial risk to those providers with fewer than 100 episodes if there were no protections such as outlier

Other Program Design Issues for Policymakers

- *Policymakers need to consider ways to mitigate patient and provider risk through risk adjustment, payment outliers, phase-ins or transitions, quality monitoring and gainsharing*
- *A minimum volume threshold of 100-200 cases appears large enough for many providers to manage risk under payment bundling*
- *Episode-specific quality measures, regional variation, waiver utilization, and threshold evaluation criteria for implementing a national program also need to be considered*

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payments, risk corridors, stop-loss provisions, and other strategies to slowly phase-in or transition from fee-for-service to bundled payments.

Previous Medicare demonstrations suggest that a minimum volume threshold of 100 to 200 Medicare procedures is appropriate.¹⁵ We also developed a statistical estimate to predict the volume of cases at which an outlier case does not substantially affect the average Medicare episode payment, and our estimates are consistent with a level of 200 cases per MS-DRG.¹⁶

QUALITY MEASUREMENT

Quality measure development efforts for bundled payments must produce metrics that reflect the entire duration of the bundle.¹⁷ Very few, if any, quality measures are episode-specific, but some existing quality measures can be applied from other settings and programs to episode-based payment.

REGIONAL VARIATION

The influence of regional variation on payment bundling will need to be addressed, with regard to the number of episodes, the mix of providers within an episode, and the most common care pathways followed by patients. For example, hospital readmission days of care per 1,000 fee-for-service Medicare beneficiaries by CMS region¹⁸ vary from 20.1 in Region 10 (Seattle) to 54.1 in Region 2 (New York) (see Exhibit 4.7). Payment bundling may be a tool that can be used to drive out unwarranted variation, after adjusting for various factors beyond the control of providers.

WAIVERS

Current Medicare requirements that impede the ability of providers to manage care across the continuum could potentially be waived in order to support the success of a national payment bundling program, such as limiting patient choice of provider, eliminating co-payments, or lifting eligibility restrictions specific to each post-acute care prospective payment system.

EVALUATION CRITERIA

Whether to implement a national program will depend on the success of a pilot or initiative, which can be evaluated using the following criteria: a) administrative concerns such as how easy the system is to understand and how simple it is to administer; b) goals such as increases in quality, patient satisfaction, and care coordination, or reductions in poor outcomes and/or costs; and c) adverse outcomes, such as increases in volume or threatened financial sustainability of providers.

¹⁵ Centers for Medicare & Medicaid Services (2009). *Solicitation for applications: Acute Care Episode Demonstration*. Available online at: <http://www.cms.gov/Medicare/Demonstration-Projects/DemoProjectsEvalRpts/Downloads/ACESolicitation.pdf>

¹⁶ Assuming a normal distribution, we estimated the number of cases for each MS-DRG at which there was less than a one percent chance of a random case increasing the average Medicare episode payment by more than one percent (the minimum discount required by the BPCI initiative).

¹⁷ McClellan M. (2011). Reforming payments to healthcare providers: The key to slowing healthcare cost growth while improving quality? *Journal of Economic Perspectives* 25(2): 78.

¹⁸ For a description of the 10 CMS regions, please see Appendix B, Exhibits B.4 and B.5.

Limitations and Considerations for Future Research

Findings from our descriptive and multivariate analyses indicate that the drivers of Medicare episode payments are numerous and complex. We have used administrative data from Medicare claims to build an exploratory payment model that explains approximately 70 percent of the variance in episode payments. Even with this level of explained variance, we show that many providers would experience severe financial dislocation.

However, Medicare prospective payment systems are intended to base payments on the relative case-mix adjusted *cost* to providers of delivering services rather than the *revenues* that were used in our models. For a complete understanding of how to implement a national bundled payment system, a payment system simulation based on the costs to providers of Medicare episodes may be needed.

Conclusion

In order to promote payment bundling as a more comprehensive population-based model, policymakers will need to design a complete payment system framework that carefully considers how to define and price the bundles, with adequate safeguards to protect the quality of patient care and the financial stability of providers. Providers, in turn, will need to understand how to manage episode costs under a new payment system that has markedly different incentives from fee-for-service and holds them accountable for the costs and quality of services delivered by other providers (factors often outside of their immediate control).

Understanding the clinical, financial, and administrative relationships between the hospital, physicians, and post-acute care providers will take time. Aligning incentives across multiple types of providers, expanding networks, building clinical capacity, and improving patient care quality while reducing costs will take even longer. Given the size and complexity of the issues raised by payment bundling, MedPAC originally recommended an incremental approach to implementation that culminated in a national pilot.

A national bundled payment system based on provider costs, as opposed to provider-specific historical benchmarks (as in the BPCI initiative), would need to account for financial contingencies through the use of powerful risk-adjusters and an outlier policy that appropriately compensate for more severely ill patients. And as with payment for any sized bundle, the provision of more bundles will likely occur.

In order to design and implement a pilot initiative on payment bundling, expand a pilot initiative into a national payment bundling program, or determine whether to participate, CMS, other policymakers, and providers should consider the findings of this report summarized below in Exhibit ES-4.

Exhibit ES-4: Summary of Findings

Defining the Bundle

- Conditions well-suited to payment bundling should be prevalent and/or expensive to the Medicare program, have limited variation in episode payments, and have evidence-based clinical guidelines.
- Episode length should be considered based on the nature of the clinical condition and the balance between risk to providers and opportunity for clinical interventions and/or efficiency gains.
- Providers, services, and patients should be evaluated for inclusion in an episode-based payment system based on clinical criteria and their likely impact on variation in episode payments.

Pricing the Bundle

- Payment bundles should be risk-adjusted for factors that cause substantial variation in episode payments, such as beneficiary demographic and clinical characteristics as well as facility characteristics.
- Episode payments will require an outlier policy to protect patient quality of care and mitigate financial risk, and may also require risk corridors, stop-loss provisions, and other protections in order to succeed.
- The inclusion or exclusion of IME, DSH, and other add-on payments in the price of the bundle should be carefully considered, as these payments have major implications for the financial sustainability of teaching hospitals and safety-net providers.

Managing the Bundle

- Providers should examine patient pathways to understand care across the continuum to better target clinical interventions.
- Hospital readmissions double the average Medicare episode payment across MS-DRGs; providers will need to target readmission reduction efforts under payment bundling, as the risk of readmission differs across beneficiary demographic and clinical characteristics as well as condition.
- As the first post-acute care setting to which a beneficiary is discharged from the hospital has a major impact on Medicare episode payment, hospitals will need to carefully consider patient placement in discharge planning efforts.
- To better focus care management efforts, providers will need to understand the distribution of Medicare episode payments across settings.
- Providers need to consider issues such as designation of a single entity to accept the payment bundle, risk management, clinical and administrative processes, network formation and data capabilities in preparing for payment bundling.

Other Program Design Issues

- While the use of provider-specific historical benchmarks as the basis for payment (such as under the BPCI initiative) takes financial risk into account, a national program based on a single, national payment rate will need to incorporate more generally applicable risk adjustment methodologies.
- Any national program should be designed to protect beneficiaries against stinting through payment mechanisms, such as risk adjustment, outlier payments and/or gainsharing, as well as episode-specific quality and outcome measures and patient assessment tools.
- The importance of episode volume should be considered, as many providers do not have the volume of services needed to manage the risk of bundled payments.
- In order to better coordinate patient care, providers will likely require waivers to current Medicare requirements that impede their ability to manage care across settings.

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Background

Fee-for-service, the predominant Medicare program payment system, has been identified as a major factor contributing to the accelerating growth of health care expenditures in the United States.¹⁹ In most cases, this form of payment rewards the volume of services delivered by physicians, hospitals, and other health care providers without concern for the expenditure implications. In addition, fee-for-service Medicare does not explicitly reward higher quality of care or patient outcomes. The prospective payment systems (PPSs) implemented for acute care hospitals in 1983 and post-acute care providers in the late 1990s were an attempt by the federal government to control rising health care costs by providing a stronger incentive to manage costs within an inpatient or post-acute care stay. Other cost control strategies have involved ratcheting down payment for specific services, but these have done little to control volume. Without further efforts to slow the growth of costs, the Medicare Hospital Insurance Trust Fund is predicted to become insolvent in 2024.²⁰

Over the past several years, there has been a growing interest in the concept of payment bundling, whereby services for physicians, hospitals, post-acute care providers and others would be “bundled” together into a single payment covering an episode of care over a specified period of time.

Payment bundling represents a significant deviation from the current volume-driven, fee-for-service payment system. If successful, payment bundling has the potential to bridge the United States health care system from its current state to a more population-based system that better serves patients. Payment bundling aggregates services from multiple providers into larger units for purposes of payment (e.g., a hospital stay and all associated post-acute and ambulatory care following hospital discharge). Through a single payment for the entire episode of care, payment bundling offers providers the flexibility and financial incentives to

¹⁹ Hackbarth G, Reischauer R, Mutti A. (2008). Collective accountability for medical care – toward bundled Medicare payments. *New England Journal of Medicine* 359: 3-5.

²⁰ Board of Trustees, Federal Hospital Insurance and Federal Supplementary Medical Insurance Trust Funds (2012). 2012 annual report of the boards of trustees of the federal hospital insurance and federal supplementary medical insurance trust funds.

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redesign care delivery to better avoid preventable complications and readmissions, and encourages cost-effective and high-quality care provision.

The American Hospital Association (AHA) and Association of American Medical Colleges (AAMC) commissioned Dobson DaVanzo & Associates, LLC (Dobson | DaVanzo) to conduct a series of quantitative analyses of a number of episode-based payment bundles.

The purpose of this report is to highlight important considerations for policymakers and providers using descriptive statistics and multivariate regression analyses to identify and demonstrate the effects of various features of payment bundles. We supplement the quantitative findings with recent literature and select interviews with potential bundling applicants.

Payment Bundling

WHAT IS PAYMENT BUNDLING?

The major focus of the debate over health care reform, which culminated in the Affordable Care Act, was health insurance coverage and insurance market reform. Since then, more attention has turned to the need for increased delivery system efficiency as a way to control the growth in health care spending. For example, the President's fiscal year (FY) 2013 budget notes the need to control health care expenditures, especially entitlement program expenditures.²¹ Increasing Medicare's ability to "purchase value" is an important component of efforts to "bend the cost curve" of health care spending. One approach long used by Medicare, the nation's largest and most influential payer, is to implement payment system reforms that provide incentives to increase efficiency in health care delivery.

Payment bundling represents a logical next step toward a more comprehensive system of population health management and health care financing with the potential to increase quality and reduce costs. The goals of bundled payment, consistent with the "triple aim" articulated by the Centers for Medicare & Medicaid Services (CMS), are three-fold:

- 1) Provide care in the most cost-effective setting, thereby improving system efficiency and reducing fee-for-service payment incentives for higher volume
- 2) Reduce hospital readmissions
- 3) Drive quality improvement through enhanced care coordination and accountability

Under Section 3023 of the Affordable Care Act, Medicare payment bundles are to be implemented in a national pilot beginning in January 2013. Although CMS has delayed the implementation of this pilot, the Center for Medicare & Medicaid Innovation (CMMI) began a parallel initiative in August 2011 known as the Bundled Payments for Care

²¹ Office of Management and Budget (2012). Budget of the United States government, fiscal year 2013. (Washington, DC: GPO).

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Improvement (BPCI) initiative (see Appendix A).²² The BPCI initiative allows for various models of bundled payment ranging from all-inclusive bundles (Model 2) to hospital and physician bundles (Models 1 and 4) and post-acute care bundles (Model 3). While the BPCI initiative is far more flexible and provider-driven than a national program would likely be, findings from the program evaluation will inform CMS's future efforts to implement a national bundling program and other payment reforms more generally.

If successful, Medicare payment bundling will encourage providers to deliver care to the patient in the right place at the right time and would encourage the substitution of lower cost for higher cost care, when clinically appropriate. Ultimately, the national payment bundling pilot must determine whether a single bundled payment will encourage coordination of care across providers and lead to increased efficiency with similar or better patient outcomes. As the Medicare program and the Secretary design and implement a national pilot or program, members of AHA and AAMC will have an opportunity to present CMS with policy recommendations to ensure that the various approaches to bundled payment will achieve CMS's objectives with limited unintended consequences for providers and Medicare beneficiaries.

THE BUNDLED PAYMENT BUSINESS MODEL

In order to consider the likely impact of a national payment bundling pilot or program on both patients and providers, it is important to understand the bundled payment business model. Under payment bundling, a single convener entity—which could take the form of a hospital or other type of convener (such as a risk-bearing third party)—is clinically and financially responsible for all of the medical services required by a patient during an episode of care. The convener will contract with a group of providers to deliver those services that it cannot directly provide itself (such as a hospital contracting with a network of skilled nursing facilities [SNFs] and home health agencies [HHAs] to provide post-acute care).

Under a bundled payment system incentive structure, individual service providers that had been revenue centers in the fee-for-service program become cost centers. This transformation of incentives represents a significant departure from current prospective payment systems toward a new paradigm of patient management, continuity of care, and improved coordination of transitions across settings. While providers must maintain a level of quality, they can be incentivized to reduce or eliminate the provision of clinically unnecessary care through gainsharing and other financial arrangements designed to share savings. Some authors maintain that payment bundling offers the potential to benefit both

²² Center for Medicare and Medicaid Innovation. (2011, August 23). Bundled payments for care improvement initiative: Frequently asked questions [Last updated June 26, 2012]. Available online at: <http://innovations.cms.gov/Files/x/BundledPaymentsFAQ.pdf>

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patients, who will receive better care, as well as providers, who could earn financial rewards for delivering care more efficiently.²³

The primary incentive under the bundled payment business model, therefore, is for providers to reduce the intensity of their services to the level required for optimal patient care. In addition, providers will likely substitute lower cost care for higher cost care when clinically appropriate. This change in behavior will generally reduce providers' internal costs, as well as make available more time and resources for other patients. For example, in the Medicare Participating Heart Bypass Center Demonstration, cardiac surgeons reduced the overall number of cardiology consults by performing those services themselves.²⁴ This commensurately reduced fee-for-service payments to outside cardiologists, which left more of the bundled payment to be distributed among the providers within the contracting organization. The concept of reducing costs through better control of ancillary physician consultations or better pricing on physician preference items also extends to reducing hospital readmissions, and thereby the hospital and physician costs associated with treating those patients.

A second strong incentive under the bundled payment business model is to better manage care across the continuum as well as reduce the utilization of providers outside of the affiliated provider network formed to deliver care under the bundled payment. As they are put at risk for all of the services delivered during the episode of care, providers will need to increase coordination activities across settings to improve care transitions, medication management, physician follow-up visits, and other preventive services that reduce adverse outcomes such as avoidable rehospitalizations. To do this, providers will benefit from developing strong networks in which they can better integrate services, control the quality of care, and share information. This incentive will need to be balanced with beneficiary freedom of choice as guaranteed under current law.

The third incentive is for hospitals and physicians to cooperate to reduce internal hospital costs (supplies, drugs, physician preference items such as implants, etc.) because the gainsharing features of the bundled payment business model allow those savings to be shared with the physicians who help create them. This process is being implemented by some hospitals in the Medicare Acute Care Episode (ACE) Demonstration and could result in savings for those hospitals to then be shared with their physicians.

In addition to these incentives, bundled payments present three major financial risks for providers. First, under freedom of choice, conveners (third parties that take on financial risk and/or provide administrative and technical support for an affiliated network of providers under payment bundling) accepting the bundled payment will be liable for any

²³ Komisar HL, Feder J, Ginsburg PB. (2011). "Bundling" payment for episodes of hospital care: Issues and recommendations for the new pilot program in Medicare. (Washington DC: Center for American Progress).

²⁴ Cromwell J, Dayhoff DA, McCall NT, Subramanian S, Freitas RC, Hart RJ, Caswell C, Stason W. (1998). Medicare Participating Heart Bypass Center Demonstration Executive Summary. Submitted by Health Economics Research, Inc. to the Health Care Financing Administration. Available online at: https://www.cms.gov/Medicare/Demonstration-Projects/DemoProjectsEvalRpts/Downloads/Medicare_Heart_Bypass_Executive_Summary.pdf

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services rendered by providers outside of the direct control of the contracting organization. The contracting organization will have limited ability to control the quality and costs of care delivered by these providers.

Second, CMS will likely require contracting organizations to discount the bundled payment amount, either from historical payment levels (as under the BPCI initiative) or through a national prospective payment system. In order to be successful under the BPCI initiative, contracting providers must achieve cost reductions of 2 to 3 percent to break even. This discount does not take into consideration any investments that providers will need to make in order to comply with program requirements, such as staff to complete the Continuity Assessment Record and Evaluation (CARE) tool, or other clinical and administrative process re-engineering efforts to improve care delivery.

Third, the contracting organization and its providers may or may not be paid on a risk-adjusted or outlier basis for more complex cases, as they would under fee-for-service payment. The BPCI initiative, by basing bundled payments on provider-specific historical benchmarks, does mitigate this financial risk somewhat (but to what degree is unknown). A national pilot could use provider-specific historical benchmarks, as under the BPCI initiative and the Medicare ACE Demonstration. However, this type of system can be difficult to administer and does not establish a national benchmark for efficiency. If using a national payment system rather than historical benchmarks to set bundled payments, a national pilot would need to account for financial contingencies through the use of powerful risk-adjusters and an outlier policy that appropriately compensate for more severely ill patients. And, presumably, a national payment system would be implemented in a budget neutral fashion as with the original Inpatient Prospective Payment System (IPPS).

OTHER EXPERIENCE AND RESEARCH ON PAYMENT BUNDLING

Medicare has previously implemented several demonstrations on payment bundling. Under the Medicare Participating Heart Bypass Center Demonstration (1991-1996), seven participating hospitals received a single payment for coronary artery bypass graft (CABG) surgery to cover both hospital and physician services. During the five-year demonstration, Medicare achieved savings of \$42.3 million (equivalent to 10 percent of expected spending). The Medicare Cataract Surgery Alternate Payment Demonstration (1993-1996) used a competitive bidding process to set payment rates for the bundle of services related to outpatient cataract surgery, and reduced payment rates by between 2 and 5 percent.²⁵

The Medicare Gainsharing Demonstration, the Medicare Physician Hospital Collaboration Demonstration, and the Medicare ACE Demonstration are all recently completed or

²⁵ American Hospital Association (2010). AHA research synthesis report: Bundled payment. Committee on Research. (Chicago, IL: AHA). Available online at: <http://www.hret.org/bundled/index.shtml>

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ongoing demonstration projects that bundled payment for selected services together and created incentives for providers to improve care and reduce costs.

The experience of both Medicare and the private sector with bundled payments has led many policymakers and researchers to believe that a national bundled payment system could be used to control the rate of growth in health care expenditures and improve the quality of care.^{26,27,28} The Medicare Payment Advisory Commission (MedPAC), in its June 2008 *Report to Congress*, stated that, “bundling Medicare payment to cover all services associated with an episode of care has the potential to improve incentives for providers to deliver the right mix of services at the right time.”²⁹ MedPAC’s rationale for bundling payment for services associated with an entire episode of care around a hospitalization is that it would limit the use of “low value” services and improve the coordination of care by making one payment to a single provider entity.³⁰

Care coordination is critical for patients at the time of discharge from an acute care hospital. Approximately 20 percent of Medicare beneficiaries who are admitted to a hospital are readmitted within 30 days, and 34 percent are readmitted within 90 days.³¹ MedPAC reported that Medicare expenditures for potentially preventable re-hospitalizations may be as high as \$12 billion per year,³² and the Office of Management and Budget (OMB) suggested that Medicare payment bundling could save approximately \$17.8 billion over 10 years by reducing re-hospitalizations through bundling Medicare payments for episodes of care.³³

Payment bundling also might result in potential unintended consequences. With payment for any sized bundle, the provision of more bundles will likely occur. If patient severity is not adequately accounted for in the development of the bundled payment, the sickest patients will be avoided and/or underserved.³⁴

MedPAC acknowledges the complexity of bundling and specifically recommends an incremental approach to the implementation of a bundled payment system. One option could be to focus on selected conditions, which is the approach taken by the Affordable Care Act in authorizing the national pilot. MedPAC notes that, for many procedures, there is no consensus on how and where patients should be treated.

²⁶ DeJong G. (2010). Bundling and postacute payment: From a culture of compliance to a culture of innovation and best practice. *Health Policy in Perspective* 90(5): 658-662.

²⁷ Guterman S, Davis K, Schoenbaum SC, Shih A. (2009). Using Medicare payment policy to transform the health system: A framework for improving performance. *Health Affairs* 28(2): w238-w250.

²⁸ Hackbarth G, Reischauer R, Mutti A. (2008). Collective accountability for medical care – toward bundled Medicare payments. *New England Journal of Medicine* 359: 3-5.

²⁹ Medicare Payment Advisory Commission (2008, June). Report to the Congress: Reforming the delivery system. (Washington, DC: MedPAC).

³⁰ In addition to acute care hospital and post-acute care services, MedPAC’s episode definition includes physician care as do the episodes presented in this paper.

³¹ Jencks SF, Williams MV, Coleman E. (2009). Rehospitalizations among patients in the Medicare fee-for-service system. *New England Journal of Medicine* 360(14): 1418-1428.

³² Medicare Payment Advisory Commission (2008, June). Report to the Congress: Reforming the delivery system. (Washington, DC: MedPAC).

³³ Office of Management and Budget (2009). A new era of responsibility: Renewing America’s promise [p. 127]. (Washington, DC: GPO).

³⁴ Mechanic R, Altman S. (2009). Payment reform options: Episode payment is a good place to start. *Health Affairs* 28(2): w262-w271.

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The center of agreement appears to be that current payment silos for acute care hospital and post-acute care, coupled with fee-for-service payments to physicians, is not an acceptable status quo and will not produce desired levels of care coordination. The key question is not so much the need for change, or even the type of change, but rather “How would the mechanics of such a system work?” The central purpose of our analyses is to raise the practical issues that need to be considered by policymakers and health care providers in designing and implementing a national bundled payment system.

Research Questions and Organization of the Report

Based on the economic incentives and clinical and administrative challenges posed by a bundled payment system, AHA and AAMC developed a list of research questions that need to be considered by policymakers and providers before a national program can be implemented (see Exhibit 1.1).

Exhibit 1.1: Research Questions

Defining the Bundle

- What are the characteristics of conditions that make attractive options for bundling? Which conditions meet those characteristics?
- Should episode length be uniform across bundles, or vary based on the service or condition?
- Which services and provider types should be included? Should this vary by type of service or patient?
- Should certain patient types be excluded? If so, which patients?

Pricing the Bundle

- How should the bundle be priced? How should add-on payments be addressed?
- What factors should be considered for risk adjustment?
- How should the outlier policy be determined?

Managing the Bundle

- What is the impact of patient pathways on episode payments?
- How do hospital readmissions affect the payment bundle?
- What is the role of the first post-acute care setting to which a patient is admitted post-discharge?
- What capabilities should organizations accepting payment bundles have (or develop)?

Other Program Design Issues for Policymakers

- What protections can be built in to guard against stinting, over-utilization of bundles, and adverse selection? How should regional variation in practice patterns be addressed?
- Should there be a minimum volume requirement?
- What are appropriate (episode-specific) quality measures?
- What evaluation criteria should be met before a pilot program is expanded nationally?

In Chapter 2, we present the methodology we used to construct payment bundles for episodes of care using Medicare claims data linked across time and across care settings.

In Chapter 3, we explore how the bundle might be defined in terms of which conditions should be considered, how long the episode should be, and what types of providers, services, and patients should be included.

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In Chapter 4, we examine how the bundled payment should be priced based on descriptive statistics of various payment drivers and a series of multivariate regression analyses that simulate the impact of several different payment policies.

In Chapter 5, we discuss issues that bundled payment entities and providers will face in managing costs within the bundle through the lens of patient pathways, readmissions, and the first post-acute care setting to which a beneficiary is discharged from the acute care hospital. We also discuss the capabilities that providers will need in preparing to operate under a bundled payment system.

In Chapter 6, we present a series of additional considerations for policymakers in designing, implementing, and evaluating a bundled payment program.

In Chapter 7, we conclude with a summary of our findings and discuss the limitations of this study as well as considerations for future research.

Chapter 2: Analytic Methodology

Overview of Methods

The episodes of care analyzed in this report were created based on specific assumptions developed and agreed upon by Dobson | DaVanzo and staff of both AHA and AAMC throughout the project. Using beneficiary-level Medicare claims files for a 5 percent sample of beneficiaries linked across time and care settings, we analyzed the effects of bundled payments on different categories of hospitals and specific patient populations. The analyses presented in this report include both descriptive statistics and multivariate regression models.

We explore numerous aspects of bundled payment, such as the definition and structure of episodes; the impact of patient demographic and clinical characteristics, facility characteristics, and other factors on bundled payments; risk adjustment strategies; provider capabilities; hospital readmissions; and care transition management. We supplemented our quantitative analyses with a targeted review of the most recent literature on bundled payments and select interviews with prospective BPCI applicants.

In order to address the research questions posed in this study, we needed to carefully consider how to specify and construct a longitudinal episode database using Medicare claims. In the remainder of this chapter, we describe the files used to construct the database, present a detailed description of the episode definition used as the basis for our analyses, discuss how several key variables included in each episode were constructed, and describe several key concepts we employed to develop and analyze descriptive statistics.

We also present the methodology used to develop several multivariate regression models, which predict episode payments based on variables in the administrative database.

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Dataset

The Medicare claims files in the database contain all Medicare Part A and Part B claims for an identifiable 5 percent sample of fee-for-service Medicare beneficiaries from 2007 to 2009 (no Medicare Part D claims are included in the database). These data allow for longitudinal tracking of patterns of care and Medicare payments for individual beneficiaries over time. Due to Health Insurance Portability and Accountability Act (HIPAA) privacy concerns, the reporting of data is limited to cell sizes in which there are at least 11 patient observations. In addition, we used the following data files to supplement the Medicare claims:

Exhibit 2.1: Supplemental Data Files

Data File	Data Source	Explanation of Use
Dartmouth Atlas of Health Care	Dartmouth University	Data to consolidate providers in different zip codes into Dartmouth Hospital Referral Regions (HRRs)
Provider of Services (POS) file	CMS	Data to link providers to geographic areas
Area Resource File (ARF)	Health Resources and Services Administration (HRSA)	Information on health facilities and professions, measures of resource scarcity, health status, and economic activity
MS-DRG Grouper	CMS	Assignment of Medicare Severity Diagnosis-Related Groups (MS-DRGs) to each Short Term Acute Care Hospital (STACH) case
Impact File	CMS	Intern/resident-to-bed ratios and geographic price adjustments

Episode Definition

Episodes represent the chronological series of encounters with Medicare providers experienced by individual beneficiaries. Episodes are all fixed in length, and end a specific number of days following discharge from the “index” acute care hospital admission (“index hospitalization” or “anchor hospital stay”), regardless of a beneficiary’s course of treatment. Varying episode lengths are fixed at seven, 15, 30, 60 and 90 days after discharge from the index hospitalization. These episode datasets are all built separately from each other (e.g., seven day episodes are not derived from existing 15 day episodes). Our episodes have some similarities to those in the BPCI initiative. (See Appendix B, Exhibit B.1 for a side-by-side comparison of our episode definition and the BPCI initiative episode definition.)

All Medicare services and payments between the discharge from the index hospitalization and the end of the fixed number of days are counted as part of the episode. Payments for care initiated during the episode that extend beyond the episode time window are pro-rated for the length of time the treatment was provided during the episode window. We used different pro-rating methods to account for the per diem payments made in the SNF PPS and episodic or case-based payments made in the HH PPS, IRF PPS, and LTCH

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PPS. For example, if a beneficiary is admitted to a SNF on day 25 of a 30-day fixed-length episode and stays for 10 days, the episode payment would include straight line pro-rated payments for five days of SNF care within the bundle.

For estimation of episodic post-acute care payments within a payment bundle, such as for an IRF or home health “stay,” a per-diem payment is calculated for that care setting and then applied to the fixed-length Medicare episode. For example, if a beneficiary begins a home health stay on day 20 of a 30-day fixed-length episode, a per-diem Medicare home health payment is calculated and 10 days of the pro-rated home health stay are included in the Medicare episode payment.

Episodes in which the beneficiary dies at any time during the episode (including during the index hospitalization) are included in the dataset. In addition, only episodes in which Medicare is the primary payer are included in the dataset. If a patient has at least one month of claims under Medicare Advantage (MA), they are excluded from the analysis. Medicare beneficiaries with end-stage renal disease (ESRD) also are excluded from the dataset. (For a summary of the number of episodes and Medicare payments represented in the episode database by episode length, please see Appendix B, Exhibit B.2.)

Index Hospitalizations

Only admissions to an IPPS short-term acute care hospital (STACH) are considered index hospitalizations and can initiate an episode. Admissions to other inpatient settings—such as critical access hospitals (CAHs), psychiatric hospitals, and cancer centers of excellence—cannot trigger the start of an episode. Admissions to CAHs or psychiatric hospitals during the episodes also are not considered *readmissions*, although care delivered in these settings is captured in the Medicare payments for the episode of care. Consistent with the IPPS, related care provided up to three days prior to the index hospitalization is included in the episode. Episodes are characterized clinically on the basis of the index admission Medicare Severity Diagnosis-Related Group (MS-DRG).

Index hospitalizations are defined using a protocol that does not allow episodes for a single patient to overlap, and are therefore not double-counted. This definition allows episode payments to be additive across individuals, but suggests that the number of episodes we observe for each MS-DRG is underestimated to the extent that hospitalizations for a specific MS-DRG may occur within another existing episode.

When examining various options for how a bundle should be developed, we decided on the following methodology. The first index hospital admission in the database for a given individual, irrespective of the MS-DRG designation, initiates episode #1. The episode includes the index hospital admission and all claims for a fixed time period (e.g., 30 days) after hospital discharge for all types of care. Episode #2 starts at the next hospitalization that is not contained within episode #1, regardless of MS-DRG. There are no clean period

Chapter 2: Analytic Methodology

breaks between episodes, and, as noted above, Medicare payments for any post-acute care that continues beyond the episode end point are pro-rated.

ROLE OF TRANSFERS IN THE INDEX HOSPITALIZATION

In the event that the index hospitalization includes a transfer to another IPPS hospital, the receiving hospital is considered to be the “owner” of the episode, which begins upon admission to the receiving hospital. As the “owner,” the database will reflect this hospital’s characteristics and the care received. For example, if the receiving hospital is a major teaching hospital, the episode will be identified as such. Additionally, the MS-DRG of the receiving hospital will clinically define the episode.

Any Medicare payments related to the first hospital admission (e.g., 72 hours prior expenses are automatically included in the claim by the carrier) that are related to the reason for admission to the second hospital are included as part of the index hospitalization payments within the bundled episode. The database contains a variable to flag each episode that contains a transfer.

Readmissions

A hospitalization that occurs in an IPPS hospital during the episode (but after discharge from the index hospital admission) is considered to be a “readmission.” In our dataset, the first three readmissions are individually identified. For each readmission, the database contains the antecedent setting (setting immediately prior to readmission), medical or surgical basis for admission (based on the MS-DRG), and the day of the week the readmission occurred. The database also includes the Medicare payments for all Part A and Part B services provided during the hospitalization. An episode with a readmission following discharge from the index hospitalization (with no other facility or ambulatory-based care following discharge from the index hospitalization) is identified as a “STACH first-setting” episode (see Exhibit 2.2 below).

“First” Post-acute Care Settings

Episodes are administratively characterized by the first-setting or “first post-acute care setting” to which the beneficiary is discharged after the index hospital admission. For each setting contained within a patient episode, total Medicare payments and primary diagnosis are provided.

Exhibit 2.2 summarizes the various first-settings and first post-acute care settings.

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Exhibit 2.2: Description of First-settings that Categorize Post-Acute Care Episodes

First-setting*	Definition
HHA	Home health agency
IRF	Inpatient rehabilitation facility
SNF	Skilled nursing facility
LTCH	Long-term care hospital
STACH	Short-term acute care hospital; patient was discharged home and readmitted to the hospital before receiving care from any other setting (readmission)
Community	Physician or outpatient visit; patient was discharged home and received a physician or outpatient visit (including hospital outpatient department visit or ambulatory surgical center visit) prior to any other care setting. Patient may have been admitted to facility-based care following the physician/outpatient visit
OP	Outpatient therapy
ER	Emergency room
Other IP	Other inpatient hospital (limited to critical access or psychiatric hospitals)
Hospice	Hospice
No Care	No care was received during the episode following discharge from the index hospitalization

*DME is included in the episode but cannot be a first-setting.

Physician Services within the Episode

Community as a first-setting means that the beneficiary is discharged to the community and receives physician and/or outpatient hospital services prior to any other formal post-acute care. Due to the extremely large number of physician claims among Medicare beneficiaries following discharge from an index hospitalization, we aggregated the physician claims into larger categories.

Specifically, while in the Community, physician claims are aggregated into a count by Berenson-Eggers Type of Service (BETOS) category. BETOS categories aggregate Current Procedural Terminology (CPT) and Healthcare Common Procedure Coding System (HCPCS) codes into a three-character system. (A description of each BETOS code is contained in Appendix B, Exhibit B.3.)

To better understand if physician services are provided by primary care physicians or specialists, the database contains a count of physician claims by primary care physicians and specialists. Therefore, while patients are in the community, we can determine the number of times a patient visited a primary care physician before a hospitalization, or if the patient only relied on specialty care.

Patient Pathways

A patient pathway is a map of the trajectory of care a patient received during an episode. Based on the patient pathway, we identify how often various settings are used in different types of episodes. This helps us understand the relationship between certain pathways, types of providers, and average Medicare episode payments. We describe an example of a pathway below:

Chapter 2: Analytic Methodology

A patient is discharged from the index hospitalization and admitted to a SNF. Following the SNF stay, the patient returns home and begins an HHA episode. During the HHA episode, the patient is readmitted to an acute care hospital, and ultimately discharged back to HHA. Upon completion of the HHA episode, the patient remains in the home and receives physician and outpatient services. The pathway for this episode would be: **A-S-H-A-H-C**

The key to understanding patient pathways is presented in Exhibit 2.3.

Exhibit 2.3: Description of Abbreviations for Care Settings within Patient Pathways

Pathway Stop	Facility/Ambulatory-based Designation
A = Index Hospitalization or Readmission	Facility
S = SNF	Facility
I = IRF	Facility
H = HHA*	Facility
L = LTCH	Facility
C = Community	Ambulatory
E = ER	Ambulatory
T = Hospice	Ambulatory
P = Outpatient Therapy	Ambulatory
Z = Other IP	Facility

* We categorize HHA as a facility-based care setting in order to group with the other formal post-acute care settings

Analyses of patient pathways within an episode identify the average number of total “sequence stops”—a term referring to each sequential setting through which a beneficiary transitions—as well as the average number of facility- and ambulatory-based sequence stops. In calculating the average number of sequence stops, the index hospitalization counts as the first stop. Therefore, every episode has at least one stop and “No Care” episodes *only* have one stop. All episodes in which a person receives care in the post-discharge period (which excludes “No Care” episodes) have at least two stops.

Variable Construction

Within each episode, we created a wide variety of exploratory variables. There are variables designed to capture information about beneficiary and facility characteristics, as well as Medicare payment information.

BENEFICIARY DEMOGRAPHIC CHARACTERISTICS

Beneficiary demographic information is attached to each patient episode. Demographic information includes race, sex, age, lives alone, and dual eligibility. Geographic information includes beneficiary state of residence, zip code, and region. Our database includes three different types of region variables (see Appendix B, Exhibits B.4-B.7):

- Hospital Referral Regions (HRRs), defined by the Dartmouth Atlas of Health Care

Chapter 2: Analytic Methodology

- 10 CMS regions, identified by the location of CMS regional offices
- Nine Census regions (and Puerto Rico), as defined in the annual IPPS Impact file

CHRONIC CONDITIONS

Patient chronic conditions are identified in two different ways. The first relies on the Chronic Condition Warehouse (CCW) data flags. The CCW data contain flags for 21 common chronic conditions. Based on a set of algorithms using two years of historical claims, CMS provides an annual flag indicating if the patient has the chronic condition. Since the chronic conditions are based on prior health care utilization, a patient that did not receive prior care for a condition will not exhibit chronic condition flags. Our episode database relies on CMS's algorithms for identifying chronic conditions (as opposed to calculating our own) in order to be consistent with current and future CMS methodologies. (See Appendix B, Exhibit B.8 for a list of the CCW chronic condition flags).

The second set of chronic condition variables is based on the Hierarchical Condition Categories (HCCs) used by Medicare Advantage to determine expected costs for each beneficiary. HCCs are the method by which CMS has aggregated a subset of the International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM) diagnosis codes into a more manageable, clinically relevant set of categories. HCCs are determined based on diagnosis information and CMS Medicare Advantage risk adjustment algorithms.

FUNCTIONAL ABILITY

To construct a variable for functional ability that was uniform across beneficiaries receiving post-acute care, we combined eight variables that measure the same aspects of beneficiary independence in performing activities of daily living from the Outcome and Assessment Information Set (OASIS) for HHAs, Minimum Data Set (MDS) 2.0 for SNFs, and the Inpatient Rehabilitation Facility Patient Assessment Instrument (IRF-PAI). Each variable was rescaled from its original scale to a 0-7 scale in a linear fashion (for example, if the original scale was from 0-3 then we multiplied the value by 7/3). Any variable missing from a beneficiary assessment was assigned a value equal to the average of all other variables for that beneficiary. The score from each of the eight variables was then added together to make a final scale from 0-56.

PAYMENT INFORMATION

We made the following adjustments to the aggregate Medicare payment amounts for all services provided during the episodes included in our analyses:

- **Standardized payments to 2009 dollars:** All Medicare payments were standardized to 2009 dollars by inflating Medicare payments in 2007 and 2008 to 2009 dollars. This was done by using the update factors for each care setting for

Chapter 2: Analytic Methodology

each year published in the *Federal Register*. This adjustment only applies the *actual* updates that were implemented, not the proposed or expected updates.

- **Standardized payments on wage:** In order to remove the effect of geographic location on Medicare payments, we standardized the database by adjusting all Medicare payments using the appropriate wage index for the labor-related portion for each type of provider payment. For physicians, we used the weighted average of the Geographic Pricing Cost Index (GPCI) for the work, practice expense, and malpractice portions of the Relative Value Unit (RVU) scale.
- **Removal of indirect medical education (IME) and disproportionate share hospital (DSH) Payments:** All IME and DSH payments were isolated and removed from payments in all index hospital admissions and readmissions.
- **Removal of pass-through payments for new technology.**
- **Removal of reimbursement for capital costs.**
- **Removal of beneficiary out-of-pocket payments, including coinsurance, deductibles, and payments from third parties.**

Therefore, the **current descriptive analyses only represent Medicare payment amounts** (as opposed to “allowed amounts”). The decision to exclude these aspects of payment from the descriptive statistics was driven by the initial CMS guidelines for the BPCI initiative (which later changed). For the purposes of these analyses, payment information is designed to examine how money flows through the episode.

Multivariate Regression Analyses

In order to better understand the payment drivers associated with 30-day fixed-length Medicare episodes, we simulated a nationwide bundled payment system using four different payment models. One model calculates bundled payments based on the average Medicare episode payment for each MS-DRG. Three additional payment models are based on multivariate regression models, where the calculated payment for each episode is based on the “expected” Medicare payment amount predicted by the regression equation. As opposed to our descriptive statistics, our regression models use the “allowed amount”—which includes IME and DSH payments, capital costs, new technology pass-throughs, and beneficiary out-of-pocket payments. The decision to use the allowed amount in the regression analyses was made because the allowed amount is a closer approximation of overall Medicare episode “costs.”

The three regression models allow us to better understand the effects of facility type, patient demographics, clinical conditions, and first post-acute care setting on Medicare bundled payments by calculating expected values of episode payments. This understanding is a pre-requisite to being able to risk-adjust bundled payments.

Chapter 2: Analytic Methodology

- *Dependent Variable:* The dependent variable is the current Medicare allowed payment per episode (including IME, DSH, capital, new technology pass-throughs, and patient copayments). This variable represents Medicare program payments, which are not necessarily equivalent to provider costs.
- *Independent Variables:* The independent variables include a variety of beneficiary characteristics (e.g., age, sex, race, chronic conditions, functional ability), facility characteristics (bed size, IME, DSH), and other episode characteristics (e.g., first post-acute care setting after hospitalization). (For a full list of variables used in the regression models, see Exhibit 4.10.)

THE OUTLIER MODEL

We also developed an outlier payment model, which constructs an outlier payment component comparable to the IPPS outlier model currently used by CMS. Our outlier payment model is based on payments for all services provided within the episode (not just inpatient acute hospital care). Once we predict the Medicare episode payment based on the multivariate regression models we have developed, we apply the outlier model to calculate the “final” predicted Medicare episode payment.

In order to understand the need for an outlier policy as part of payment bundling, we examined episodes with and without the outlier payment. After the predicted payments are calculated, we applied the outlier model as follows: 10 percent of all modeled episode payments are moved into a shared outlier pool;³⁵ then, all actual payments in excess of a specified fixed-loss threshold (FLT) are paid at 80 percent. This FLT was chosen to meet budget neutrality relative to the original aggregate amount paid by CMS. An example of an episode with an outlier payment follows:

An episode under Model A has a modeled payment of \$45,000 and an actual payment of \$48,000. First, 10 percent of the modeled payment, or \$4,500 is moved to the outlier pool in the calculation of the FLT. This means the initial modeled payment is \$40,500 (\$45,000 - \$4,500) during the outlier calculation. The threshold for Model A is \$37,438 (the FLT calculated to maintain budget neutrality) and the actual payment of \$48,000 is larger than this threshold, so this episode is eligible for an outlier payment. The episode is \$10,562 (\$48,000 - \$37,438) in excess of the threshold. This means the outlier payment will be 80 percent of that excess amount, or \$8,450 (80 percent x \$10,562). Thus, the total payment after the outlier model would be \$48,950 (\$40,500 + \$8,450).

As can be seen in the above example, the final payment (\$48,950) is higher than the actual payment (\$48,000). As we do not know the cost of the episode, it is difficult to determine the extent to which the outlier model is serving its intended purpose (to limit

³⁵ The 10 shared percent outlier pool was set slightly above the LTCH PPS outlier pool (8 percent) to account for wide variation in episode payments.

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losses from high-cost cases). These episodes could very well be high-payment, moderate-cost episodes where distributing an outlier payment is inappropriate; however, we believe these high-payment episodes are likely also high-cost episodes. This cannot be known with certainty until a complete cost-based episode payment model is constructed.

In summary, the regression models we developed are exploratory in nature (because they are not based on provider costs, and our “cost relative” estimates across providers are distorted by Medicare “margins” that vary across provider types. However, the regression results provide a useful understanding of the relative impact of various payment drivers on overall Medicare episode payments that can inform policy discussions.

Stakeholder Interviews

In addition to the descriptive statistics and regression analyses, we also conducted select interviews with a convenience sample of prospective applicants to the BPCI initiative. These prospective BPCI applicants offer valuable insight based on their hands-on experience attempting to analyze data, build episodes, and price payment bundles under the four BPCI initiative models, and include:

- One network of acute care hospitals
- One facilitator-convener of multiple teaching hospital-based applicants
- One consultant representing multiple BPCI applicants, including one SNF with multiple facilities and one consortium of approximately 30 SNFs
- One consultant working with an integrated delivery system

We use the results of our descriptive statistics and multivariate regression models, supplemented by recent published literature and responses from select interviews, to address the research questions raised by AHA and AAMC.

Evidence-Based Practice Guidelines

We used the American Academy of Orthopaedic Surgeons (AAOS) and the National Guideline Clearinghouse (NGC) to determine if a clinical condition has evidence-based practice guidelines. NGC is a comprehensive public resource containing clinical guidelines maintained by the Agency for Healthcare Research and Quality (AHRQ). (For a list of the AAOS and NGC criteria for inclusion, see Appendix B, Exhibits B.9 and B.10.)

Chapter 3: Policy Issue

– Defining the Bundle

Research Questions: Defining the Bundle

- What are the characteristics of conditions that make attractive options for bundling? Which conditions meet those characteristics?
- Should episode length be uniform across bundles, or vary based on the service or condition?
- Which services and provider types should be included? Should this vary by type of service or patient?
- Should certain patient types be excluded? If so, which patients?

In determining how to define the bundle, there are several important issues to consider, including which clinical conditions are the most appropriate for bundled payments, how long the episode should be, which types of providers and services to include in the bundled payment, and which types of patients to exclude.

We first present several key findings on the amount of Medicare fee-for-service payments represented by payment bundles and the concentration of Medicare payments within a subset of MS-DRGs.

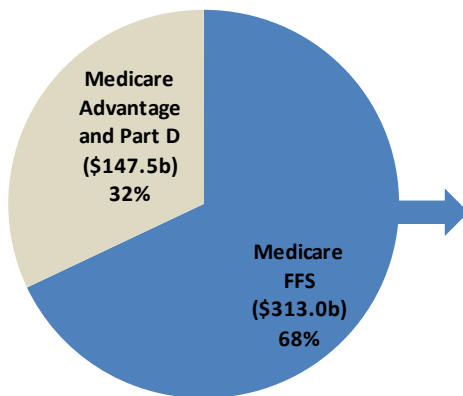
Amount and Concentration of Bundled Payments

According to MedPAC, Medicare payments totaled \$460.5 billion in 2008 (Exhibit 3.1). Medicare fee-for-service payments accounted for more than two-thirds of this total (\$313.0 billion), while the remaining one-third of payments was comprised of Medicare Advantage and Part D payments.

Chapter 3: Policy Issue – Defining the Bundle

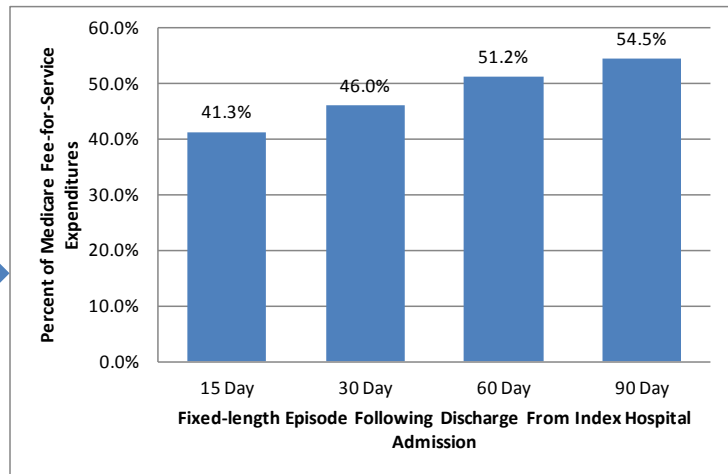
Exhibit 3.1: Total Medicare Expenditures by Medicare Program, and Medicare Fee-for-service Expenditures within Fixed-length Episodes Following Discharge from Index Hospitalization (2008)

Total 2008 Medicare Expenditures



Total 2008 Medicare Expenditures: \$460.5 billion

Source: Medicare Payment Advisory Commission. (2009). A Databook: Healthcare Spending and the Medicare Program.



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2008, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries.

Episodes of acute and post-acute care that include an “index” hospitalization and all care provided in the 15 days following hospital discharge account for 40 percent of Medicare fee-for-service expenditures, while more than one-half of Medicare fee-for-service payments (54.5 percent) occur within 90 days following hospital discharge.³⁶

In addition to representing a substantial amount of total Medicare fee-for-service spending, Medicare episode payments are highly concentrated within MS-DRGs. The top 20 percent of MS-DRGs (ranked by total Medicare episode payments) represent approximately 80 percent of total episodes and 80 percent of total Medicare episode payments (data not shown).³⁷

The concentration of Medicare episodes and payments within MS-DRGs suggests that a payment bundling system that included a limited number of MS-DRGs, if chosen well, could represent the majority of care being delivered in post-acute care episodes.

Characteristics of Clinical Conditions

Exhibit 3.2 summarizes 16 MS-DRG families of interest to the study team ranked by episode frequency and payment amount, and presents the coefficient of variation (CV) for the episode payment. The CV, also known as “**relative variability**,” is often used to

³⁶ The one-half of Medicare fee-for-service payments not captured within 90-day episodes following an index hospitalization includes dialysis and other services for end-stage renal disease (ESRD) patients; any services for beneficiaries with one month or more of Medicare Advantage (MA) claims; other physician, ambulatory surgical center, and outpatient procedures; and community-referred home health episodes.

³⁷ Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars.

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judge the amount of variability within a proposed payment category. The CV is equal to the standard deviation of a distribution divided by its mean, and is a measure of variability where values above 1.0 can be considered highly variable. The goal in identifying conditions best suited to bundling is choosing conditions that offer providers the opportunity to achieve savings by reducing unnecessary or inefficient care, while maintaining patient outcomes and protecting providers against financial risk.

Our data support the use of four characteristics to identify clinical conditions well-suited to payment bundling:

Conditions that are prevalent in the Medicare population in order to have a sufficient number of cases to work with. High-volume conditions allow providers to average costs over a large number of patients, making costs more predictable and spreading the risk of potential outlier cases. Major joint replacement of lower extremity (MS-DRGs 469 and 470) and heart failure and shock (MS-DRGs 291-293) are the most prevalent conditions, both representing approximately 4.7 percent of episodes respectively. We consider frequencies above 1 percent of total episodes to be prevalent in the Medicare population in terms of overall patient volume.

Conditions that are expensive, so that being able to reduce costs matters, and there is room for improvement. The concept of “expensive” can take two forms: 1) expensive on a per-unit basis; and 2) expensive because of high prevalence in the population, i.e. high-volume conditions. Coronary artery bypass w/ PTCA (MS-DRGs 231 and 232) has an average Medicare episode payment of \$50,720, making it the second most expensive condition on average of the 16 selected conditions. However, this MS-DRG family represents less than 0.1 percent of episodes in our database. Conversely, intracranial hemorrhage or cerebral infarction (MS-DRGs 64-66) represents 2.4 percent of all 30-day episodes in our database and 2.7 percent of total Medicare episode payments. As a preliminary threshold, we consider episodes with aggregate total payments above 2 percent of overall Medicare episode payments, as well as average Medicare episode payments above \$20,000, to be expensive.

Conditions that have enough variance to represent opportunity, but not so much variance that the risk of multiple outlier cases outweighs the reward from bundled payment. As noted above, higher CV values mean greater variability. In Exhibit 3.2, the CV for Medicare episode payment ranges from 0.33 (bilateral or multiple major joint procedures of lower extremity) to 0.80 (heart failure and shock). Surgical procedures generally have a lower CV than medical conditions, but many are conditions in which there is wide variation in payments that offer opportunity to reduce unnecessary services and produce savings. We consider a CV of less than 0.50 to be sufficiently variable to balance opportunity for cost savings with a limit on the risk of outliers, although interviews with prospective BPCI applicants suggest that some providers are willing to accept greater risk.

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Conditions that have clear, evidence-based practice guidelines. For example, conditions such as coronary bypass and knee replacement, as well as medical conditions such as heart failure, pneumonia, and chronic obstructive pulmonary disease (COPD), have clear, evidence-based practice guidelines for providers in delivering the most clinically appropriate patient care.

According to a Government Accountability Office (GAO) report on private-sector initiatives to bundle payment, conditions should be, “high-cost procedures, which increase the potential for achieving substantial savings; they have clearly defined start and end points, which is a necessity in defining an episode of care; and they have well-established clinical protocols for care and well-defined outcome measures.”³⁸ The literature further suggests that clear, evidence-based practice guidelines are important for standardizing care patterns and identifying opportunities for care redesign.³⁹ To identify conditions with evidence-based practice guidelines we used the American Academy of Orthopaedic Surgeons (AAOS) and the National Guideline Clearinghouse (NGC) maintained by AHRQ (see Appendix B, Exhibits B.9 and B.10).

Exhibit 3.3 presents a matrix of 16 MS-DRG families of interest to the study team, arrayed by the criteria described above for choosing conditions that are best suited to payment bundling: prevalent in the Medicare population, high total episode payments, high average episode payments, low variance in payments, and have clear, evidence-based practice guidelines. According to these criteria, coronary bypass, major joint procedures, intracranial hemorrhage or cerebral infarction, and hip or femur replacement are the best candidates for Medicare payment bundling. The conditions that meet these criteria also are consistent with previous Medicare payment bundling demonstrations and our interviews with prospective BPCI applicants (see Appendix C, Exhibit C.1).

Conditions that are rapidly moving to the outpatient setting due to advancements in technology, such as implantable cardiac defibrillators, pacemakers, and spinal fusion, may not be good candidates for payment bundling that is anchored by an index acute care hospitalization. In addition, the patients that require these procedures in the inpatient setting are likely to be more severe, which would have payment implications as well.

³⁸ Sood N, Huckfeldt PJ, Escarce JJ, et al. (2011). Medicare’s bundled payment pilot for acute and postacute care: Analysis and recommendations on where to begin. *Health Affairs* 30(9): 1708-1717.

³⁹ Komisar HL, Feder J, Ginsburg PB. (2011). “Bundling” payment for episodes of hospital care: Issues and recommendations for the new pilot program in Medicare. (Washington DC: Center for American Progress).

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Exhibit 3.2: Frequency and Total and Average Medicare Episode Payments of Select MS-DRG Families for 30-day Fixed-length Episodes (2007-2009)

MS-DRG Family	Med/ Surg	Number of Episodes	Percent of Episodes	Rank	Total Episode Payment (billions)	Percent of Episode Payment	CV of Total Episode Payment	Average Episode Payment
Major joint replacement or reattachment of lower extremity (469, 470)	Surgical	1,230,640	4.7%	1	\$24.2	6.3%	0.42	\$19,631
Heart failure & shock (291, 292, 293)	Medical	1,228,240	4.7%	2	\$14.7	3.9%	0.80	\$12,006
Simple pneumonia & pleurisy (193, 194, 195)	Medical	1,029,800	3.9%	3	\$10.7	2.8%	0.82	\$10,381
Chronic obstructive pulmonary disease (190, 191, 192)	Medical	956,240	3.7%	4	\$9.0	2.3%	0.79	\$9,382
Intracranial hemorrhage or cerebral infarction (64, 65, 66)	Medical	619,860	2.4%	9	\$10.3	2.7%	0.71	\$16,681
Hip & femur procedures except major joint (480, 481, 482)	Surgical	403,940	1.5%	15	\$9.9	2.6%	0.38	\$24,432
Perc cardiovasc proc w drug-eluting stent (247)	Surgical	329,800	1.3%	20	\$4.5	1.2%	0.40	\$13,568
Coronary bypass w cardiac cath (233, 234)	Surgical	100,260	0.4%	59	\$4.0	1.0%	0.42	\$39,646
Revision of hip or knee replacement (466,467,468)	Surgical	94,480	0.4%	65	\$2.3	0.6%	0.45	\$24,121
Cardiac valve & oth maj cardiothoracic proc w/o card cath (219, 220, 221)	Surgical	71,420	0.3%	78	\$3.2	0.8%	0.45	\$44,926
Coronary bypass w/o cardiac cath (235, 236)	Surgical	66,120	0.3%	86	\$2.0	0.5%	0.45	\$29,534
Cardiac valve & oth maj cardiothoracic proc w card cath (216, 217, 218)	Surgical	39,800	0.2%	125	\$2.3	0.6%	0.39	\$58,075
Bilateral or multiple major joint procedures of lower extremity (461,462)	Surgical	33,720	0.1%	137	\$1.0	0.3%	0.33	\$30,281
Nonspecific cva & precerebral occlusion w/o infarct (67,68)	Medical	32,520	0.1%	140	\$0.3	0.1%	0.76	\$10,533
Acute ischemic stroke w use of thrombolytic agent (61, 62, 63)	Medical	18,020	0.1%	177	\$0.4	0.1%	0.56	\$24,599
Coronary bypass w ptca (231, 232)	Surgical	6,260	0.0%	249	\$0.3	0.1%	0.37	\$50,720

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

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Exhibit 3.3: Select MS-DRG Families by Criteria for Payment Bundling

MS-DRG Family	Prevalent in Medicare Population (> 1% of Episodes)	High Total Episode Payments (> 2% of Total Payments)	High Average Episode Payments (> \$20,000)	Low Variance in Episode Payments (CV < 0.50)	Clear Evidence-Based Practice Guidelines*
Acute ischemic stroke w use of thrombolytic agent (61, 62, 63)			X		X
Intracranial hemorrhage or cerebral infarction (64, 65, 66)	X	X			X
Nonspecific cva & precerebral occlusion w/o infarct (67,68)					X
Chronic obstructive pulmonary disease (190, 191, 192)	X	X			X
Simple pneumonia & pleurisy (193, 194, 195)	X	X			X
Cardiac valve & oth maj cardiothoracic proc w card cath (216, 217, 218)			X	X	X
Cardiac valve & oth maj cardiothoracic proc w/o card cath (219, 220, 221)			X	X	X
Coronary bypass w ptca (231, 232)			X	X	X
Coronary bypass w cardiac cath (233, 234)			X	X	X
Coronary bypass w/o cardiac cath (235, 236)			X	X	X
Perc cardiovasc proc w drug-eluting stent (247)	X		X	X	X
Heart failure & shock (291, 292, 293)	X	X			X
Bilateral or multiple major joint procedures of lower extremity (461, 462)			X	X	X
Revision of hip or knee replacement (466, 467, 468)			X	X	X
Major joint replacement or reattachment of lower extremity (469, 470)	X	X		X	X
Hip & femur procedures except major joint (480, 481, 482)	X	X	X	X	X

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

* Maintained by the American Academy of Orthopaedic Surgeons (AAOS) or included in the National Guideline Clearinghouse (NGC) maintained by the Agency for Healthcare Research and Quality (AHRQ). For inclusion criteria, see Appendix B, Exhibits B.9 and B.10.

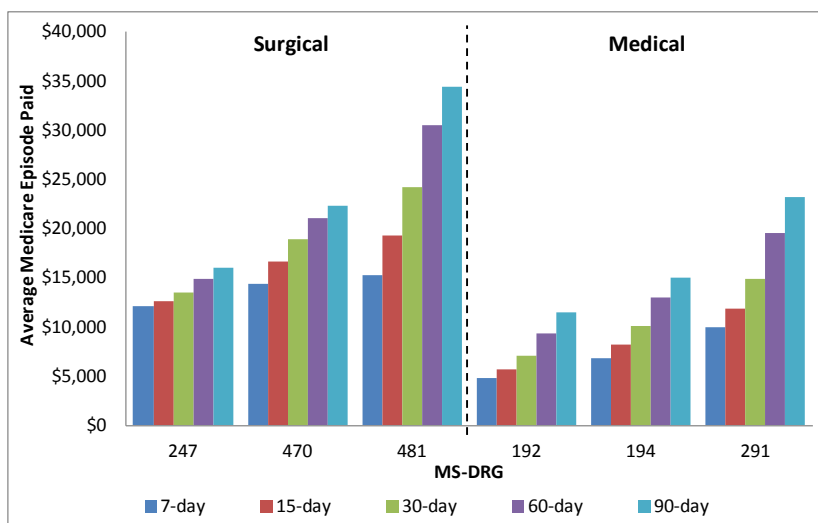
Episode Length

Episode length is an important policy lever in expanding provider accountability for patient care. There are several factors that should be considered in determining the length of the episode: the nature of the index hospital admission (surgical or medical), variation in Medicare episode payments as the length of the episode increases, the relative proportion of episode payments represented by the index hospitalization, and the ability of providers to control downstream post-acute care.

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The difference in average Medicare payments across episode lengths varies by MS-DRG. We found that among certain MS-DRGs, the vast majority (over two-thirds) of Medicare episode payments occur within seven days following index hospitalization, such as MS-DRG 247 (percutaneous cardiovascular procedure with drug-eluting stent w/ MCC) (Exhibit 3.4). In others, such as MS-DRG 291 (heart failure and shock w/ MCC), Medicare episode payments within seven days account for less than half of payments in a 90 day episode and are more dispersed over the 90 days following hospital discharge.

Exhibit 3.4: Average Medicare Episode Payment (Including Index Hospital Admission) for Select MS-DRGs across Seven-, 15-, 30-, 60-, and 90-day Fixed-length Episodes (2007-2009)



247: Percutaneous cardiovascular procedure with drug-eluting stent w/ MCC
 470: Major joint replacement or reattachment of lower extremity w/o MCC
 481: Hip & femur procedures except major joint w CC

192: Chronic obstructive pulmonary disease without CC/MCC
 194: Simple pneumonia & pleurisy w CC
 291: Heart failure & shock w MCC

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

In general, surgical MS-DRG episodes appear to have substantially less variance in average Medicare episode payments from seven days to 90 days than medical episodes (with the exception of MS-DRG 481 [hip & femur procedures except for major joint w/ CC], which shows significant variance across episode lengths). This trend could in part be related to comorbid conditions: on average, medical MS-DRG episodes have an average of 5.6 chronic conditions, whereas surgical MS-DRGs have an average of 4.7 (data not shown).⁴⁰ Also, Medicare payments for episodes that have an index hospitalization MS-DRG with a complication or comorbidity (CC) or a major complication or comorbidity (MCC) show more variance than MS-DRGs without, due to the increased case complexity (as with MS-DRGs 192 and 194).

⁴⁰ Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars.

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In MS-DRG 247 there is a 30 percent increase of average Medicare episode payments from seven to 90 days, but in MS-DRG 291 this increase is more than 130 percent. While longer episodes have greater risk to providers in terms of payment variance, there may be greater opportunity to manage costs within longer medical MS-DRG episodes and, thus, the impact of variance upon provider risk is not clear. (For the percent increase in Medicare episode payments represented by each episode length for the six MS-DRGs above, see Appendix C, Exhibit C.2.)

Episodes in which the index hospitalization is a smaller portion of the episode payment also have greater opportunity for clinical intervention, but greater risk to providers in controlling downstream post-acute care spending. As the episode length increases from seven to 90 days, the percent of Medicare episode payments represented by the index hospitalization tends to decrease. Exhibit 3.5 shows that for a 30-day episode, the percent of Medicare episode payments for the index hospitalization ranges from 35 percent of the episode payment for intracranial hemorrhage or cerebral infarction (MS-DRGs 64–66) to 76 percent of the episode payment for coronary bypass w/ PTCA (MS-DRGs 231 and 232). For a 90-day episode, the index hospitalization represents approximately one-quarter of episode payments for medical MS-DRGs (such as stroke, COPD, and heart failure), but represents two-thirds or more of many surgical MS-DRGs (such as coronary bypass). Exhibit 3.5 also indicates that the CV increases as episode length increases. This is because Medicare post-acute payments are more variable than those of the index hospital admission within a given MS-DRG.

Based on Medicare claims data alone, there is no clear answer concerning optimal episode length based solely on MS-DRG, because MS-DRG payments vary so much depending on the condition. The “lever” to achieve savings within the bundle changes based on whether the condition is surgical or medical, and whether the beneficiary has complications. In a longer bundle, such as a 90-day bundle, providers can achieve savings by moving patients from higher to lower intensity settings and reducing length of stay within settings, and by reducing the number of “stops” in the patient pathway.

Overall, episode length should be long enough for the patient who requires appropriate post-acute care services, but short enough for providers to manage risk and still achieve cost savings.

The growth rate in episode payments as the length of the episode increases also can be used to determine appropriate episode length, where episodes that do not have a substantial rate of change in episode payments reflect less risk as episode length increases. (See Appendix C, Exhibits C.3 and C.4 for the rate of increase and the percent increase in Medicare payments for select MS-DRG families as the episode length increases from seven to 90 days.)

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Exhibit 3.5: Percent of Medicare Episode Payment for Index Hospitalization and Coefficient of Variation for Seven-, 15-, 30-, 60-, and 90-day Fixed-length Episodes (2007-2009)

MS-DRG Family	7-Day		15-Day		30-Day		60-Day		90-Day	
	% of Payment for Index	CV of Total Episode Payment	% of Payment for Index	CV of Total Episode Payment	% of Payment for Index	CV of Total Episode Payment	% of Payment for Index	CV of Total Episode Payment	% of Payment for Index	CV of Total Episode Payment
Acute ischemic stroke w use of thrombolytic agent (61, 62, 63)	64.0%	0.38	53.2%	0.46	44.5%	0.56	37.0%	0.65	33.6%	0.68
Intracranial hemorrhage or cerebral infarction (64, 65, 66)	55.3%	0.54	43.5%	0.63	34.6%	0.71	27.6%	0.79	24.2%	0.84
Nonspecific cva & precerebral occlusion w/o infarct (67,68)	59.9%	0.59	49.5%	0.69	39.7%	0.76	31.1%	0.85	27.1%	0.92
Chronic obstructive pulmonary disease (190, 191, 192)	69.8%	0.52	58.6%	0.66	46.2%	0.79	34.3%	0.91	28.5%	0.96
Simple pneumonia & pleurisy (193, 194, 195)	68.1%	0.56	56.9%	0.66	45.5%	0.82	35.1%	0.91	29.9%	0.96
Cardiac valve & oth maj cardiothoracic proc w card cath (216, 217, 218)	82.6%	0.37	78.8%	0.37	74.8%	0.39	71.0%	0.42	68.9%	0.43
Cardiac valve & oth maj cardiothoracic proc w/o card cath (219, 220, 221)	82.3%	0.43	78.2%	0.43	74.0%	0.45	69.7%	0.49	67.1%	0.52
Coronary bypass w ptca (231, 232)	83.0%	0.34	80.0%	0.35	76.3%	0.37	73.1%	0.42	71.9%	0.43
Coronary bypass w cardiac cath (233, 234)	79.9%	0.36	75.8%	0.38	71.5%	0.42	67.0%	0.48	64.2%	0.52
Coronary bypass w/o cardiac cath (235, 236)	79.5%	0.41	75.3%	0.42	71.0%	0.45	66.1%	0.51	63.5%	0.55
Perc cardiovasc proc w drug-eluting stent (247)	83.5%	0.25	79.7%	0.32	74.4%	0.40	67.3%	0.50	62.6%	0.56
Heart failure & shock (291, 292, 293)	66.7%	0.64	54.9%	0.72	42.6%	0.80	31.3%	0.87	25.8%	0.92
Bilateral or multiple major joint procedures of lower extremity (461,462)	65.8%	0.27	58.5%	0.29	54.1%	0.33	50.9%	0.37	49.1%	0.40
Revision of hip or knee replacement (466, 467, 468)	73.2%	0.35	64.7%	0.39	57.1%	0.45	50.5%	0.49	46.7%	0.56
Major joint replacement or reattachment of lower extremity (469, 470)	67.1%	0.31	57.7%	0.36	50.6%	0.42	44.9%	0.49	42.1%	0.55
Hip & femur procedures except major joint (480, 481, 482)	58.7%	0.34	46.8%	0.37	37.4%	0.38	29.7%	0.42	26.3%	0.47
Total	70.4%	1.02	60.8%	0.99	50.9%	0.98	41.2%	0.99	36.2%	1.01

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

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Inclusion of Services and Provider Types

All services and provider types can initially be considered for inclusion in the bundled payment. Whether or not a service or type of provider is initially included depends on: a) whether the service or type of provider is clinically related to the episode; and b) whether inclusion of the service or provider increases variation in Medicare payments (or financial risk to providers) in a manageable fashion.

For example, hospice services have been excluded from the BPCI initiative. Hospice care may not be clinically related to the cause of the index admission and may represent unaccounted for risk. Hospice services tend to have an unclear end point, and can equate to more costly episodes of care (see Exhibit 3.6). Because hospice can be a longer-term benefit, it may make sense to initially exclude this care from some payment bundles. End-of-life care, however, will be important to consider in future payment bundling systems, especially for medical conditions that have high rates of mortality (such as heart failure).

Exclusions based on MS-DRG could be considered for certain hospital readmissions within the episode based on whether the readmission was preventable or related to the index hospital admission. In general, medical readmissions following a medical index hospital admission are thought to be “potentially preventable.” Most medical readmissions following a surgical index hospital admission are also likely to be potentially preventable. In contrast, most surgical readmissions following either a medical or a surgical admission are less likely to be preventable and may be purposefully scheduled. (See Appendix C, Exhibit C.5 for a diagram of MedPAC’s logic for defining potentially preventable hospital readmissions.)

Other procedures or services may be inappropriate for a payment bundle if they are clinically unrelated to the payment bundle, based on either ICD-9-CM or CPT-4 codes. Providers or services also could be included based on physician specialty. For example, in the Medicare Participating Heart Bypass Center demonstration, the physician services of the thoracic surgeon, cardiologist, anesthesiologist, and radiologist were included but the inclusion of other specialists was determined individually by participating hospitals.

Exclusions need to be carefully considered, as the use of exclusions to mitigate financial risk to providers may be limited, and the exclusion of more services increases the incentive for providers to shift services, costs, and responsibility for the patient to providers and service types that are outside of the bundle. Optimally, all care during the episode could be considered for inclusion in future payment bundles.

Exclusion of or Adjustment for Patients

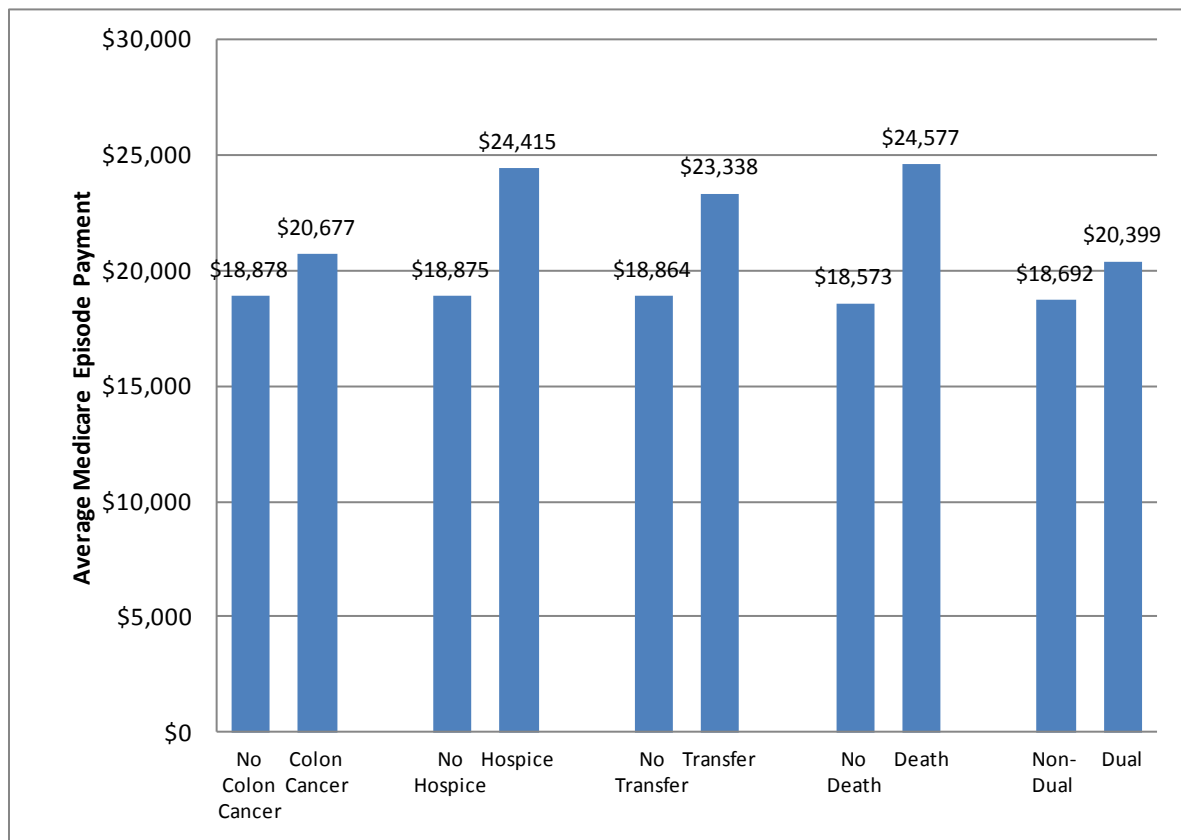
While the majority of Medicare patients can be included in a bundled payment system, there are several types of patients that merit consideration for exclusion (or explicit risk adjustment). These patients have a clinical condition or characteristic that either

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distinguishes them from other beneficiaries or markedly changes the average Medicare episode payment. Exclusions could include beneficiaries enrolled in the Medicare Advantage (MA) program and patients with end-stage renal disease (ESRD).

Other types of patients may not merit exclusion, but could require risk adjustment in order to include them in a bundled payment system. These include patients dually eligible for both Medicare and Medicaid, as well as patients with cancer, hospice and acute care hospital transfer patients, and patients who die during the episode (see Exhibit 3.6). (See Appendix C, Exhibit C.6 for comparable findings for MS-DRG 291.)

Exhibit 3.6: Average Medicare Episode Payment by Beneficiary Clinical and Demographic Characteristics for Exclusion or Adjustment for MS-DRG 470 for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

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Below we discuss the patients who could be excluded:

Medicare Advantage (MA). Patients in the MA program (identified in the data as having one month or more of claims in MA) are excluded from our current episode database (consistent with the BPCI initiative). Bundled payments are intended to improve care coordination and create incentives to deliver more efficient care for beneficiaries in the Medicare fee-for-service program, and MA patients already receive care under a different type of payment system.

End-stage renal disease (ESRD). Patients with ESRD are excluded from our current episode database (consistent with the BPCI initiative). Due to the severity of their condition and their high utilization of dialysis and vascular access-related services, ESRD patients have significantly higher average Medicare episode payments than patients without ESRD. In addition, ESRD services already are delivered under a form of bundled payment.

Other patient characteristics may be considered for exclusion or explicit risk adjustment in order to include them in a bundled payment system. These patients generally have expected costs that are either low enough to produce profit for providers or high enough that a provider cannot appropriately manage costs under a bundled payment, and include the following categories:

Cancer. Patients with cancers that have an expensive treatment regimen are clinically unpredictable and require specialized, ongoing care that is often not acute and is more supportive in nature. These patients have substantially higher average Medicare episode payments as well. We show this trend by highlighting colon cancer in Exhibit 3.6 above, but the level of variation in episode payments for patients with other types of expensive cancers to treat, such as breast and prostate cancer, are consistent with this trend.

Hospice. Patients who use hospice services during an episode of care could be excluded from the bundle if clinically appropriate. As noted above, these patients are receiving palliative and other related care in preparation for the end of life, rather than restorative or rehabilitative care, and are therefore clinically very different from other patients and have substantially different average Medicare episode payments (Exhibit 3.6).

Transfers. Transfers have little effect on average Medicare episode payments for some conditions, but a large effect on others. For example, episodes with an index hospital admission of MS-DRG 470 (major joint replacement w/o MCC) that include a transfer are nearly 25 percent more expensive than episodes without (Exhibit 3.6), while episodes with an index hospital admission of heart failure with shock (MS-DRGs 291-293) that include a transfer are more than twice as expensive on average (see Appendix C, Exhibit C.7). The inclusion of transfers in the payment bundle has cost implications for teaching hospitals and other types of providers that receive complex transfer patients from community hospitals.

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Deaths. Average Medicare episode payments for patients who die during the episode are well above those of patients who survive, similar to patients who use hospice. There is some precedent in the Medicare program for risk-adjusting payments based on patient deaths, as the IPPS distinguishes between acute myocardial infarction, discharged alive (MS-DRGs 280-282) and acute myocardial infarction, expired (MS-DRGs 283-285). The BPCI initiative includes deaths in the definition of the episode.

Dual eligibles. The BPCI initiative includes beneficiaries dually eligible for Medicare and Medicaid (and CMS may consider chronic care bundles at a later time, which may also include dual eligibles). Although dual eligibles are generally sicker, frailer, and more likely to live alone and experience behavioral health issues than the general Medicare population,⁴¹ Medicare episode payments are only slightly higher for dual eligibles than non-dual eligibles (Exhibit 3.6). Research being conducted by Dobson | DaVanzo for The Commonwealth Fund suggests that dual eligibles may stand to benefit greatly from the improved care coordination bundled payment has the potential to encourage.⁴² (See Appendix C, Exhibit C.8 for a comparison of demographic and clinical characteristics, patient pathways, and Medicare episode payments between dual and non-dual eligibles.)

Implications

There are many different issues to consider in determining how to define the payment bundle: which conditions are best suited to payment bundling (based on prevalence, expense to the Medicare program, variation in Medicare episode payments, and the availability of clinical practice guidelines); the length of the episode covered by the payment bundle; and the types of services and patients to include or exclude in the payment bundle.

Once the episode has been defined, a methodology needs to be determined for how to set prices for the payment bundles.

⁴¹ Medicare Payment Advisory Commission (2011, June). Report to the Congress: Medicare and the health care delivery system. (Washington, DC: MedPAC).

⁴² Manuscript under development.

Chapter 4: Policy Issue

– Pricing the Bundle

Research Questions: Pricing the Bundle

- How should the bundle be priced? How should add-on payments be addressed?
- What factors should be considered for risk adjustment?
- How should the outlier policy be determined?

Drivers of Medicare Episode Payments

In our episode definition, the price of a payment bundle includes all of the services that are provided during the episode and pro-rated services that extend beyond the episode end date. Before bundled payment policies can be broadly considered, it is necessary to understand the composition of Medicare episode payments.

The various factors influencing the frequencies, expenditures, and composition of episodes, including MS-DRGs, episode lengths, chronic conditions, readmissions and beneficiary characteristics, are the building blocks of payment bundles and will ultimately support a risk adjustment system. A comparison of these variables offers insight into the current fee-for-service program, explores areas where bundled payments could improve care coordination and reduce costs, and shows the varied and complex care used during patient episodes of care.

A payment bundle should be priced based in part on episode payment drivers. The sources of variance in Medicare payments for episodes are somewhat different from those for hospital stays or post-acute care prospective payment system cases. Our descriptive statistics identify numerous drivers of Medicare episode payments, including:

Chapter 4: Policy Issue – Pricing the Bundle

- MS-DRG
- Number of comorbid conditions (measured using HCCs)
- Beneficiary demographic characteristics such as age, race, and sex, and clinical characteristics such as chronic conditions and functional ability
- Hospital characteristics such as IME and DSH payments received
- Regional variation due to differences in wage index and practice patterns
- The unique number of physicians seen during the episode
- Inpatient hospital readmissions
- The first post-acute care setting after hospital discharge within the episode

In this chapter, we present descriptive statistics and the findings of our multivariate regression analyses concerning the impact of various payment drivers on episode payments. In the BPCI initiative, CMS did not address risk adjustment directly since the applicants' historical revenue base served as a form of risk adjustment; however, risk adjustment and outlier policies will become increasingly important to providers and to CMS if national payment bundling policies are adopted.

MS-DRG

There is substantial variation in episode payments as defined by MS-DRG (or MS-DRG family). For example, major joint replacements (MS-DRGs 469 and 470) are the most prevalent condition in the Medicare population and have an average Medicare episode payment of \$19,631, while coronary bypass w/ cardiac cath (MS-DRGs 233 and 234) are one-tenth as prevalent but have an average Medicare episode payment of \$39,646 (Exhibit 3.2). The index hospitalization MS-DRG is, accordingly, a major driver of Medicare episode payments and is the first level of risk adjustment used in the BPCI initiative, previous Medicare payment bundling demonstrations, and existing hospital prospective payment systems.

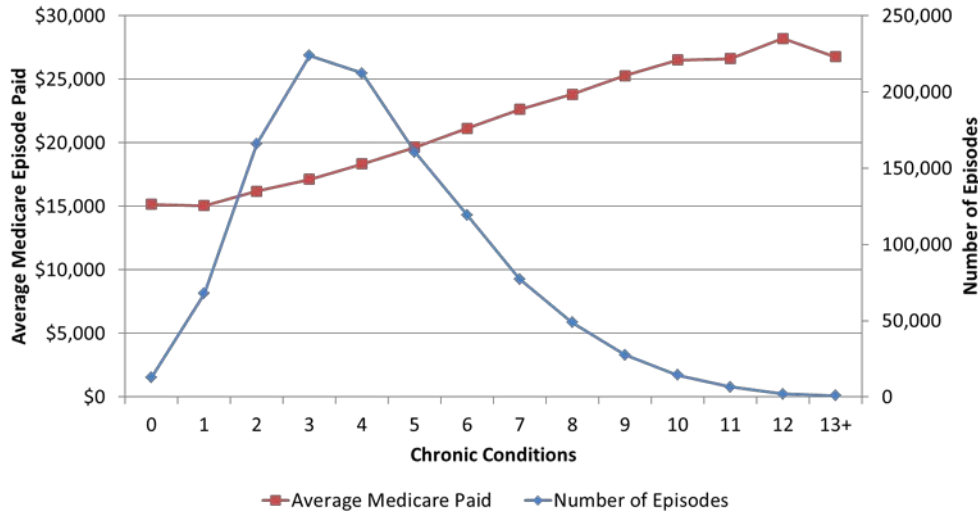
NUMBER OF CHRONIC CONDITIONS

Beneficiary clinical conditions also exert an impact on the Medicare payments for episodes of care, but this effect has less to do with the specific conditions for which a patient is diagnosed and more to do with the number of comorbid conditions.

For example, for MS-DRG 470 (major joint replacement or reattachment of lower extremity w/o MCC), average Medicare episode payment appears to increase in a linear fashion with the number of chronic conditions (Exhibit 4.1). Average Medicare episode payments are nearly twice as high for beneficiaries with 12 chronic conditions as for those with none. MS-DRG 291 (heart failure and shock w/ MCC) exhibits a similar trend to MS-DRG 470 (see Appendix D, Exhibit D.1).

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Exhibit 4.1: Number of Episodes and Average Medicare Episode Payment by Number of Chronic Conditions for MS-DRG 470 for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

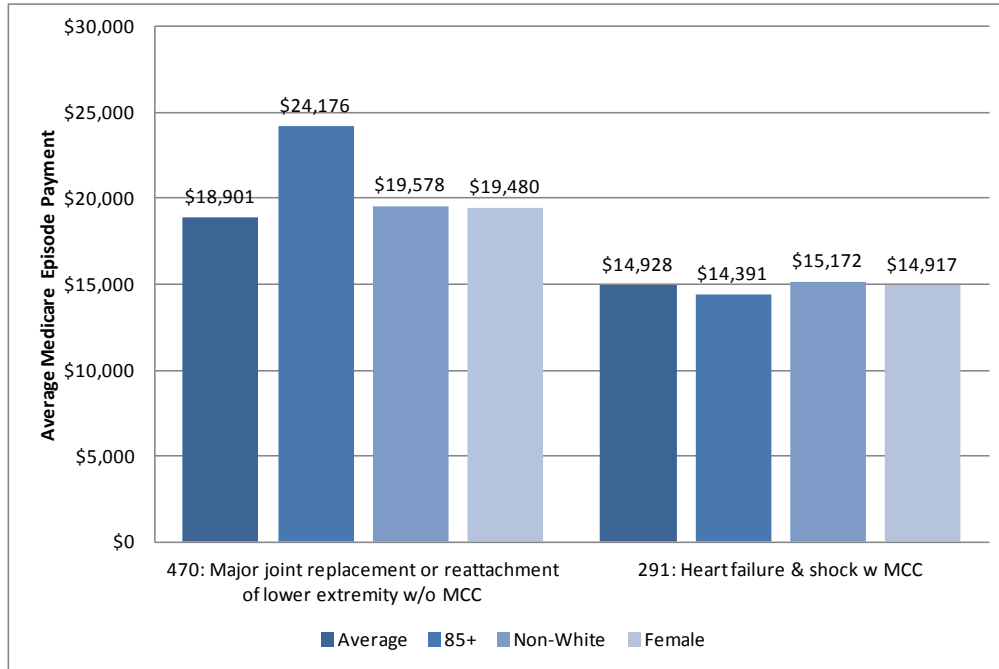
BENEFICIARY DEMOGRAPHIC CHARACTERISTICS

Another important driver of Medicare payments within the episode is beneficiary demographic characteristics. The importance and magnitude of the effect of demographic characteristics—such as gender, race, or age—on the average Medicare episode payment for a 30-day fixed-length episode differs based on the MS-DRG family. For example, the average Medicare episode payment for MS-DRG 470 is \$18,901, but for beneficiaries over the age of 85 it is \$24,176 (Exhibit 4.2).

For MS-DRG 291, however, the difference between the average Medicare episode payment overall and for beneficiaries over age 85 is much smaller and in the opposite direction (\$14,928 vs. \$14,391). Beneficiary demographic characteristics have differential impacts on average Medicare episode payment across MS-DRGs. Medicare does not adjust MS-DRG payment rates for age, but does assign beneficiaries to MS-DRGs based on sex in a few instances.

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Exhibit 4.2: Average Medicare Episode Payment by Select Beneficiary Demographic Characteristics for MS-DRGs 470 and 291 for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

ADD-ON PAYMENTS

A national bundling program should address the issue of add-on payments, such as IME and DSH. We first removed IME, DSH, and capital from the Medicare episode payment—consistent with the BPCI initiative episode definition—and found that the variance in average Medicare episode payments between hospitals with a DSH patient percentage of zero is within a few hundred dollars of hospitals with a DSH patient percentage of more than 20 (Appendix D, Exhibit D.2). This finding suggests that the impact of having a large DSH population alone on Medicare episode payment is minimal. But, the impact of DSH payments becomes much more pronounced when using the Medicare “payment plus add-ons” which includes IME, DSH, and capital payments.

The magnitude of add-on payments on the average Medicare episode payment is shown in Exhibit 4.3, which compares the average Medicare episode payment (excluding add-on payments) to the average Medicare episode “payment plus add-ons” (which includes IME, DSH, and capital payments) by facility type according to teaching status and the DSH patient percentage of the index hospital.

Chapter 4: Policy Issue – Pricing the Bundle

For MS-DRG 470 episodes (major joint replacement or reattachment of lower extremity w/o MCC) and MS-DRG 291 episodes (heart failure and shock w/ MCC), the percent difference due to add-on payments is substantially higher for major teaching hospitals and hospitals with a high proportion of DSH patients.

For example, for MS-DRG 470 episodes, the difference between the average Medicare episode payment and average Medicare “payment plus add-ons” increases from 11.1 percent for non-teaching hospitals to 35.2 percent for major teaching hospitals. For MS-DRG 291, the difference ranges from 13.5 percent for non-teaching hospitals to 40.3 for major teaching hospitals.

Exhibit 4.3: Percent Difference between Average Medicare Episode Payment and Average Medicare “Payment Plus Add-ons” (Including IME, DSH, and Capital Payments) by Teaching Status and DSH Patient Percentage for MS-DRGs 470 and 291 for 30-day Fixed-length Episodes (2007-2009)

	MS-DRG 470: Major joint replacement or reattachment of lower extremity w/o MCC			MS-DRG 291: Heart failure & shock w MCC		
	Average Medicare Episode Payment	Average Medicare Episode “Payment Plus Add-ons”	Percent Difference between Payment and Allowed Amount	Average Medicare Episode Payment	Average Medicare Episode “Payment Plus Add-ons”	Percent Difference between Payment and Allowed Amount
Teaching Status						
Non-Teaching	\$18,499	\$20,559	11.1%	\$14,718	\$16,706	13.5%
Minor Teaching	\$20,365	\$24,732	21.4%	\$15,994	\$20,047	25.3%
Major Teaching	\$20,390	\$27,560	35.2%	\$16,273	\$22,835	40.3%
Total	\$18,705	\$21,130	13.0%	\$14,900	\$17,293	16.1%
DSH Patient Percentage						
DSH Pct = 0%	\$18,318	\$19,214	4.9%	\$14,812	\$15,813	6.8%
DSH Pct < 5%	\$19,324	\$21,173	9.6%	\$14,766	\$16,788	13.7%
DSH Pct 5%-10%	\$18,319	\$20,719	13.1%	\$15,055	\$18,233	21.1%
DSH Pct 10%-20%	\$17,921	\$20,949	16.9%	\$15,971	\$20,615	29.1%
DSH Pct > 20%	\$19,176	\$22,858	19.2%	\$20,869	\$29,649	42.1%
Total	\$18,784	\$21,052	12.1%	\$14,864	\$17,152	15.4%

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Excluding IME and DSH payments from the price of the payment bundle, or only including IME and DSH payments for the index hospitalization, could result in under-payments to teaching and safety-net hospitals. This unintended consequence is most obvious in the case of hospital readmissions.

Add-on payments sometimes comprise a larger portion of the dollars received by hospitals in the event of a readmission than in the overall episode, as seen in Exhibit 4.4.

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This exhibit shows the percent that average Medicare episode payments would increase if add-on payments were included in the bundled payment for episodes in which a patient is readmitted to the index hospital. Major teaching hospitals would be most affected if add-on payments are excluded, as the price of the bundled payment would increase by 60.8 percent with the inclusion of add-on payments across MS-DRGs.

Exhibit 4.4: Average Add-on Payments for Episodes with a Readmission to the Index Hospital by Teaching Status for 30-day Fixed-length Episodes (2007-2009)

Teaching Status	Average Medicare Episode Payment for Readmission	Average Medicare Episode Add-on Payments for Readmission	Percent Increase of Average Medicare Episode Payment with Add-on Payments
Non-Teaching	\$7,377	\$1,469	19.9%
Minor Teaching	\$8,352	\$3,313	39.7%
Major Teaching	\$8,996	\$5,469	60.8%
Total	\$7,542	\$1,814	24.1%

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars.

Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

FACILITY CHARACTERISTICS

In addition to add-on payments, other facility characteristics are important to consider in pricing payment bundles. Average Medicare episode payments also vary with MS-DRGs by teaching status, urban/rural status, bed size, and ownership type; however, the differences are marginal, suggesting that while these facility characteristics should be considered for risk adjustment, the impact may be relatively small (see Appendix D, Exhibits D.3-D.6).

REGIONAL VARIATION

Wage index. The area wage index has an impact on average Medicare episode payment across Hospital Referral Regions (HRRs). For example, we observe that the ratio of wage-adjusted Medicare episode payments to wage-neutral Medicare episode payments in Macon, Georgia is 0.95 (meaning Medicare payments are 5 percent lower after the adjustment), but the ratio in Joliet, Ill. is 1.03 (meaning episode payments are three percent higher) (Exhibit 4.5).

While it is possible that the effect of the wage index is correlated with regional practice patterns, we find the same trend when comparing episodes within each HRR that have identical patient pathways (Exhibit 4.6). These trends also are observed for MS-DRG 291 (see Appendix D, Exhibits D.7 and D.8).

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Exhibit 4.5: Comparison of Average Medicare Episode Payment by Wage Index Adjustment in Two HRRs for MS-DRG 470 for 30-day Fixed-length Episodes (2007-2009)

HRR City, State	Number of Episodes	Wage Adjusted	Wage Neutral	Ratio of Wage Adjusted to Wage Neutral
		Average Medicare Episode Payment	Average Medicare Episode Payments	
Macon, GA	78,980	\$13,199	\$13,829	0.95
Joliet, IL	80,360	\$14,308	\$13,954	1.03

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Exhibit 4.6: Comparison of Average Medicare Episode Payment by Wage Index Adjustment in Two HRRs for Patient Pathway “A-H-C” for MS-DRG 470 for 30-day Fixed-length Episodes (2007-2009)

Pathway	HRR City, State	Number of Episodes	Wage Adjusted	Wage Neutral	Ratio of Wage Adjusted to Wage Neutral
			Average Medicare Episode Payment	Average Medicare Episode Payments	
A-H-C	Macon, GA	4,100	\$13,550	\$14,247	0.95
A-H-C	Joliet, IL	7,000	\$13,719	\$13,390	1.02

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

CMS adjusts all of its prospective payment systems by the area wage index, in recognition of discrepancies in price for the same labor and professional services across the United States. Our findings suggest that adjustments for the area wage index should be incorporated into the mechanism used to set prices for bundled payments as well.

Utilization and payment. As with other types of Medicare services that vary widely by region, the average days of inpatient acute hospital care were substantially different across CMS regions (Exhibit 4.7). Across all regions, an average of 186 days of care per 1,000 fee-for-services beneficiaries was provided.

Days of care for readmissions averaged 39 days per 1,000 fee-for-services beneficiaries across all regions. Region 10 (Seattle) had substantially fewer average days of care during index hospitalization (118 days) and readmission (20 days), while Region 2 (New York) had substantially more days of care during index hospitalization (245 days) and readmission (54 days).

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Exhibit 4.7: Days of Care per 1,000 Fee-for-service Beneficiaries by CMS Region for 30-day Fixed-length Episodes (2007-2009)

CMS Region	Index Hospital Stay Days of Care per 1,000 Fee-for-Service Beneficiaries	Episode Readmission Days of Care per 1,000 Fee-for-Service Beneficiaries
Region 1-Boston	175.36	37.23
Region 2-New York	245.22	54.13
Region 3-Philadelphia	202.69	44.78
Region 4-Atlanta	193.58	40.30
Region 5-Chicago	183.87	39.99
Region 6-Dallas	185.60	37.85
Region 7-Kansas City	166.07	33.82
Region 8-Denver	125.03	20.66
Region 9-San Francisco	167.23	32.63
Region 10-Seattle	117.72	20.10
Overall Average	186.13	38.93

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries.

We also find that average Medicare episode payments vary substantially across region (see Appendix D, Exhibit D.9). Regional variations in both average Medicare episode payments and utilization (e.g., practice patterns) have been studied for decades and there is no complete explanation to date. However, given the differences in Medicare episode payments and practice patterns, our findings suggest that region should be carefully considered in any risk adjustment policy for a national payment bundling system.

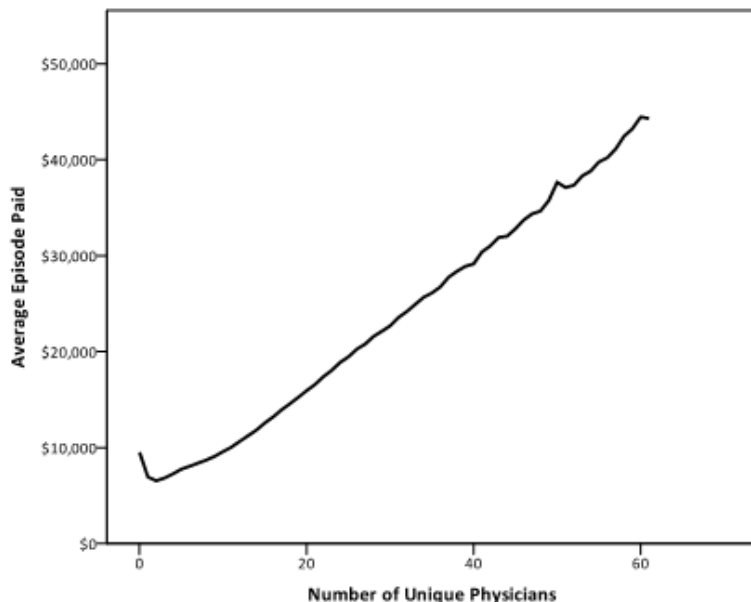
NUMBER OF PHYSICIANS SEEN

The unique number of physicians seen by a patient during an episode of care varies from zero to 60 across all MS-DRGs (trimmed to two standard deviations from the average). As seen in Exhibit 4.8, the average Medicare episode payment increases from \$9,521 for episodes with zero physicians seen to \$44,588 for episodes with 60 individual physicians seen.

The unique number of physicians included within a patient episode of care therefore has major implications for Medicare episode payments. It is not clear, however, that this statistic should be adjusted for in an episode payment model. An increasing number of physicians seen could indicate inefficient care as well as increased patient severity.

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Exhibit 4.8: Average Medicare Episode Payment by Unique Number of Physicians in Episode for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments. Data trimmed to two standard deviations from the average number of unique physicians (maximum of 60).

FIRST POST-ACUTE CARE SETTING

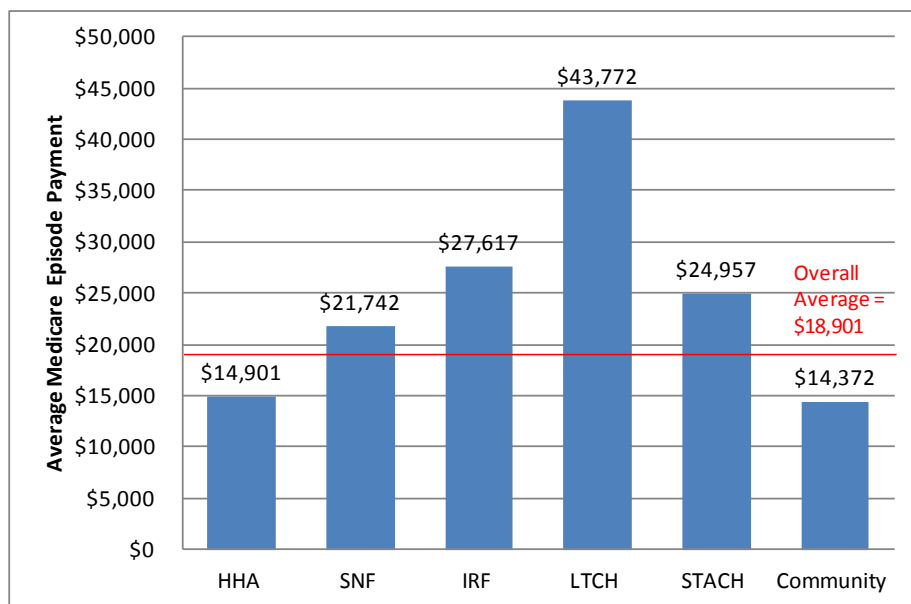
In comparing average Medicare episode payments for MS-DRG 470 (major joint replacement or reattachment of lower extremity w/o MCC) by first-setting to overall average Medicare expenditures across first-settings, there are substantial differences. For 30-day episodes defined by MS-DRG 470, the overall average Medicare episode payment is \$18,901 across first-settings (Exhibit 4.9). HHA first-setting episodes are \$4,000 less than the overall average Medicare episode payment (\$14,901), while LTCH first-setting episodes are \$24,871 more than average (\$43,772). SNF first-setting episodes are the most frequent among all first-setting types, and have an average Medicare episode payment that is \$2,841 greater than the average payment across all first-settings (\$21,742). It is also interesting to note that formal or facility-based first-settings, including HHA, account for more than 80 percent of episodes for MS-DRG 470, while ambulatory-based first-settings account for less than 20 percent of episodes.

Similar to MS-DRG 470, there were significant variations when comparing average Medicare episode payments for MS-DRG 291 (heart failure and shock w/ MCC) by first-setting to overall average Medicare episode payments across first-settings (see Appendix D, Exhibit D.10). This finding suggests that payment bundling will provide incentives

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which currently do not exist to place patients in the most cost-effective setting. Ideally, risk adjustment systems will provide the correct price signals as to which settings a patient should be placed upon discharge from an acute care hospital.

Exhibit 4.9: Difference between Overall Average Medicare Episode Payment and Average Medicare Episode Payment by First-setting for MS-DRG 470 for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Risk Adjustment

In the previous sections, we presented a series of descriptive statistics that show how average Medicare episode payments vary by MS-DRG across episode lengths, beneficiary demographic and clinical characteristics, types of facilities, and region. In order to determine the relative influence of these various Medicare episode payment drivers within the bundle, we developed a series of multivariate regression models that predict the average Medicare episode payment based on MS-DRGs and the characteristics described above.

The prospective payment systems developed by CMS are intended to base Medicare payments on the relative case-mix adjusted *cost* to providers of delivering services. The Medicare claims used in this study relate to Medicare *revenue* rather than cost. Medicare payments are less variable than provider costs due to the structure of prospective payment systems. Medicare margins also vary across providers and settings, further confounding the relationship between Medicare payments and patient costs.

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Our regression payment models create an analytic framework through which to consider developing a bundled payment system for episodes of care. Our regression analyses should be considered as an investigation of the relationship between episodes variously defined and Medicare payments. Ultimately, analyses should be based on episode costs in order to accurately risk adjust the payments and understand the financial risk to providers.

METHODOLOGY

We constructed four exploratory payment models. A “Naïve” Model estimates payments based on the average Medicare episode payment within MS-DRGs. Models A, B, and C use multivariate regressions to calculate the expected value of Medicare episode payments based on a series of explanatory variables (Exhibit 4.10). (For variable definitions, see Appendix D, Exhibit D.11.)

Exhibit 4.10: Variables Included in Each Episode Payment Model

	Naïve Model	Model A	Model B	Model C
MS-DRGs	x	x	x	x
Age		x	x	x
Sex		x	x	x
Race		x	x	x
Chronic Conditions		x	x	x
HCC Count		x	x	x
Functional Ability Score		x	x	x
Live Alone		x	x	x
Dual Eligibility		x	x	x
IME		x	x	x
DSH		x	x	x
Index Outlier Payment		x	x	x
Look Back CCU			x	x
Look Back ICU			x	x
Episode Death			x	x
Region			x	x
Rural			x	x
Bed Size			x	x
Unique Physician Count			x	x
First PAC Setting				x

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars.

Using three separate regression models allows us to isolate the impact of related blocks of variables in explaining the cost drivers of bundled payment. Model A examines the impact of MS-DRGs, various patient demographic and clinical characteristics (such as age, functional ability, and chronic conditions), and IME, DSH, and IPPS hospital outlier payments. Model B builds on Model A by including whether the beneficiary had an intensive care unit (ICU) or coronary care unit (CCU) stay during the 60 days prior to the

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episode, whether the beneficiary died during the episode, regional variation, urban/rural status, bed count, and unique physician count.

Model C builds on Model B and includes an additional variable indicating the first-setting the beneficiary enters after discharge from the index admission. While we doubt that payments will be explicitly based on the first post-acute care setting, this model is exploratory and illustrates how first post-acute care setting payment adjustments would improve payment accuracy after accounting for numerous other explanatory variables.

DESCRIPTION OF MODELS

The Naïve model sets episode payments at the national average payment level for a specific MS-DRG. This amount is independent of facility type, beneficiary clinical conditions (except for MS-DRG), and beneficiary demographics. In the regression models, we predict each individual episode payment amount. That is, we use the regression models to estimate the expected payment value at the episode level for each episode, which we use to model the overall impact of each payment simulation model on various types of facilities presented.

Adjustment Factors

The three regression models allow us to make adjustments to predicted Medicare payments due to episode characteristics (type of facility, beneficiary demographics, etc.). Categorical variables were entered as “dummy” variables, while continuous variables (such as DSH patient percentage) were entered in logarithmic form. HCC count and functional ability score were treated as categorical variables.⁴³

For each model, we present adjustment factors for multiple variables. Adjustment factors for dummy variables work as multipliers to the standardized payments, while adjustment factors for continuous variables work as exponents.⁴⁴

Explanatory Power

Exhibit 4.11 shows the progression of the R^2 value as blocks of variables are added to the regression in Models A, B, and C. The R^2 value is a statistical measure of how much of the variation in the dependent variable (in this case, the Medicare episode payment for each episode) is being explained by the independent variables included in the model. We present the results of the regression models in four ways: 1) all MS-DRGs; 2) select MS-DRGs; 3) MS-DRGs 291-293 (heart failure); and 4) MS-DRGs 469-470 (major joint

⁴³ This meant that we utilized a non-linear transformation in our regressions (the dependent variable was the logarithm of the allowed payment). Due to the anti-logarithmic transformation required to convert our results back to non-logarithmic dollars, significant differences between our mean predicted values and the actual overall mean payment could be introduced. In other words, the regression produced expected mean episode payment values that were significantly larger than the actual mean values. We used a process known as “smearing” to correct this bias. Smearing refers to the process by which we adjusted values on the transformed scale to correspond to the predicted values prior to the transformation. For more methodological details, see: Duan N. (1983). Smearing estimate: A nonparametric retransformation method. *Journal of the American Statistical Association* 78(383): 605-610.

⁴⁴ For example, for DSH, the multiplier to the standardized payment would be $1 + \text{DSH patient percentage raised to the power of the adjustment factor}$. These adjustment factors are all prior to smearing, after which further adjustments were made.

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replacement). The select MS-DRGs are comprised of 10 of the 16 MS-DRG families on which we focused much of our descriptive analyses.⁴⁵

These R² values at 0.669 in Model A, 0.762 in Model B, and 0.781 in Model C may seem high, but this is because all of our regression models are “payment to payment” models, as opposed to “payment to cost” models. However, as we see below, these high R² values do not necessarily indicate high payment accuracy. In practice, CMS would use average adjustments for each payment variable and would most likely use cost-based regression models as opposed to payment-based models.

Exhibit 4.11: Progression of R² Value with Addition of Variables in Model A, Model B, and Model C

		All MS-DRGs	Select MS-DRGs	MS-DRGs 291-293	MS-DRGs 469-470
Number of Observations		1,292,352	169,666	60,875	60,654
Regression Model	Variables	Cumulative R²*	Cumulative R²*	Cumulative R²*	Cumulative R²*
Model A	MS-DRG	0.511	0.396	0.125	0.096
	Age, Sex, Race	0.514	0.404	0.127	0.212
	Chronic Conditions	0.528	0.418	0.136	0.262
	HCC Count	0.534	0.426	0.142	0.294
	Functional Ability and Live Alone	0.647	0.598	0.349	0.515
	Dual Eligibility	0.647	0.598	0.349	0.516
	IME, DSH, Index Outlier Payment	0.669	0.629	0.473	0.558
Model B	Look Back CCU, ICU, and Episode Death	0.669	0.630	0.476	0.558
	Region	0.669	0.631	0.477	0.564
	Rural	0.669	0.631	0.477	0.564
	Bed Size	0.670	0.631	0.477	0.564
	Unique Physician Count	0.762	0.724	0.634	0.645
Model C	First PAC	0.781	0.754	0.659	0.724

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

* The adjusted-R², which accounts for degrees of freedom, was nearly identical to the R² values presented and follows the same trend.

The progression of the R² value in the first column—for all MS-DRGs—shows that MS-DRGs by themselves explain approximately half of the variation in episode payment (0.511). Age, sex, race, chronic conditions, and HCC count combined increases the R² from 0.514 to 0.534. The inclusion of beneficiary functional ability and whether the

⁴⁵ The select 10 MS-DRG families include: Intracranial hemorrhage or cerebral infarction (64, 65, 66); chronic obstructive pulmonary disease (190, 191, 192); simple pneumonia & pleurisy (193, 194, 195); cardiac valve & oth maj cardiothoracic proc w/o card cath (219, 220, 221); coronary bypass w cardiac cath (233, 234); perc cardiovasc proc w drug-eluting stent (247); heart failure & shock (291, 292, 293); revision of hip or knee replacement (466, 467, 468); major joint replacement or reattachment of lower extremity (469, 470); hip & femur procedures except major joint (480, 481, 482).

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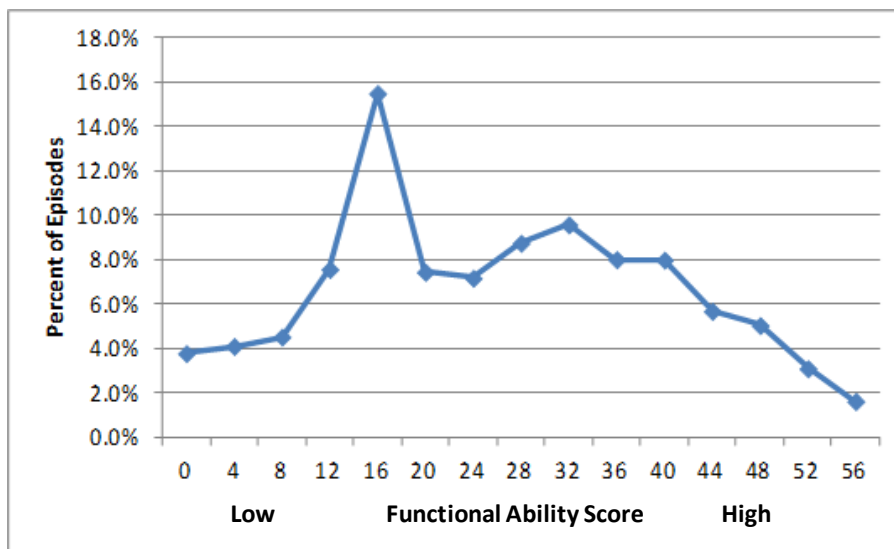
beneficiary lives alone explains 11 percent of the variation in average Medicare episode payment, increasing the R^2 from 0.534 to 0.647.

The variable “unique physician count” also has substantial explanatory power, increasing the R^2 value from 0.670 to 0.762; however, we suspect this variable is biased upward due to its correlation with length of stay and other variables omitted from the regression that may influence the average payment amount. The iterations for select MS-DRGs, MS-DRGs 291-293, and MS-DRGs 469-470 show similar trends in the overall progression of R^2 values.

Functional ability is a powerful driver of Medicare episode payments. As can be seen in Exhibit 4.11, it also has more explanatory power for MS-DRGs 469-470 than for MS-DRGs 291-293. (See Appendix D, Exhibit D.12 for a comparison of R^2 values for episodes with and without functional ability.)

Below we present the distribution of functional ability score by percent of episodes, as well as the average Medicare episode payment at each functional ability score. With the exception of a spike at 16,⁴⁶ the beneficiaries in our episode database exhibit a relatively bell-shaped distribution of functional ability score (Exhibit 4.12). Due to its explanatory power in our regression models, the concept of beneficiary functional ability should be explored as part of any risk adjustment policy for bundled payments.

Exhibit 4.12: Distribution of Episodes by Functional Ability Score for 30-day Fixed-length Episodes (2007-2009)



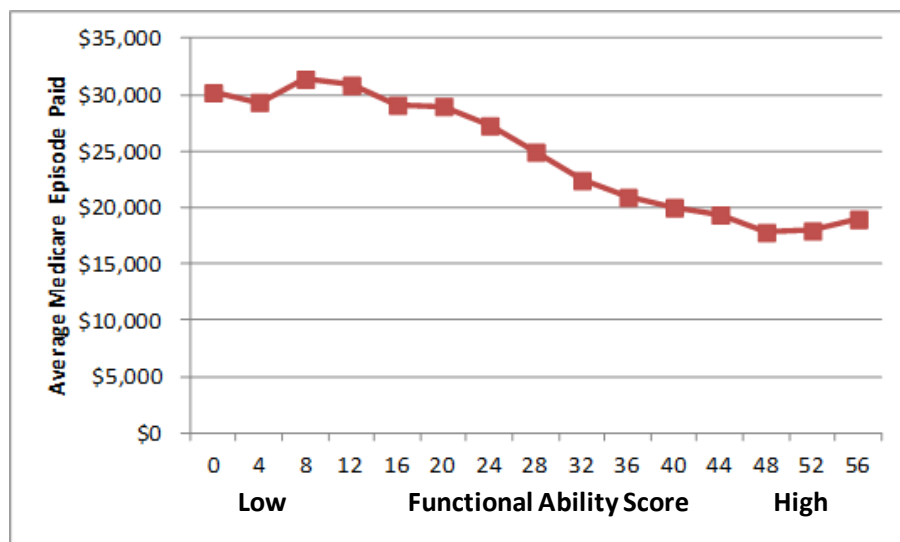
Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars.

⁴⁶ The spike at 16 is an artifact of the methodology used to construct the functional ability scale. For more detail, please see Chapter 2: Analytic Methodology.

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We also observe that average Medicare episode payments decrease relatively consistently from episodes with low beneficiary functional ability (i.e., very dependent) to episodes with high beneficiary functional ability (i.e., very independent) (Exhibit 4.13).

Exhibit 4.13: Average Medicare Episode Payment by Functional Ability Score for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

SUMMARY OF FINANCIAL IMPACT MODELING

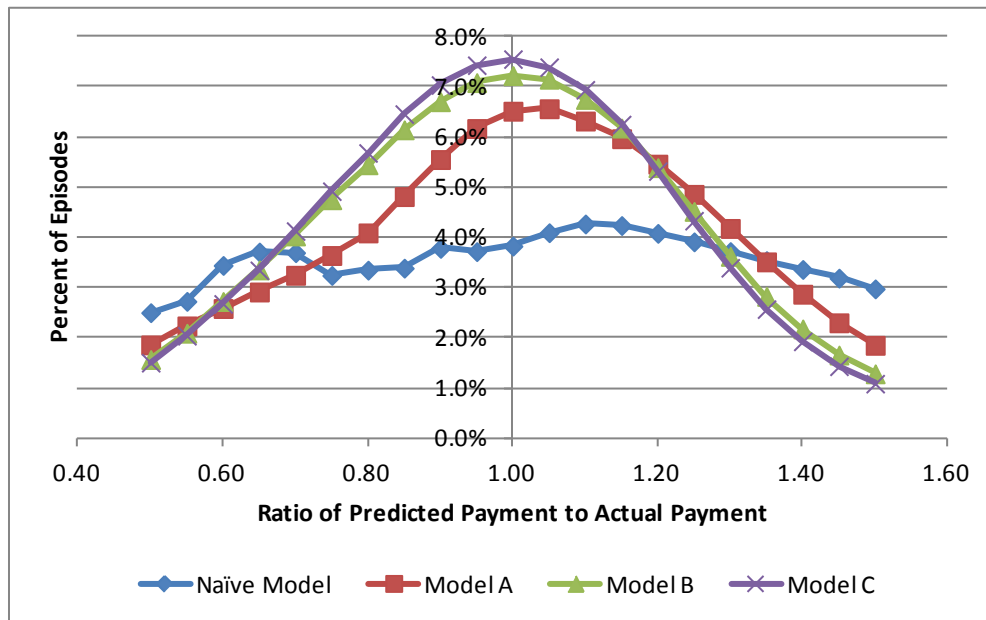
In every simulation we compare the “expected” payment to the actual payment for each episode and groups of episodes in order to determine the impact of the simulation payment model under discussion. Positive values of this impact indicate that the modeled payment is higher than the actual payment (gains to providers). Negative values indicate that the modeled payment is lower than the actual payment (losses to providers). In our analyses, all gains and losses accrue to the anchor hospitals, thus gains and losses are calculated at the level of the individual facility (for distributional analyses) or type of facility (e.g., major teaching).

In order to understand the distributions *at the episode level*, we show the impact of each of the four payment simulation models as a percent of episode revenue (Exhibit 4.14). This chart indicates that at the episode level, the impact of the Naïve model on revenues is relatively flat, indicating a wide range in gains and losses. Model C (the most comprehensive model) has a normal distribution in which approximately half of the episodes have a ratio of predicted payment to actual payment between 0.80 and 1.20. The

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shape of the Model C curve suggests that variables included in the regression to risk-adjust Medicare episode payment are working properly to redistribute payments across episodes. That is, some degree of risk adjustment is observed.

Exhibit 4.14: Percent of Episodes by Ratio of Predicted Payment to Actual Payment



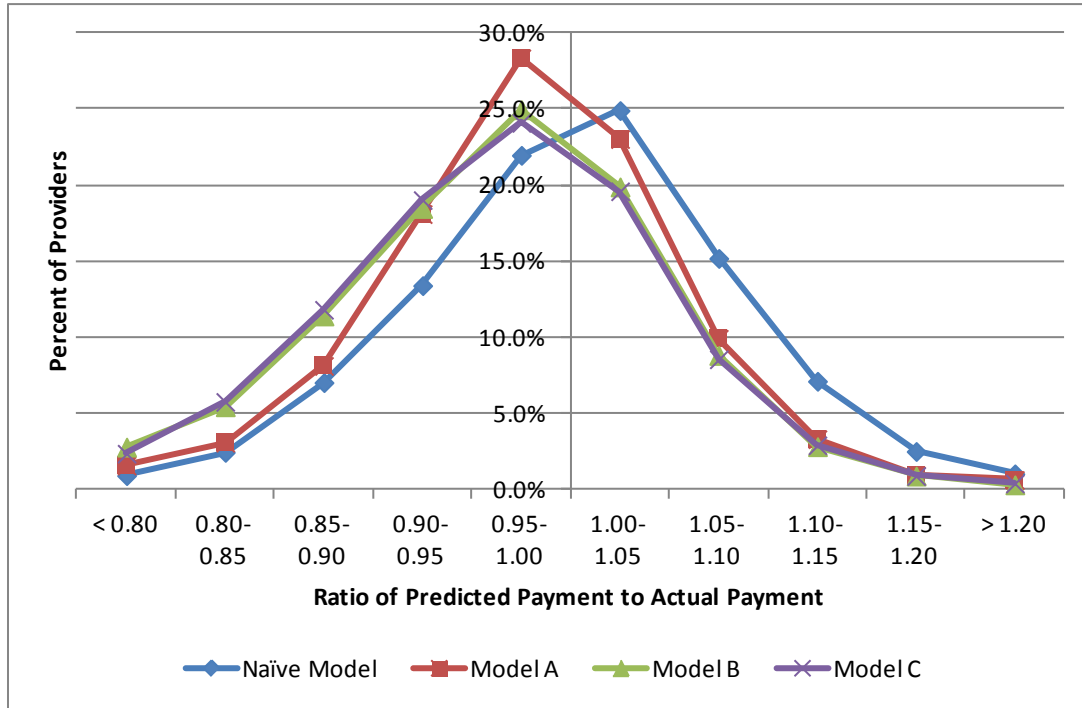
Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

A graph of the impact distribution *at the provider level* rather than the episode level for each model is shown in Exhibit 4.15. The more pronounced the peak is around zero percent impact (the y-axis), the greater the predictive power of the model (this also corresponds to a larger R^2 value). In general, a perfect predictive model (R^2 value of 1) would not be desired in a cost-based model as that result would essentially be retrospective cost-based reimbursement. In a payment-based model, an R^2 of 1.0 would mean that all episodes are paid at the same level as episode payments before under the various prospective payment systems that currently exist. Exhibit 4.15 indicates that Model A is the most highly predictive for facility-level episode payments. In this model, more than two-thirds of providers would have a ratio of predicted payment to actual payment between 0.90 and 1.10.

It is interesting to note that Model B and Model C perform slightly worse than Model A in Exhibit 4.15. This is most likely due to differing case mixes of the providers. Our regressions are run at the episode level, so an improvement in the ratio of predicted to actual payment at the facility level is not assured.

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Exhibit 4.15: Percent of Providers by Ratio of Predicted Payment to Actual Payment



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

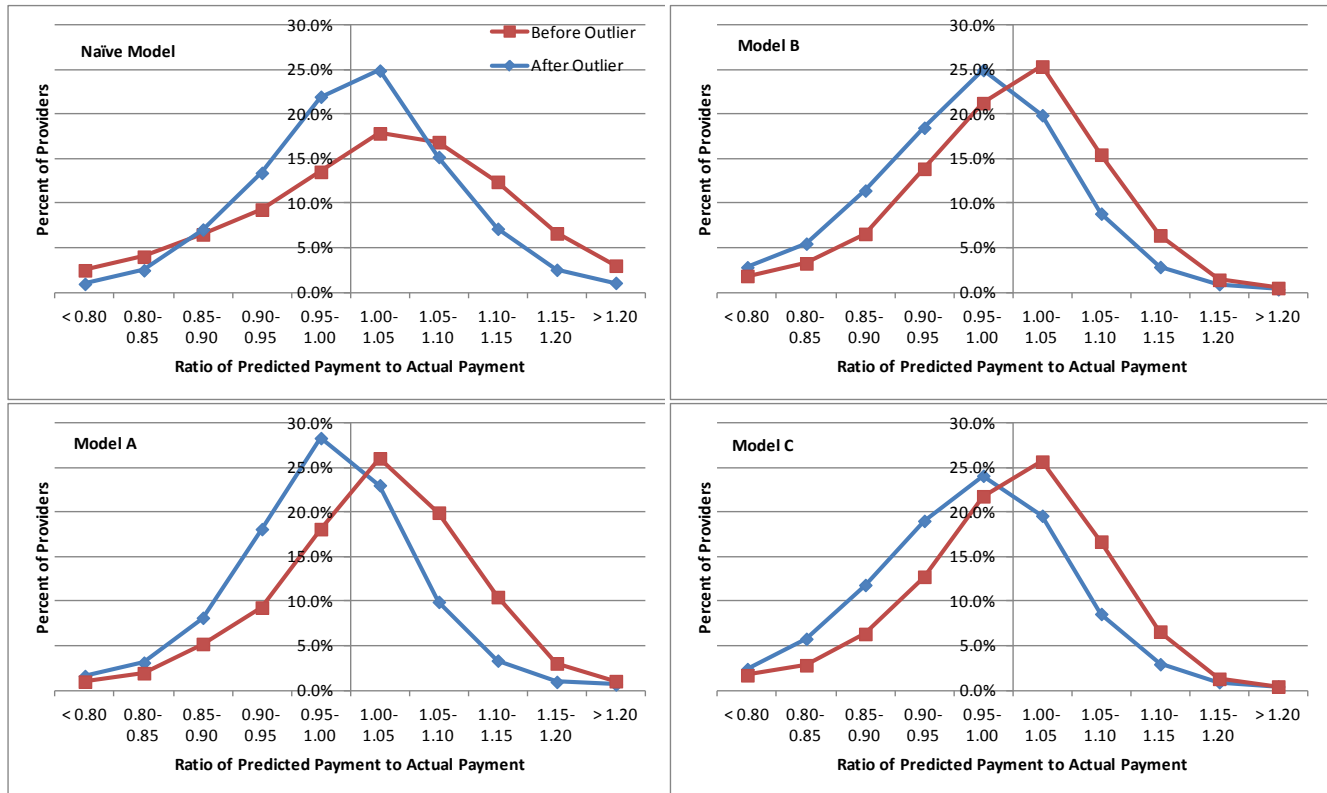
THE OUTLIER MODEL

In order to understand the need for an outlier policy as part of payment bundling, we examined episodes with and without episode outlier payments. After the predicted payments are calculated, we applied an outlier model comparable to the IPPS outlier model currently used by CMS. (For a more detailed description of the outlier payment methodology, please see Chapter 2: Analytic Methodology.)

The effect of the outlier model on our payment simulations can be seen in Exhibit 4.16. As shown, the distribution of the impact on providers shifts toward the negative due to the 10 percent offset in Medicare payments to the shared outlier pool in order to meet budget neutrality. The peak also becomes more pronounced, implying that our outlier model is working as expected, in that “payment compression” is reduced.

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Exhibit 4.16: Comparison of Percent of Providers by Ratio of Predicted Payment to Actual Payment Before and After the Outlier Model is Applied



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Exhibit 4.17 presents the effect of the outlier model on payment compression.⁴⁷ The predictive ratio reported is the average expected value divided by the average actual value. A predictive ratio less than 1.0 means the predicted value is less than the actual payment (under payment), while a ratio of more than 1.0 means the predicted value is more than the actual payment (over payment).

Exhibit 4.17 shows that before the outlier model is applied, the bottom 5 percent (based on actual Medicare episode payment) will be paid much more than the actual payment under any of our models (e.g., Model A pays the bottom 5 percent 1.65 times the actual Medicare episode payment). On the other hand, the top 5 percent will be paid much less than the actual payment under any of our models (e.g., 81 percent of the actual payment for Model A). After the outlier model is applied, there still is payment compression on the bottom 5 percent; however, it is less than before (the predictive ratios fall closer to

⁴⁷ Payment compression refers to the tendency for low-cost items to be overpaid and high-cost items to be underpaid.

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1.0). The top 5 percent are actually paid more than the actual payments after the outlier model is applied, and are generally closer to a predictive ratio of 1.0 than before (with the exception of Model C). This may or may not be appropriate relative to underlying costs.

Exhibit 4.17: Predictive Ratio before and after the Outlier Model is Applied to the Bottom and Top 5 Percent of Episodes

Model	Predictive Ratio			
	Bottom 5%		Top 5%	
	Before Outlier	After Outlier	Before Outlier	After Outlier
Naïve Model	2.11	1.90	0.71	1.04
Model A	1.65	1.49	0.81	1.10
Model B	1.41	1.27	0.84	1.15
Model C	1.42	1.27	0.90	1.19

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

IMPACT BY HOSPITAL CATEGORY: NAÏVE MODEL

In the Naïve model, we calculate a bundled payment to be the average episode payment for each MS-DRG. This differs from the BPCI payment system in that we do not set individual MS-DRG bundled payments for each facility. We use the average value for all facilities, which is far less accurate than the BPCI model but conceptually more relevant for a national payment system. The data we use for these analyses and subsequent models is the wage-adjusted Medicare allowed amount (including IME, DSH, capital costs, technology pass-throughs, and beneficiary co-payments), standardized to 2009 dollars.

Exhibit 4.18 shows the distribution of the impact on Medicare payments by anchor hospital providers. We calculate the impact as the ratio of predicted payment to actual payment. As can be seen in Exhibit 4.18, 46.9 percent (22.0 percent + 24.9 percent) of providers would have a ratio of predicted payment to actual payment between 0.95 and 1.05 under the Naïve payment model, and 75.5 percent would have a ratio between 0.90 and 1.10. This means that about 25 percent of anchor hospitals would gain or lose more than 10 percent of episode revenue under the Naïve model. While it is difficult to interpret this finding in an absolute sense, higher variance in gains and losses would clearly cause greater financial dislocation at the individual provider level.

Exhibit 4.18 also shows the distribution of impact by urban/rural and teaching status. Looking at the urban/rural distributions, we see that the Naïve model is underestimating urban and rural payments at approximately the same rate (with 46.5 percent of urban and 47.4 percent of rural hospitals with a negative impact). The Naïve model also underestimates payment to major teaching hospitals, with nearly 83 percent of providers

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having a negative impact. This is likely due to the fact that the Naïve model assumes an average payment across all providers, and does not consider the additional add-on payments for IME or DSH, indicating the importance of add-on payments at the facility level (as opposed to at the episode level).

Exhibit 4.18: Percent of Hospitals by Ratio of Predicted Payment to Actual Payment for the Naïve Model

Hospital Type	Ratio of Predicted Payment to Actual Payment									
	< 0.80	0.80-0.85	0.85-0.90	0.90-0.95	0.95-1.00	1.00-1.05	1.05-1.10	1.10-1.15	1.15-1.20	> 1.20
Total	1.8%	2.5%	7.1%	13.4%	22.0%	24.9%	15.2%	7.1%	2.5%	3.5%
Urban/Rural										
Urban	1.6%	2.5%	7.2%	13.4%	21.7%	24.7%	15.6%	7.3%	2.3%	3.6%
Rural	2.4%	2.3%	6.6%	13.5%	22.6%	25.5%	14.2%	6.8%	3.0%	3.0%
Teaching Status										
Major Teaching	2.7%	5.8%	17.6%	27.5%	29.2%	10.2%	4.4%	0.7%	0.7%	1.4%
Minor Teaching	0.7%	2.2%	6.4%	12.6%	22.1%	27.8%	17.2%	6.8%	1.2%	3.0%
Non-Teaching	2.1%	2.2%	6.0%	12.0%	21.0%	25.8%	15.9%	8.0%	3.2%	3.9%

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Exhibit 4.19 shows the impact on select hospital types under the Naïve Model. The first column lists the category of hospital. Column Two lists the number of providers within the category. The total number of episodes and the average Medicare episode payment are detailed in the next two columns. The next column shows the expected payment. The average impact is defined as the difference between expected and actual episode payment. The percent impact is the impact as a percent of actual payments. The “Impact SD” is the standard deviation of the impact. This value shows the extent of the variance in gains and losses. The second to last column is the predictive ratio before the outlier model is applied, and the final column is the predictive ratio after the outlier model is applied.

As can be seen in Exhibit 4.19, the standard deviation of the impact typically is about one-half of the average episode payment. That is, there is very large variance in episode payments. One common trend that persists across hospital types is that the larger the volume of episodes, the smaller the impact on payment. This is to be expected with the level of variance for the episode payments, as larger volume allows for more risk mitigation. Non-teaching, low-DSH, and lower bed size hospitals tend to be over-paid in the Naïve model (predictive ratios of more than 1.0), while for-profit, governmental, major teaching, high-DSH, and large bed size hospitals tend to be under-paid (predictive ratios of less than 1.0).

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Exhibit 4.19: Impact on Select Hospital Types for the Naïve Model

Hospital Type	Number of Providers	Number of Episodes	Average Medicare Episode Payment	Average Naïve Model Payment	Average Naïve Model Impact	Percent Impact	Naïve Model Impact SD	Predictive Ratio Before Outlier	Predictive Ratio
Total	3,472	1,292,353	\$18,776	\$18,776	\$0	0.0%	\$9,124	1.00	1.00
Urban/Rural									
Urban	2,477	1,100,307	\$19,259	\$19,254	-\$4	0.0%	\$9,309	0.99	1.00
Rural	995	192,046	\$16,011	\$16,036	\$26	0.2%	\$7,986	1.04	1.00
Control Type									
For-Profit	715	179,729	\$18,447	\$18,244	-\$202	-1.1%	\$9,051	0.99	0.99
Governmental	505	139,349	\$19,181	\$19,006	-\$175	-0.9%	\$9,343	0.98	0.99
Non-Profit	1,829	840,579	\$18,728	\$18,769	\$41	0.2%	\$9,082	1.00	1.00
Unknown	423	132,696	\$19,099	\$19,300	\$200	1.0%	\$9,250	1.01	1.01
Region									
New England	141	69,443	\$18,629	\$17,913	-\$716	-3.8%	\$8,687	0.97	0.96
Middle Atlantic	403	186,455	\$19,192	\$18,527	-\$666	-3.5%	\$9,371	0.96	0.97
South Atlantic	592	279,713	\$18,769	\$18,808	\$38	0.2%	\$9,121	1.00	1.00
East North Central	499	226,861	\$18,499	\$18,605	\$106	0.6%	\$9,051	1.01	1.01
East South Central	333	107,473	\$17,877	\$18,220	\$344	1.9%	\$9,018	1.03	1.02
West North Central	275	95,482	\$18,053	\$18,909	\$856	4.7%	\$8,794	1.06	1.05
West South Central	525	144,881	\$19,462	\$19,178	-\$284	-1.5%	\$9,391	0.97	0.99
Mountain	233	57,449	\$18,677	\$19,365	\$688	3.7%	\$9,041	1.04	1.04
Pacific	420	120,968	\$19,424	\$19,574	\$151	0.8%	\$9,114	0.99	1.01
Puerto Rico	51	3,628	\$16,238	\$17,284	\$1,046	6.4%	\$7,852	1.10	1.06
Teaching Status									
Major Teaching	295	191,961	\$23,069	\$22,051	-\$1,018	-4.4%	\$10,900	0.89	0.96
Minor Teaching	763	445,482	\$19,103	\$19,310	\$207	1.1%	\$9,134	1.01	1.01
Non-Teaching	2,414	654,910	\$17,295	\$17,453	\$158	0.9%	\$8,506	1.03	1.01
DSH Patient Percentage									
DSH Pct = 0%	15	355	\$19,512	\$20,378	\$866	4.4%	\$7,777	1.10	1.04
DSH Pct < 5%	137	34,497	\$17,457	\$18,147	\$690	4.0%	\$8,338	1.08	1.04
DSH Pct 5% - 10%	300	125,664	\$18,091	\$18,631	\$540	3.0%	\$8,861	1.05	1.03
DSH Pct 10% - 20%	960	388,046	\$17,728	\$18,169	\$442	2.5%	\$8,730	1.05	1.02
DSH Pct > 20%	2,060	743,791	\$19,499	\$19,145	-\$354	-1.8%	\$9,385	0.97	0.98
Bed Size									
0 to 99 Beds	1,276	150,338	\$15,519	\$15,710	\$191	1.2%	\$7,846	1.06	1.01
100 to 249 Beds	1,351	470,574	\$17,696	\$17,711	\$15	0.1%	\$8,635	1.02	1.00
250 to 499 Beds	675	468,220	\$19,469	\$19,506	\$37	0.2%	\$9,317	1.00	1.00
500 to 749 Beds	133	137,698	\$21,991	\$21,776	-\$215	-1.0%	\$10,353	0.95	0.99
More than 750 Beds	37	65,523	\$22,298	\$21,936	-\$362	-1.6%	\$10,928	0.93	0.98
First PAC Setting									
HHA	3,351	195,250	\$18,284	\$19,298	\$1,013	5.5%	\$7,826	1.09	1.06
SNF	3,323	245,391	\$26,476	\$21,431	-\$5,046	-19.1%	\$8,653	0.80	0.81
IRF	2,534	41,782	\$41,477	\$32,980	-\$8,496	-20.5%	\$11,749	0.65	0.80
LTCH	1,859	12,337	\$73,660	\$75,155	\$1,495	2.0%	\$34,022	0.63	1.02
Other	3,469	797,593	\$14,489	\$16,215	\$1,726	11.9%	\$7,540	1.17	1.12

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

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IMPACT BY HOSPITAL CATEGORY: MODEL A

The Model A regression uses select beneficiary demographic characteristics, as well as facility characteristics of the anchor hospital, to adjust the episode payment. The standardized payment amount (derived from the regression equation constant) was \$8,103. The payment adjustments (derived from the regression equation coefficients) are listed in Exhibit 4.20.

The adjustment factors for categorical (dummy) variables are multiplicative adjustments to the standardized payment. For example a white female between the ages of 65 and 69 would have an episode payment (before any other adjustments) of \$8,528. This is calculated by multiplying the adjustment factors (1.000 for white, 0.979 for female, and 1.075 for 65 to 69 years old) by the standardized payment of \$8,103 (or $1.000 \times 0.979 \times 1.075 \times \$8,103 = \$8,528$).

Because continuous variables are expressed as logarithms, the adjustment factors for continuous variables act as exponents of the variables. As an example, if the same beneficiary (white, female and 65 to 69 years old) was admitted to an index hospital with a 10 percent DSH patient percentage, the payment would be multiplied by 1.043 (1+DSH percentage raised to the power of 0.444 or 1.1 raised to 0.444). The episode payment would then become \$8,896 ($\$8,528 \times 1.043$).

It is important to note that these adjustment factors *cannot* be viewed in isolation. For example, one cannot simply infer from the adjustment factors that the average episode payment for a beneficiary age 64 and under would be 9.8 percent (1.098) more than for a beneficiary over age 85 (the reference group). This is due to the interaction of age with all of the other variables in the regression. Beneficiaries age 64 and under could have a different distribution of adjustment factors than older beneficiaries, leading to different average Medicare episode payments. One can *only* infer that, on average, if all else is equal (or held constant), a beneficiary age 64 and under would have an episode payment that is 9.8 percent more than the payment if that *same* episode was for a beneficiary age 85 or older.

By examining the adjustment factors, we can see the relative payments for episodes based on a selection of beneficiary and facility characteristics. The larger the factor, the more payments that specific hospital category receives. The largest adjustment factors (or the greatest relative payments) were for a beneficiary with eight chronic conditions (adjustment factor of 1.375) or a functional ability score of eight (adjustment factor of 1.723). Episodes for chronic conditions other than CHF* COPD all tended to have lower payments, and episodes for dual eligible beneficiaries had a lower predicted payment as well (adjustment factor of 0.986). All coefficients except an HCC count of nine or more

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are statistically significant ($p < .001$). (This could be due to small sample size or unobservable characteristics that are correlated with clinical severity in beneficiaries with nine or more HCCs, as these are substantially more complex patients).

Exhibit 4.20: Model A Payment Adjustment Factors

Categorical Variables	Adjustment Factor	Significance	Categorical Variables	Adjustment Factor	Significance
Age Band			HCC Count (continued)		
64 or Younger	1.098	0.000	4	1.113	0.000
65 to 69	1.075	0.000	5	1.163	0.000
70 to 74	1.061	0.000	6	1.226	0.000
75 to 79	1.048	0.000	7	1.288	0.000
80 to 84	1.030	0.000	8	1.375	0.000
85 or Older	1.000	n/a	9 or More	0.956	0.755
Race			Functional Ability Score		
Asian	1.016	0.000	No Score	1.000	n/a
Black	1.009	0.000	0	1.530	0.000
Hispanic	1.018	0.000	4	1.530	0.000
Native American	1.000	0.000	8	1.723	0.000
Other	1.007	0.062	12	1.664	0.000
Unknown	1.011	0.008	16	1.661	0.000
White	1.000	n/a	20	1.692	0.000
Gender			24	1.641	0.000
Male	1.000	n/a	28	1.513	0.000
Female	0.979	0.000	32	1.376	0.000
Chronic Conditions			36	1.250	0.000
Cataract	0.838	0.000	40	1.260	0.000
CHF*COPD	1.000	n/a	44	1.211	0.000
CHF*RENAL	0.978	0.000	48	1.156	0.000
Depression	0.879	0.000	52	1.126	0.000
Diabetes	0.796	0.000	56	1.166	0.000
Diabetes*CHF	0.962	0.000	Miscellaneous		
Glaucoma	0.850	0.000	Live Alone	1.035	0.000
Osteoporosis	0.920	0.000	Dual Eligible	0.986	0.000
HCC Count			Continuous Variables		
0	0.954	0.000	IME	0.279	0.000
1	1.000	n/a	DSH	0.444	0.000
2	1.036	0.000	Index Outlier Amount	-0.059	0.000
3	1.070	0.000			

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Note: For the sake of brevity, this table contains only a selection of payment adjustment factors for the chronic condition, functional ability and MS-DRG variables.

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Model A shows a slight increase over the Naïve model in predictive power with 51.4 percent of the providers having a ratio of predicted payment to actual Medicare payment between 0.95 and 1.05, up slightly from 46.9 percent in the Naïve model, and 79.4 percent of providers having a ratio of predicted payment to actual payment between 0.90 and 1.10 (see Exhibit 4.21). About 74.2 percent of rural hospitals are being paid less under Model A, while 55.8 percent of urban hospitals have a negative impact. These are larger proportions than under the Naïve model. Adding IME to the model as a covariate has a large effect on the predicted payments to teaching hospitals. The Naïve model predicted that 82.7 percent of major teaching hospitals would face a negative payment impact, in comparison to the 20.7 percent predicted in Model A.

Exhibit 4.21: Percent of Hospitals by Ratio of Predicted Payment to Actual Payment for Model A

Hospital Type	Ratio of Predicted Payment to Actual Payment									
	< 0.80	0.80-0.85	0.85-0.90	0.90-0.95	0.95-1.00	1.00-1.05	1.05-1.10	1.10-1.15	1.15-1.20	> 1.20
Total	3.3%	3.1%	8.2%	18.1%	28.3%	23.0%	9.9%	3.3%	1.0%	1.7%
Urban/Rural										
Urban	2.3%	1.9%	6.1%	16.2%	29.3%	26.0%	11.5%	3.8%	1.0%	1.9%
Rural	6.0%	6.0%	13.3%	22.9%	25.9%	15.7%	6.0%	2.2%	0.8%	1.1%
Teaching Status										
Major Teaching	0.7%	0.0%	1.4%	6.1%	12.5%	23.7%	30.8%	18.3%	3.1%	3.4%
Minor Teaching	1.2%	0.1%	3.7%	12.3%	31.3%	32.6%	14.3%	2.1%	0.9%	1.4%
Non-Teaching	4.3%	4.4%	10.4%	21.4%	29.3%	19.9%	6.0%	1.9%	0.7%	1.5%

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Exhibit 4.22 shows that Model A overall has a similar story as the Naïve model in that lower episode volume tends to have higher variance (see Exhibit 4.22, Model A Impact SD). We see rural, for-profit, non-teaching, low-DSH, and small bed size hospitals being under-paid in this model while urban, governmental, major teaching, high-DSH, and large bed size hospitals are paid higher than fee-for-service under Model A.

Model B includes additional beneficiary characteristics (such as the presence of care in an ICU or CCU prior to the episode) and additional facility factors (such as urban/rural status, region, and bed size) (see Appendix D, Exhibits D.13-D.15). Model C, the final model, adds the first post-acute care setting after discharge from the anchor hospital as a set of independent variables (see Appendix D, Exhibits D.16-D.18). Adjusting for the first post-acute care setting somewhat increases the predictive power of the regression.

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Exhibit 4.22: Impact on Select Hospital Types for Model A

Hospital Type	Number of Providers	Number of Episodes	Average Medicare Episode Payment	Average Model A Payment	Average Model A Impact	Percent Impact	Model A Impact SD	Predictive Ratio Before Outlier	Predictive Ratio
Total	3,472	1,292,353	\$18,776	\$18,776	\$0	0.0%	\$11,134	1.02	1.00
Urban/Rural									
Urban	2,477	1,100,307	\$19,259	\$19,369	\$110	0.6%	\$11,545	1.03	1.01
Rural	995	192,046	\$16,011	\$15,379	-\$632	-3.9%	\$8,369	1.01	0.96
Control Type									
For-Profit	715	179,729	\$18,447	\$17,981	-\$466	-2.5%	\$10,187	1.00	0.97
Governmental	505	139,349	\$19,181	\$19,444	\$263	1.4%	\$12,777	1.03	1.01
Non-Profit	1,829	840,579	\$18,728	\$18,786	\$58	0.3%	\$11,030	1.03	1.00
Unknown	423	132,696	\$19,099	\$19,085	-\$15	-0.1%	\$11,147	1.02	1.00
Region									
New England	141	69,443	\$18,629	\$18,817	\$188	1.0%	\$10,487	1.05	1.01
Middle Atlantic	403	186,455	\$19,192	\$19,647	\$455	2.4%	\$12,933	1.05	1.02
South Atlantic	592	279,713	\$18,769	\$18,528	-\$242	-1.3%	\$10,707	1.01	0.99
East North Central	499	226,861	\$18,499	\$18,602	\$103	0.6%	\$10,720	1.04	1.01
East South Central	333	107,473	\$17,877	\$18,028	\$152	0.8%	\$11,063	1.04	1.01
West North Central	275	95,482	\$18,053	\$17,929	-\$125	-0.7%	\$10,408	1.02	0.99
West South Central	525	144,881	\$19,462	\$18,988	-\$474	-2.4%	\$11,009	0.99	0.98
Mountain	233	57,449	\$18,677	\$18,459	-\$218	-1.2%	\$10,845	1.01	0.99
Pacific	420	120,968	\$19,424	\$19,663	\$239	1.2%	\$11,149	1.02	1.01
Puerto Rico	51	3,628	\$16,238	\$14,678	-\$1,560	-9.6%	\$8,926	0.94	0.90
Teaching Status									
Major Teaching	295	191,961	\$23,069	\$24,499	\$1,430	6.2%	\$16,663	1.04	1.06
Minor Teaching	763	445,482	\$19,103	\$19,193	\$90	0.5%	\$10,759	1.03	1.00
Non-Teaching	2,414	654,910	\$17,295	\$16,815	-\$480	-2.8%	\$9,147	1.01	0.97
DSH Patient Percentage									
DSH Pct = 0%	15	355	\$19,512	\$16,329	-\$3,183	-16.3%	\$7,531	0.89	0.84
DSH Pct < 5%	137	34,497	\$17,457	\$16,439	-\$1,018	-5.8%	\$8,600	0.99	0.94
DSH Pct 5% - 10%	300	125,664	\$18,091	\$17,471	-\$621	-3.4%	\$9,491	1.00	0.97
DSH Pct 10% - 20%	960	388,046	\$17,728	\$17,513	-\$215	-1.2%	\$9,621	1.03	0.99
DSH Pct > 20%	2,060	743,791	\$19,499	\$19,765	\$266	1.4%	\$12,174	1.03	1.01
Bed Size									
0 to 99 Beds	1,276	150,338	\$15,519	\$14,766	-\$754	-4.9%	\$7,856	1.01	0.95
100 to 249 Beds	1,351	470,574	\$17,696	\$17,389	-\$307	-1.7%	\$9,657	1.02	0.98
250 to 499 Beds	675	468,220	\$19,469	\$19,644	\$176	0.9%	\$11,618	1.03	1.01
500 to 749 Beds	133	137,698	\$21,991	\$22,826	\$835	3.8%	\$14,209	1.03	1.04
More than 750 Beds	37	65,523	\$22,298	\$23,219	\$921	4.1%	\$15,505	1.02	1.04
First PAC Setting									
HHA	3,351	195,250	\$18,284	\$20,288	\$2,004	11.0%	\$9,802	1.17	1.11
SNF	3,323	245,391	\$26,476	\$27,396	\$920	3.5%	\$14,230	1.07	1.03
IRF	2,534	41,782	\$41,477	\$39,821	-\$1,656	-4.0%	\$22,495	0.89	0.96
LTCH	1,859	12,337	\$73,660	\$75,091	\$1,431	1.9%	\$46,482	0.68	1.02
Other	3,469	797,593	\$14,489	\$13,780	-\$709	-4.9%	\$7,294	1.00	0.95

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

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IMPLICATIONS

The regression analyses presented identify the most important episode characteristics that have an impact on the predicted Medicare episode payment as contained in our database. We found that MS-DRG, facility characteristics, beneficiary characteristics (most notably functional ability), number of unique physicians seen, and the first post-acute care setting to which a beneficiary is admitted after discharge from the hospital all have a significant impact on expected Medicare payments for the episode.

We found that by controlling for these factors, we are able to predict the average Medicare episode payment with relative consistency across facility types (a predictive ratio of near 1.0). Model C, the most complete linear regression model, yields a ratio of predicted payment to actual payment between 0.90 and 1.10 for more than two-thirds of all providers, and between 0.80 and 1.20 for more than 90 percent of providers (see Appendix D, Exhibit D.17). These results suggest that, even after controlling for beneficiary and facility characteristics, the unique number of physicians seen and the first post-acute care setting after discharge, accounting for outliers, and using payments rather than costs, more than 90 percent of providers would experience a predicted gain or loss of up to 20 percent.

The degree to which these characteristics affect Medicare payments, and how these characteristics should be considered in setting a bundled payment price or determining criteria for whether an episode should be included or excluded in a bundled payment, are important decisions to be made in developing a bundled payment system.

It is important to note that, since our regression models are based on Medicare *payments* rather than Medicare *costs*, the results of our modelling should be interpreted with some caution. Although current prospective payment systems are based on cost, they are specific to the costs of each care setting and represent different Medicare margins. Only a cost-based model capturing the full episode of care could form the basis of a future prospective payment system for a national program on bundled payment.

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Discussion – Managing the Bundle

Research Questions: Managing the Bundle

- What is the impact of patient pathways on episode payments?
- How do hospital readmissions affect the payment bundle?
- What is the role of the first post-acute care setting to which a patient is admitted post-discharge?
- What capabilities should organizations accepting payment bundles have (or develop)?

Beyond the specific episode characteristics that should be considered for risk adjustment under a bundled payment system, there are several important components of episodes that need to be managed by providers in order to reduce costs within the bundle: patient pathways and hospital readmissions. The first post-acute care setting following hospital discharge, identified through our multivariate regression analyses as an important driver of Medicare episode payments, is a critical part of the patient pathway.

In this chapter we present the findings of our descriptive analyses of how Medicare episode payments vary by MS-DRGs in terms of these issues. These findings indicate how complex the implementation of a bundled payment system may be and highlight payment drivers within episodes that will need to be managed by the recipient of the payment bundle and providers delivering services within the bundle. We also discuss the management and operational capabilities that providers will need to have or develop in order to accept bundled payments.

Patient Pathways

Patient pathways are the sequences of settings that a patient moves across following discharge from an index hospital stay. Patient pathways vary significantly across MS-

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DRGs. Analyses of these pathways offer a critical perspective on the types and mix of care patients are receiving. As the concern around hospital readmissions and inefficiency in patient care coordination grows, this understanding will be essential to integrating coordinated care systems and re-engineering care. Bundled payments present risks to providers if they are unable to control pathways and the number of “sequence stops” (or number of care settings) within an episode; it is therefore important to study pathways across various MS-DRGs in order to understand and mitigate this risk.

Exhibit 5.1 shows the average number of sequence stops for 16 selected MS-DRG families. The overall average is 2.8 for a 30-day episode, with the first “stop” being the index hospital stay. Generally, the more sequence “stops” there are in the care pathway, the higher the episode payment.

We calculated the CV for the total number of sequence stops during the episode within the seven-, 15-, 30-, 60-, and 90-day episode lengths, and found that the CV increases with the length of the episode (which we would expect). This suggests that a longer episode will have more sequence stops on average and more variation in the number of sequences stops across episodes, meaning that patient pathways become a larger source of payment variation as the episode increases in length. This “challenge” also can present an opportunity to those taking the financial risk associated with bundled payments.

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Exhibit 5.1: Average Number of Sequence “Stops” and Coefficient of Variation (CV) for Select MS-DRG Families for Seven-, 15-, 30-, 60-, and 90-day Fixed-length Episodes (2007-2009)

Select DRG Families	7-Day		15-Day		30-Day		60-Day		90-Day	
	Average Sequence Stops	CV of Total Sequence Stops	Average Sequence Stops	CV of Total Sequence Stops	Average Sequence Stops	CV of Total Sequence Stops	Average Sequence Stops	CV of Total Sequence Stops	Average Sequence Stops	CV of Total Sequence Stops
Acute ischemic stroke w use of thrombolytic agent (61, 62, 63)	2.1	0.33	2.4	0.44	2.9	0.49	3.7	0.57	4.3	0.65
Intracranial hemorrhage or cerebral infarction (64, 65, 66)	2.0	0.35	2.4	0.42	2.9	0.49	3.6	0.56	4.2	0.64
Nonspecific cva & precerebral occlusion w/o infarct (67,68)	1.9	0.39	2.3	0.43	2.8	0.51	3.4	0.56	4.0	0.64
Chronic obstructive pulmonary disease (190, 191, 192)	1.8	0.41	2.3	0.43	2.8	0.51	3.6	0.59	4.3	0.69
Simple pneumonia & pleurisy (193, 194, 195)	1.9	0.38	2.3	0.41	2.7	0.48	3.4	0.57	3.9	0.66
Cardiac valve & oth maj cardiothoracic proc w card cath (216, 217, 218)	2.3	0.35	2.8	0.43	3.5	0.48	4.0	0.53	4.5	0.59
Cardiac valve & oth maj cardiothoracic proc w/o card cath (219, 220, 221)	2.3	0.36	2.8	0.43	3.4	0.48	3.9	0.54	4.3	0.60
Coronary bypass w ptca (231, 232)	2.1	0.41	2.5	0.47	3.2	0.54	3.6	0.57	4.0	0.63
Coronary bypass w cardiac cath (233, 234)	2.1	0.39	2.7	0.44	3.3	0.47	3.8	0.53	4.3	0.61
Coronary bypass w/o cardiac cath (235, 236)	2.1	0.40	2.6	0.45	3.1	0.49	3.5	0.56	3.8	0.64
Perc cardiovasc proc w drug-eluting stent (247)	1.6	0.41	2.0	0.39	2.3	0.43	2.7	0.53	3.0	0.64
Heart failure & shock (291, 292, 293)	2.0	0.37	2.4	0.42	3.0	0.51	3.8	0.57	4.6	0.66
Bilateral or multiple major joint procedures of lower extremity (461,462)	2.3	0.25	3.0	0.30	3.7	0.31	4.5	0.37	5.1	0.48
Revision of hip or knee replacement (466, 467, 468)	2.2	0.28	2.8	0.36	3.5	0.40	4.3	0.45	5.0	0.56
Major joint replacement or reattachment of lower extremity (469, 470)	2.3	0.27	2.8	0.34	3.4	0.38	4.2	0.42	4.8	0.52
Hip & femur procedures except major joint (480, 481, 482)	2.1	0.24	2.5	0.34	3.1	0.41	3.9	0.45	4.7	0.50
Overall	1.9	0.41	2.3	0.44	2.8	0.51	3.5	0.61	4.1	0.68

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars.

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As shown in Exhibit 5.2, the most frequent pathway for MS-DRG 470 (major joint replacement or reattachment of lower extremity w/o MCC) for a 30-day episode is a first-setting of HHA followed by a Community “stop” (physician or outpatient visit) for 20.7 percent of episodes. The average Medicare episode payment for MS-DRG 470 patients with this pathway is \$14,519. However, in episodes with a first-setting of SNF followed by HHA and then Community, the average Medicare episode payment increases by almost 40 percent to \$20,039. This pathway comprises 10 percent of episodes and represents a significant portion of MS-DRG 470 average Medicare episode payments.

Among all episodes, the addition of a SNF, IRF, LTCH, or hospital readmission to the pathway substantially increases the average Medicare episode payment. Out of the top 10 pathways for MS-DRG 470, five contain a sequence stop in an IRF, LTCH, or SNF. Out of those five pathways, four have an average Medicare episode payment that is considerably larger than the average across all pathways for MS-DRG 470.

Exhibit 5.2: Top 10 Patient Pathways Ranked by Number of Episodes for MS-DRG 470 for 30-day Fixed-length Episodes (2007-2009)

Facility-Based Sequence Stops:	Pathway	Number of Episodes	Percent of Episodes	Average Medicare Episode Payment
A=STACH (Index or Readmission)	A-H-C	236,300	20.7%	\$14,519
H=HHA	A-S-H-C	116,300	10.2%	\$20,039
I=IRF	A-S	88,900	7.8%	\$23,396
L=LTCH	A-C	84,220	7.4%	\$12,078
S=SNF	A-I-H-C	50,460	4.4%	\$26,925
Ambulatory-Based Sequence Stops:	A-S-C	48,620	4.3%	\$18,786
C=Community (Physician and Outpatient)	A-S-H	44,240	3.9%	\$21,481
E=ER	A-H-C-P	34,360	3.0%	\$14,649
P=OP Therapy	A-H	26,860	2.4%	\$14,145
T=Hospice	A-P-P	24,740	2.2%	\$12,317
Z=Other IP	Subtotal	755,000	66.2%	\$17,575
	Other	385,340	33.8%	\$21,501
	Total	1,140,340	100.0%	\$18,901

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

The top 10 pathways for MS-DRG 291 (heart failure and shock w/ MCC) differ substantially from MS-DRG 470, yet similar trends can be seen across these conditions (Exhibit 5.3). The most common pathway for MS-DRG 291 episodes is STACH to Community, with the second most common pathway having a first-setting of HHA followed by Community. Adding HHA to the pathway as a first-setting does not appear to markedly increase the average Medicare episode payment for this MS-DRG.

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However, significantly higher average Medicare episode payments are seen in two out of the top 10 pathways in this group, both of which contain readmissions. For example, an episode with a pathway of the index hospitalization followed by Community followed by a readmission has an average Medicare episode payment of \$19,244; more than double that of an episode with a first-setting of Community that has no readmission (\$8,853). Readmissions occur in two out of the top 10 pathways for MS-DRG 291. Similar to MS-DRG 470, those pathways containing a SNF stop show significantly higher average Medicare episode payment than those following similar pathways that do not.

Exhibit 5.3: Top 10 Patient Pathways Ranked by Number of Episodes for MS-DRG 291 for 30-day Fixed-length Episodes (2007-2009)

Facility-Based Sequence Stops:	Pathway	Number of Episodes	Percent of Episodes	Average Medicare Episode Payment
A=STACH (Index or Readmission)	A-C	114,620	25.8%	\$8,853
H=HHA	A-H-C	38,060	8.6%	\$10,550
I=IRF	A	36,480	8.2%	\$9,939
L=LTCH	A-S	34,440	7.7%	\$17,497
S=SNF	A-T	11,220	2.5%	\$11,002
Ambulatory-Based Sequence Stops:	A-C-H-C	11,220	2.5%	\$10,760
C=Community (Physician and Outpatient)	A-C-A	10,220	2.3%	\$19,244
E=ER	A-C-A-C	10,160	2.3%	\$18,647
P=OP Therapy	A-S-C	8,560	1.9%	\$16,058
T=Hospice	A-T-T	6,980	1.6%	\$13,380
Z=Other IP	Subtotal	281,960	63.4%	\$11,500
	Other	162,700	36.6%	\$20,868
	Total	444,660	100.0%	\$14,928

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

First Post-acute Care Setting

The first post-acute care setting to which a patient is admitted after discharge from the index hospitalization has a major impact on the payment for the episode. Whether the patient goes to a SNF or HHA after discharge makes a difference, irrespective of the length of stay. Exhibit 5.4 shows the average Medicare episode payment by each first post-acute care setting for 30-day, fixed-length episodes for 16 selected MS-DRG families. All else being equal, episode payments are lower if HHA is the first-setting.

Using intracranial hemorrhage or cerebral infarction as an example, this family comprises 2.4 percent of all 30-day, fixed-length episodes and the average episode payment is \$16,681.

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If HHA is the first post-acute care setting after the index hospital stay, the average episode payment is \$10,816 and HHA first-setting episodes account for 18.9 percent of episodes with this condition that have a post-acute care first-setting. On the other hand, if the patient goes to an IRF as the first post-acute care setting, the average episode payment is \$31,122 and IRF first-setting episodes account for 33.2 percent of episodes with this condition that have post-acute care as a first-setting.⁴⁸

Exhibit 5.4: Percent of Episodes and Average Medicare Episode Payment by First-setting by MS-DRG Family for 30-day Fixed-length Episodes (2007-2009)

Select MS-DRG Family	Overall		HHA		SNF		IRF		LTCH	
	Percent of Episodes	Average Episode Payment	Percent of Episodes	Average Episode Payment	Percent of Episodes	Average Episode Payment	Percent of Episodes	Average Episode Payment	Percent of Episodes	Average Episode Payment
Acute ischemic stroke w use of thrombolytic agent (61, 62, 63)	0.1%	\$24,599	16.7%	\$16,098	34.4%	\$27,510	46.5%	\$38,326	2.3%	\$42,269
Intracranial hemorrhage or cerebral infarction (64, 65, 66)	2.4%	\$16,681	18.9%	\$10,816	46.4%	\$19,422	33.2%	\$31,122	1.5%	\$40,853
Nonspecific cva & precerebral occlusion w/o infarct (67, 68)	0.1%	\$10,533	42.7%	\$10,772	48.9%	\$16,718	7.8%	\$29,574	0.7%	\$35,050
Chronic obstructive pulmonary disease (190, 191, 192)	3.7%	\$9,382	51.1%	\$9,808	44.2%	\$16,445	2.4%	\$27,216	2.3%	\$35,020
Simple pneumonia & pleurisy (193, 194, 195)	3.9%	\$10,381	36.2%	\$9,951	59.8%	\$16,294	2.0%	\$28,308	2.1%	\$37,475
Cardiac valve & oth maj cardiothoracic proc w card cath (216, 217, 218)	0.2%	\$58,075	46.1%	\$48,741	36.4%	\$63,175	14.8%	\$71,058	2.7%	\$97,925
Cardiac valve & oth maj cardiothoracic proc w/o card cath (219, 220, 221)	0.3%	\$44,926	56.0%	\$38,640	30.9%	\$53,325	11.3%	\$62,481	1.8%	\$91,142
Coronary bypass w PTCA 231, 232)	0.0%	\$50,720	60.1%	\$46,302	25.0%	\$61,415	10.1%	\$75,417	4.8%	\$96,514
Coronary bypass w cardiac cath (233, 234)	0.4%	\$39,646	58.5%	\$34,343	28.3%	\$46,775	11.1%	\$58,961	2.1%	\$84,586
Coronary bypass w/o cardiac cath (235, 236)	0.3%	\$29,534	67.7%	\$26,936	22.1%	\$37,886	9.2%	\$48,651	1.1%	\$66,664
Perc cardiovasc proc w drug-eluting stent (247)	1.3%	\$13,568	73.0%	\$16,932	24.9%	\$25,111	1.9%	\$33,676	0.1%	\$27,631
Heart failure & shock (291, 292, 293)	4.7%	\$12,006	45.2%	\$11,232	51.0%	\$18,282	2.4%	\$31,127	1.4%	\$42,739
Bilateral or multiple major joint procs of lower extremity (461, 462)	0.1%	\$30,281	14.1%	\$23,443	29.1%	\$29,186	56.6%	\$33,658	0.3%	\$34,675
Revision of hip or knee replacement (466, 467, 468)	0.4%	\$24,121	37.7%	\$18,403	46.1%	\$27,540	15.2%	\$32,846	1.0%	\$58,510
Major joint replacement or reattachment of lower extremity (469, 470)	4.7%	\$19,631	36.9%	\$15,041	48.1%	\$22,438	14.7%	\$28,567	0.3%	\$50,280
Hip & femur procedures except major joint (480, 481, 482)	1.5%	\$24,432	6.6%	\$14,752	70.9%	\$23,843	21.7%	\$32,019	0.8%	\$45,904
Overall	100.0%	\$14,615	35.8%	\$14,602	53.2%	\$21,285	8.5%	\$34,392	2.6%	\$62,421

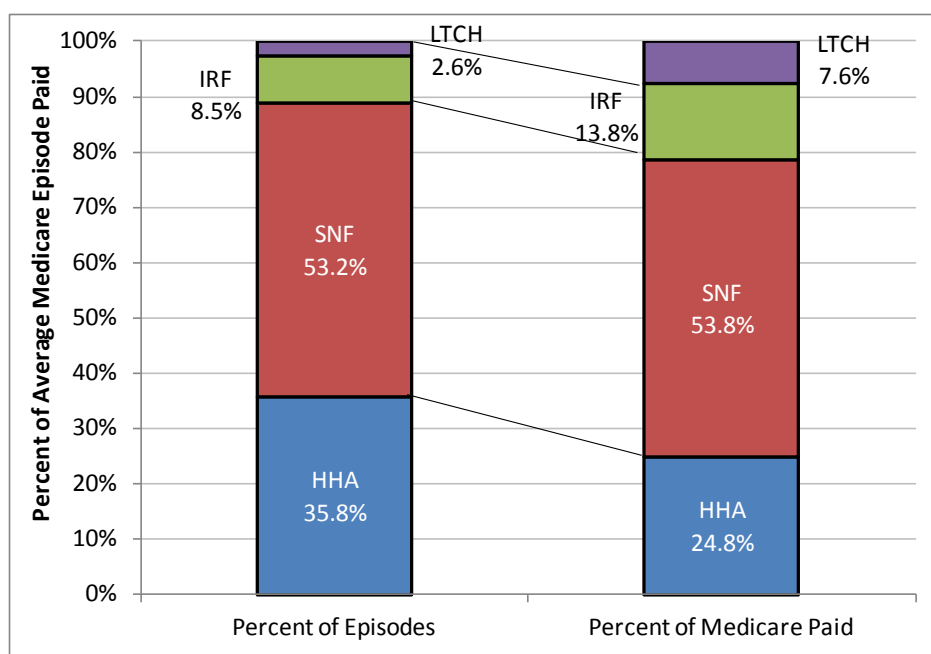
Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

⁴⁸ We did not compare differences in quality or patient outcomes across post-acute care settings and do not suggest current levels of service use are inappropriate.

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Across all MS-DRGs, HHA first-setting episodes represent 35.8 percent of episodes but account for only 25 percent of the average Medicare episode payment (Exhibit 5.5). Conversely, LTCH and IRF first-settings combined represent 11.1 percent of episodes but account for 21.4 percent of the average Medicare episode payments. SNFs represent a substantial portion of both episodes (53.2 percent) and average Medicare episode payments (53.8 percent). The differences in the relative costliness by setting highlight the importance of choosing the first-setting of post-acute care wisely.

Exhibit 5.5: Percent of Episodes versus Percent of Payment by First-setting Across all MS-DRGs for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Given the wide range of average Medicare episode payments across first-settings, these findings reinforce the importance of appropriate discharge planning and admitting patients to the most clinically appropriate, lower-cost setting within the bundle. It is unclear from these distributions, however, how much clinical overlap there is between patient populations and the extent to which some of the differences between episode payments across first-settings could be attributed to differences in patient severity.

We next compare the top 10 MS-DRGs ranked by total Medicare payment within each first-setting (Exhibit 5.6). There is significant overlap in payment rankings by MS-DRG across first-settings. For example, MS-DRG 470 (major joint replacement or

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reattachment of lower extremity w/o MCC) ranks first for HHA, SNF, and IRF, meaning that MS-DRG 470 episodes represent the highest proportion of Medicare episode payments in each of those first-settings. MS-DRG 871 (septicemia or severe sepsis w/o MV 96+ hours w/ MCC) ranks second in expenditures overall and for SNF, and third for HHA, LTCH, and Community. However, there is substantial variation in payment rankings across first-settings by MS-DRG. For example, MS-DRG 003 (ECMO or trach w/ MV 96+ hrs or PDX exc face, mouth & neck w/ maj O.R.) ranked first in average Medicare episode payment for LTCH but 89th for HHA, and 166th for STACH, suggesting there is little overlap in patients for this condition across first-settings.

Exhibit 5.6: Top 10 MS-DRGs Ranked by Total Medicare Episode Payment for Each First-setting for 30-day Fixed-length Episodes (2007-2009)

MS-DRG	Overall	HHA	SNF	IRF	LTCH	STACH	Community
470: Major joint replacement or reattachment of lower extremity w/o MCC	1	1	1	1	48	58	8
871: Septicemia or severe sepsis w/o MV 96+ hours w MCC	2	3	2	17	3	9	3
291: Heart failure & shock w MCC	3	2	5	26	9	2	2
003: ECMO or trach w MV 96+ hrs or PDX exc face, mouth & neck w maj O.R.	4	89	34	11	1	166	56
481: Hip & femur procedures except major joint w CC	5	70	3	3	57	252	111
194: Simple pneumonia & pleurisy w CC	6	9	6	60	19	6	7
292: Heart failure & shock w CC	7	4	9	46	41	1	6
690: Kidney & urinary tract infections w/o MCC	8	10	4	43	37	13	12
065: Intracranial hemorrhage or cerebral infarction w CC	9	32	7	2	33	56	48
329: Major small & large bowel procedures w MCC	10	5	8	18	5	49	44

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

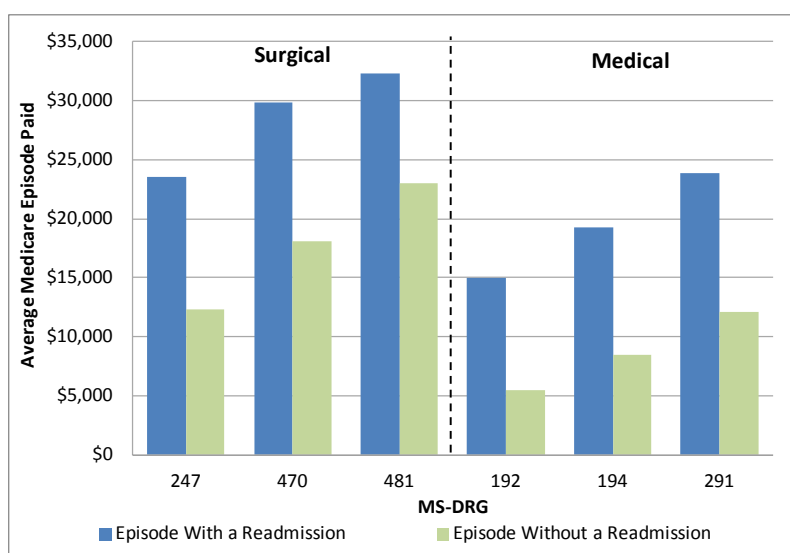
These rankings suggest that there is some degree of clinical comparability in patients across first-settings, and that, for certain conditions, providers may be able to safely substitute lower-intensity for higher-intensity settings when “clinically appropriate” in order to reduce costs within the bundle. Conversely, similar rankings across first-settings could suggest that MS-DRGs are not sufficiently risk-adjusting for patient episodes; however, the overlap in rankings by patient chronic condition across first-settings provides additional support for the idea of clinical comparability across settings. (See Appendix E, Exhibit E.1 for a comparison of Medicare episode payment rankings across first-settings by primary chronic condition.)

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Readmissions

Across all MS-DRG families, the presence of a hospital readmission approximately doubles the average Medicare episode payment (see Exhibit 5.7). For example, the average Medicare episode payment for MS-DRG 247 (percutaneous cardiovascular procedure with drug-eluting stent w/ MCC) is \$12,301 without a readmission and \$23,527 with a readmission. This trend is relatively consistent across both the surgical and medical MS-DRGs. (See Appendix E, Exhibit E.2 for the data underlying Exhibit 5.7.)

Exhibit 5.7: Average Medicare Episode Payment by Readmission Status for Select MS-DRGs for 30-day Fixed-length Episodes (2007-2009)



247: Percutaneous cardiovascular procedure with drug-eluting stent w/ MCC
470: Major joint replacement or reattachment of lower extremity w/o MCC
481: Hip & femur procedures except major joint w CC
192: Chronic obstructive pulmonary disease without CC/MCC
194: Simple pneumonia & pleurisy w CC
291: Heart failure & shock w MCC

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

In some cases this rate is lower (a 40 percent increase in MS-DRG 481 [hip & femur procedures except for major joint w CC]), and in others much higher (a 172 percent increase in MS-DRG 192 [chronic obstructive pulmonary disease without CC/MCC]). Readmissions for medical MS-DRGs (192, 194, and 291) have a higher percentage impact on average Medicare episode payment than those for surgical MS-DRGs (247, 470, 481).

Across MS-DRGs, the relative difference in readmission rates by first-setting varies substantially in both surgical and medical episodes (Exhibit 5.8). For example, for MS-DRG 247 (percutaneous cardiovascular procedure with drug-eluting stent w/ MCC) the readmission rate for episodes with a first-setting of Community is 7.8 percent, while the readmission rate with a first-setting of SNF is 29.1 percent. For MS-DRG 291 (heart

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failure and shock w/ MCC), the rate for readmissions with a first-setting of Other is 14.8 percent, while it is nearly twice as high (29.2 percent) with a first-setting of IRF.

Exhibit 5.8: Percent of Episodes with a Readmission for Select MS-DRGs by First-setting for 30-day Fixed-length Episodes (2007-2009)

First-setting	Percent of 30-day Episodes with a Readmission by MS-DRG					
	Surgical			Medical		
	247	470	481	192	194	291
HHA	17.4%	4.0%	6.9%	18.5%	16.8%	24.8%
SNF	29.1%	8.7%	13.6%	21.2%	18.6%	27.7%
IRF	*	8.5%	11.5%	23.7%	14.0%	29.2%
LTCH	*	6.9%	*	18.9%	12.9%	19.7%
Community	7.8%	5.0%	13.1%	12.9%	12.3%	23.1%
Other	12.9%	3.8%	6.8%	17.8%	13.0%	14.8%
Total	11.3%	6.6%	12.6%	17.1%	15.7%	24.2%

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries.

* Indicates cell size fewer than 11 observations.

In comparison to readmissions by first-setting, the distribution of readmissions by antecedent setting (the care setting immediately preceding the readmission) varies more substantially across various MS-DRGs (Exhibit 5.9). In all displayed medical MS-DRGs and one surgical MS-DRG (247 [percutaneous cardiovascular procedure with drug-eluting stent w/ MCC]), more than half of readmissions have Community as the antecedent setting.

However, in the two other surgical MS-DRGs (470 [major joint replacement or reattachment of lower extremity w/o MCC] and 481 [hip & femur procedures except for major joint w/ CC]), most of the readmissions are coming from antecedent facility-based post-acute care settings. Readmissions for MS-DRG 194 (simple pneumonia & pleurisy w/ CC) and MS-DRG 291 (heart failure and shock w/ MCC) are distributed more evenly across all antecedent settings.

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Exhibit 5.9: Percent of Episodes with a Readmission for Select MS-DRGs by Antecedent Setting for 30-day Fixed-length Episodes (2007-2009)

Antecedent Setting	Percent of Readmissions by MS-DRG					
	247	Surgical		Medical		
	247	470	481	192	194	291
HHA	4.4%	25.8%	7.9%	13.3%	15.2%	17.4%
SNF	2.3%	38.4%	65.5%	6.4%	20.1%	21.0%
IRF	*	8.8%	10.4%	0.4%	0.5%	1.0%
LTCH	*	*	*	*	0.3%	0.5%
Community	84.3%	18.3%	9.5%	74.6%	56.9%	52.9%
Other	8.2%	8.3%	5.4%	4.9%	6.9%	7.3%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

247: Percutaneous cardiovascular procedure with drug-eluting stent w/ MCC

470: Major joint replacement or reattachment of lower extremity w/o MCC

481: Hip & femur procedures except major joint w CC

192: Chronic obstructive pulmonary disease without CC/MCC

194: Simple pneumonia & pleurisy w CC

291: Heart failure & shock w MCC

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries.

* Indicates cell size fewer than 11 observations.

Together Exhibits 5.8 and 5.9 provide insight into where readmission reduction programs might be focused—either in the Community or with various post-acute care providers. These exhibits make the point that, even though the rate of readmissions might be higher for one post-acute care setting or another, in general, a very high proportion of readmissions are coming from the Community. This finding means that improvements in the hospital discharge planning process could have a large and direct impact on episode costs and readmissions.

PATIENT DEMOGRAPHIC CHARACTERISTICS

In looking at MS-DRG 470 (major joint replacement or reattachment of lower extremity w/o MCC), we see that the percent of episodes containing a readmission varied substantially across beneficiary characteristics (Exhibit 5.10). High readmission rates were seen in episodes containing a death (21.5 percent), for beneficiaries that were 85 and older (11.8 percent), and were dual eligible (9.2 percent). Beneficiaries in rural areas had a lower readmission rate than average (5.8 percent). The average readmission rate across all demographic characteristics was 6.6 percent for MS-DRG 470.

There was significantly less variation in readmission rates across demographic characteristics for MS-DRG 291 (heart failure and shock w/ MCC) in comparison to MS-DRG 470 (Exhibit 5.11).

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Exhibit 5.10: Percent of Episodes with a Readmission for Select Demographic Characteristics for MS-DRG 470 (Major Joint Replacement or Reattachment of Lower Extremity w/o MCC) for 30-day Fixed-length Episodes (2007-2009)

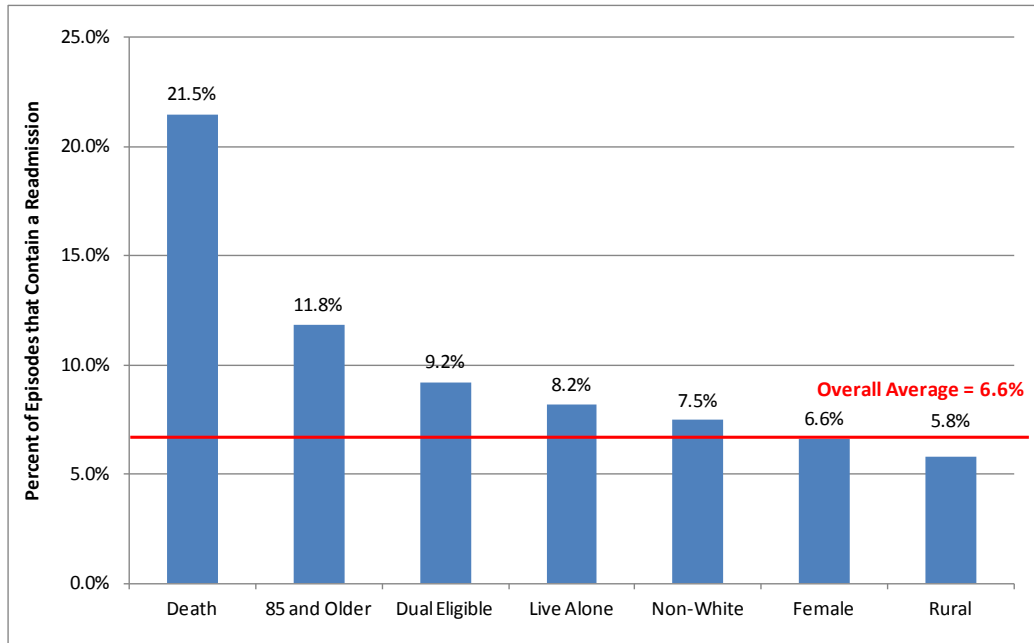
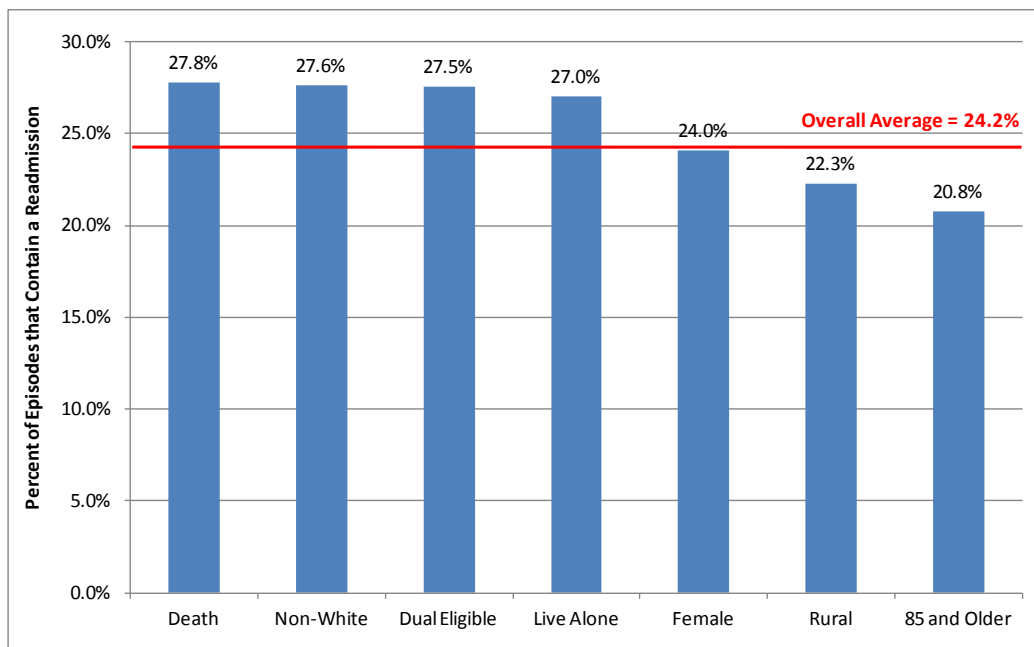


Exhibit 5.11: Percent of Episodes with a Readmission for Select Demographic Characteristics for MS-DRG 291 (Heart Failure and Shock w/ MCC) for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries.

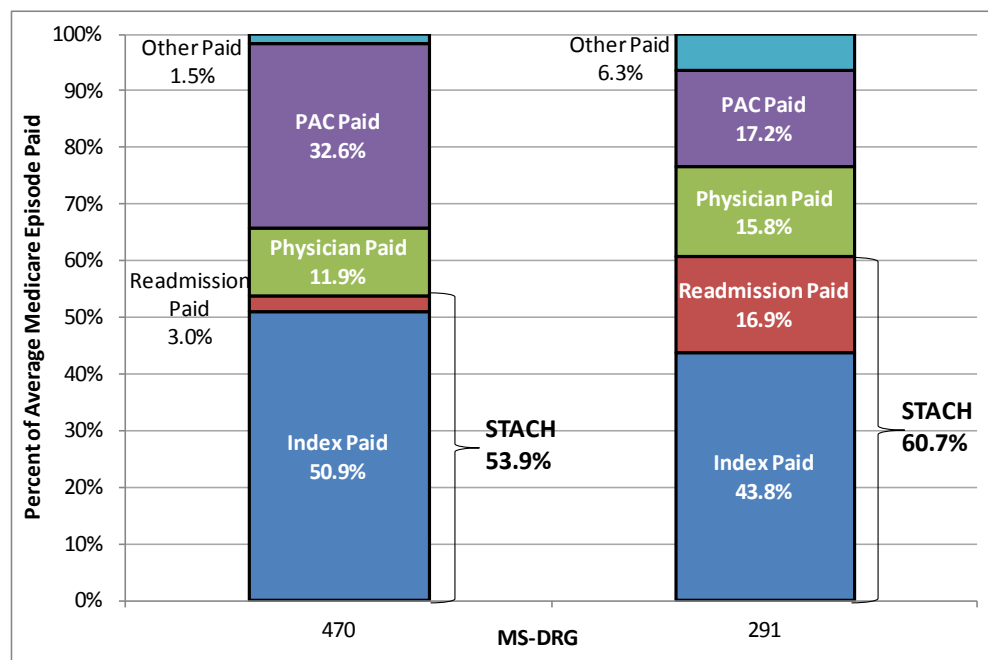
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Distribution of Costs across Service Types

Nearly one-third (32.6 percent) of average Medicare episode payment was for post-acute care in MS-DRG 470 episodes in comparison to 17.2 percent of average Medicare episode payment for post-acute care for MS-DRG 291 (Exhibit 5.12). Physician expenditures are similar in both MS-DRGs (although slightly higher in MS-DRG 291), while readmission expenditures as a percent of average Medicare episode payment are substantially higher in MS-DRG 291 (16.9 percent) than MS-DRG 470 (3.0 percent).

Having access to these types of data on a “real time” basis would allow bundling organizations to focus efforts on opportunities for cost reduction that likely exist. For example, more emphasis might be placed on managing readmissions for MS-DRG 291 than for MS-DRG 470, while more emphasis might be placed on post-acute care for MS-DRG 470. (See Appendix E, Exhibits E.3 and E.4 for the average and percent of Medicare episode payments for each type of service by first-setting for MS-DRGs 470 and 291.)

Exhibit 5.12: Percent of Medicare Payment by Setting for MS-DRG 470 and MS-DRG 291 for 30-day Fixed-length Episodes (2007-2009)



470: Major joint replacement or reattachment of lower extremity w/o MCC

291: Heart failure & shock w MCC

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

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Capabilities Required of Organizations Managing the Bundle

Beyond cost management, we have identified several additional considerations for providers in transitioning to a bundled payment system. The literature on payment bundling for episodes of care, from episodes as narrowly defined as the acute care surrounding a hospital admission to an annual global patient budget, suggests that an organization should have several management and operational capabilities in order for the organization to accept and manage bundled payments successfully.

A case study of ACOs—a payment reform that shares many overlapping goals and challenges with payment bundling—recently published by The Commonwealth Fund proposes the following three criteria for becoming an ACO: 1) the ability to provide or manage the continuum of care for patients through a real or virtually integrated delivery system; 2) sufficient size to support comprehensive performance measurement and expenditure projects; and 3) capability to design a provider-payer contract that supports prospective budget planning and internal distribution of shared savings.⁴⁹

Based upon the experience of private-sector bundled payment initiatives, participants in Medicare demonstrations on payment bundling, and prospective BPCI applicants, the following capabilities should be considered by providers in preparing for or implementing a bundled payment program:

- Designation of a single responsible entity
- Risk management
- Clinical and administrative processes
- Network formation
- Data capabilities

DESIGNATION OF A SINGLE RESPONSIBLE ENTITY

In its June 2008 *Report to Congress*, MedPAC recommended that Medicare reimburse a single provider entity (composed of a hospital and affiliated physicians) for the care provided during a hospitalization episode.⁵⁰ After a review of private-sector initiatives to bundle payments, GAO later reached the same conclusion: “successful implementation of bundled payments requires that a single entity, composed of the hospital and its physicians, contract with payers to receive and distribute the bundled payment.”⁵¹ The BPCI initiative allows health systems and other types of conveners to apply to serve as awardees (an awardee is the entity that receives the payment bundle), but requires that each applicant

⁴⁹ Van Citters AD, Larson BK, Carluzzo KL, Gbemudu JN, Kreindler SA, Wu FM, Shortell SM, Nelson EC, Fisher ES. (2012). Four health care organizations’ efforts to improve patient care and reduce costs [The Commonwealth Fund Publication No. 1571]. (New York, NY: The Commonwealth Fund). Available online at: http://www.commonwealthfund.org/~media/Files/Publications/Case%20Study/2012/Jan/1571_Van%20Citters_dartmouth_ACO_synthesis_01_12_2012.pdf

⁵⁰ Medicare Payment Advisory Commission (2008, June). Report to the Congress: Reforming the delivery system. (Washington, DC: MedPAC).

⁵¹ Cosgrove JC (2011, January 31). Medicare: Private sector initiatives to bundle hospital and physician payments for an episode of care [GAO-11-126R]. (Washington, DC: GAO).

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designate a single entity to accept financial responsibility for the bundle, consistent with MedPAC and GAO's recommendations.⁵²

This entity could take the form of a risk-bearing convener under the BPCI initiative. Other entities, such as a risk-bearing, third-party convener, could also be considered. The September 2012 MedPAC meeting suggested that payment bundles could include only the post-acute care following a hospitalization.⁵³ The four models included in the BPCI initiative (see Appendix A) also indicate that a variety of different entities could be responsible for different definitions of payment bundles.

RISK MANAGEMENT

Under a bundled payment system, individual providers will transition from being a revenue center under fee-for-service payment to being a cost center within the bundle. Payment bundling places risk on the convener and all associated providers to control costs, and therefore, the entity receiving the payment (whether a provider or a third-party convener) will be responsible for managing and mitigating risk.⁵⁴ Although many providers and conveners do not have previous experience managing or sharing risk, the capacity to do so is a pre-requisite for accepting a payment bundle.

Internal Discount

Under BPCI, the contracting organization is required to propose a minimum discount percentage of the historical average payments based on the length of the episode. In many cases, because the hospital may end up being totally responsible for the discount, the "internal discount" to the hospital may be larger than the nominal CMS discount amount. The proportion of the episode cost that will be under the control of the hospital is an important consideration for providers in designing risk management strategies. As noted above, a 30-day episode tends to have a larger proportionate share of the payment allocated to the inpatient hospital stay than a 90-day episode. Generally, as the proportion of cost that is allocated to the later part of the episode increases, the internal discount to the hospital increases if payments to post-acute care providers are not controlled.

For example, assuming that the hospital's portion of the episode cost is 50 percent, a 3 percent discount becomes an internal discount to the hospital of up to 6 percent, if the hospital can only control its own costs and has to assume the whole discount on only its own cost base. Depending on the relative proportion of the episode payment that is attributable to the hospital, the 90-day episode (with a two percent discount) may make more sense than the 30-day episode for a condition in which less of the relative allocation of the payment is to the hospital and the internal discount is therefore higher (such as a medical MS-DRG episode). See the example in Exhibit 5.13 below.

⁵² Bundled Payments for Care Improvement Initiative: Request for Application." (2011, August 22). Center for Medicare & Medicaid Innovation. Available online at: <http://innovations.cms.gov/Files/x/Bundled-Payments-for-Care-Improvement-Request-for-Applications.pdf>

⁵³ Medicare Payment Advisory Commission (2012, September 6). Approaches to bundling post-acute care [Transcript]. Available online at: http://www.medpac.gov/transcripts/092012_transcript.pdf

⁵⁴ MITRE Corporation (2011). Contracting for bundled payment. Prepared for the Centers for Medicare & Medicaid Services. (McLean, VA: MITRE Corporation).

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Exhibit 5.13: Example of How Internal Discount to Hospital Changes Based on Episode Length

Episode Payment	Percent Discount	Episode Length (days)	Percent Payment to Hospital	Discount	Payment to Hospital	Internal Discount
\$10,000	2%	30	75%	\$200	\$7,500	2.7%
\$10,000	2%	90	30%	\$200	\$3,000	6.7%

MS-DRGs 233 and 234 (coronary bypass w/ cardiac cath) have 71.5 percent of Medicare episode payments allocated to the index hospital admission in a 30-day, fixed-length episode (Chapter 3, Exhibit 3.5). At an average Medicare episode payment of \$39,646 (Chapter 3, Exhibit 3.2), a 3 percent discount would be \$1,189. If the hospital has to assume the whole discount, the internal discount would be 4.2 percent (or \$1,189/\$28,347). For heart failure and shock, the 3 percent discount of the \$12,006 episode would be \$360. Because the hospital is only 45 percent of the episode payment, the internal discount of the \$5,118 payment to the hospital would be 7 percent (\$360/\$5,118).

CLINICAL AND ADMINISTRATIVE PROCESSES

One factor influencing the selection process of target MS-DRGs for participation in the BPCI initiative was whether the provider had clinical and administrative processes in place to improve care over the duration of the episode, and whether the hospital had demonstrated expertise in the MS-DRG. Redesigned clinical and administrative processes are central to improving quality, reducing unnecessary care, and increasing the efficient use of resources under a bundled payment. Development of this infrastructure will require considerable local and national investment.

Additionally, the bundled payment entity must be able to apportion and distribute the bundled payment to all of the providers delivering services within the bundle. This responsibility will require providers to execute contracts with all participating providers, negotiate payment rates, and maintain the administrative capacity and information technology infrastructure to manage billings, collections, and any shared savings or gainsharing arrangements. Most providers currently lack the level of administrative, clinical, and data integration necessary to accept and distribute bundled payments.⁵⁵

Both Blue Cross Blue Shield of Massachusetts and the medical groups accepting global payments under the Alternative Quality Contract indicated that a “practice-based managed care infrastructure” is critical for success, which includes the capacity for data analysis and reporting, performance improvement processes that formally engage physicians, and care management programs for patients with chronic conditions.⁵⁶ Other features of a bundled

⁵⁵ Volk G, Petterson J. (2011). Global and episodic bundling: An overview and considerations for Medicaid. Prepared for the State Coverage Initiatives by Navigant Consulting, LLC. (Princeton, NJ: Robert Wood Johnson Foundation). Available online at: <http://www.rwjf.org/files/research/72272globalbundling201104.pdf>

⁵⁶ Mechanic RE, Santos P, Landon BE, Chernew ME. (2011). Medical group responses to global payment: Early lessons from the ‘Alternative Quality Contract’ in Massachusetts. *Health Affairs* 30(9): 1734-1742.

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payment system, such as leadership and physician engagement, have been highlighted as necessary in order to enable bundled payments to succeed.⁵⁷

FORMING A NETWORK

The transition from a fee-for-service system to a bundled payment system imposes risk on the potential bundled payment entity for the cost and care provided by a wide range of provider types, many of which are not affiliated or integrated with the lead organization. Providers will need to develop new, innovative business and clinical models and form strong networks with other providers.

Exhibit 5.14 below shows the average number of physicians, HHAs, SNFs, IRFs, and LTCHs that each hospital interacted with during the 2007-2009 time period. The average hospital would need to have contracts with 636 physicians, 14 HHAs, 16 SNFs, two IRFs, and one LTCH to capture all of the major providers included in Medicare payment bundles.

Exhibit 5.14: Count of Unique Providers: Distribution by Type Based on Index Hospital for 30-day Fixed-length Episodes (2007-2009)

Measure	Physicians	HHA	SNF	IRF	LTCH
Number of Index Hospitals	3,635	3,635	3,635	3,635	3,635
Minimum	1	0	0	0	0
25th Percentile	234	4	6	1	0
50th Percentile	477	9	12	1	1
75th Percentile	853	18	22	2	2
Maximum	6,598	168	140	28	20
Mean	636	14	16	2	1
Standard Deviation	589	16	16	2	1
Coefficient of Variation	0.93	1.14	0.98	1.19	1.36

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars.

From a business perspective, bundled payment entities will need to conduct detailed analyses and planning in order to select the right physician and post-acute care partners. Aligned partners are critical to developing and implementing effective information and clinical practice systems. Other factors for hospitals are the employment status of physicians and the level of partnership with post-acute care providers. Beneficiary freedom of choice to select any post-acute care provider was a major concern of the prospective BPCI initiative applicants we interviewed, as this undermines the ability of bundled payment entities to manage costs during the episode, even if contracts have been negotiated with partners.

⁵⁷ MITRE Corporation (2011). Contracting for bundled payment. Prepared for the Centers for Medicare & Medicaid Services. (McLean, VA: MITRE Corporation); Mechanic RE, Santos P, Landon BE, Chernew ME. (2011). Medical group responses to global payment: Early lessons from the 'Alternative Quality Contract' in Massachusetts. *Health Affairs* 30(9): 1734-1742.

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DATA CAPABILITIES

An early step in the process of constructing a payment bundle under the BPCI initiative is calculating baseline revenues and costs. According to MITRE Corporation, which produced a series of documents for CMS to offer guidance to applicants under the BPCI initiative, “the participating organization will need the necessary capabilities of storing, managing, and analyzing the underlying financial source data (e.g., claims), supported by systems and personnel in place to develop and refine statistical models”⁵⁸ in order to develop accurate prices for the bundles. While this capacity does not necessarily have to reside within the organization itself—an organization accepting payment bundles could hire an external vendor to conduct all necessary data processing and management activities—this capability must be present in organizations accepting a bundled payment.

There is evidence in the literature that this capability is important: the preliminary success of participants in Blue Cross Blue Shield of Massachusetts’ Alternative Quality Contract depended on being able to generate and distribute performance data, thereby engaging physicians in the performance improvement process.⁵⁹ MedPAC believes that tracking data on service use, costs, and payments over time and across settings will be necessary in order for provider entities to implement payment bundling as well.⁶⁰

A robust data warehouse—that integrates clinical, financial, and billing data in order to produce reports on quality measures, comparative costs across patients or procedures, or physician performance as well as allow for predictive modeling to identify high risk patients⁶¹—will be necessary to manage and evaluate the effectiveness of bundled payments. The experience of four ACOs participating in the Brookings–Dartmouth ACO Pilot program indicated that a data warehouse was fundamental to support analytic and reporting capabilities across the continuum of care management.⁶² In order to understand and manage costs under a bundled payment system, providers will need ongoing access to real-time data and the necessary capabilities—including information technology systems and personnel—to store, manage, and analyze the underlying financial and clinical data.

Once the episodes of care for payment bundling have been defined and a methodology has been chosen for how the prices will be set, convener organizations managing risk—and other providers delivering care—under the bundled payment will likely have these and other considerations in the implementation, operationalization, and day-to-day management of payment bundling.

⁵⁸ MITRE Corporation (2011). Information technology for bundled payment. Prepared for the Centers for Medicare & Medicaid Services. (McLean, VA: MITRE Corporation).

⁵⁹ Mechanic RE, Santos P, Landon BE, Chernew ME. (2011). Medical group responses to global payment: Early lessons from the ‘Alternative Quality Contract’ in Massachusetts. *Health Affairs* 30(9): 1734-1742.

⁶⁰ Medicare Payment Advisory Commission (2010, March). Report to the Congress: Medicare payment policy. (Washington, DC: MedPAC).

⁶¹ MITRE Corporation (2011). Information technology for bundled payment. Prepared for the Centers for Medicare & Medicaid Services. (McLean, VA: MITRE Corporation)

⁶² Van Citters AD, Larson BK, Carluzzo KL, Gbemudu JN, Kreindler SA, Wu FM, Shortell SM, Nelson EC, Fisher ES. (2012). Four health care organizations’ efforts to improve patient care and reduce costs [The Commonwealth Fund Publication No. 1571]. (New York, NY: The Commonwealth Fund). Available online at: http://www.commonwealthfund.org/~media/Files/Publications/Case%20Study/2012/Jan/1571_Van%20Citters_dartmouth_ACO_synthesis_01_12_2012.pdf

Chapter 6: Other Program Design Issues for Policymakers

Research Questions: Other Program Design Issues for Policymakers

- What protections can be built in to guard against stinting, over-utilization of bundles, and adverse selection? How should regional variation in practice patterns be addressed?
- Should there be a minimum volume requirement?
- What are appropriate (episode-specific) quality measures?
- What evaluation criteria should be met before a pilot program is expanded nationally?

In addition to defining and setting the price of the bundle, the design and implementation of a national payment bundling program raises a number of other issues for policymakers; namely: a) how to protect against stinting (or the under-provision of care), adverse selection, and over-utilization; b) whether to set a minimum volume threshold; c) how to measure quality; d) how to address regional variation in costs and practice patterns; and e) how to evaluate a national payment bundling program.

STINTING, ADVERSE SELECTION AND OVER-UTILIZATION

Bundled payment recipients must mitigate risks including incentives for hospitals and providers to reduce necessary clinical care for patients and reduce investments in resources with proven safety and patient outcome efficacy in order to reduce costs within the payment bundle. Protections against these potential unintended consequences of bundling include: 1) risk (or case-mix) adjustment; 2) outlier payment policy; 3) phase-in/transition; 4) gainsharing; 5) pay-for-performance; and 6) quality and outcomes measurement and reporting as well as the use of patient assessment tools that cross the care continuum. Policies also will need to be considered that prevent or disincentivize providers from shifting care beyond the end of the episode covered by the payment bundle.

Chapter 6: Considerations for Policymakers

Risk Adjustment

Developing a coherent risk adjustment policy will likely be the primary method for preventing the practice of “cherry picking” or “cream skimming” patients under payment bundling. Risk adjustment is needed for both payment and outcome measurement; it is essential to creating a level playing field that takes into account patient differences.⁶³ Risk adjustment ensures that high-need patients are well served and that payers and providers are not penalized for serving them well.⁶⁴

As discussed in Chapter 4, our regression models—which predict Medicare episode payments—show that using MS-DRGs and facility and beneficiary characteristics to risk-adjust bundled payments is one approach that could be used to increase the accuracy of a payment system. The impact of risk adjustment would become more pronounced under a bundled payment system based on provider *costs*.

Outlier Payment Policy

In most existing payment systems, patient characteristics (e.g., severity, function) explain only about 20 percent of the variation in resource utilization and costs. Even under the best circumstances, regardless of the patient grouper used, there will be outliers, especially given the larger bundle of services to be incorporated into a new system where providers will be responsible for all of the downstream care following the index hospitalization. Outlier policies narrow the boundary of financial uncertainty thereby helping to mitigate undue provider risk. The outlier component of our payment modeling, also discussed in Chapter 4, suggests that outliers can improve payment accuracy substantially.

Phase-In/Transition

Congress often includes transitions or phase-ins of new Medicare payment systems, which enable providers and beneficiaries to adapt to new payment rates and incentives over time, rather than simply cutting costs and the services that are supportive of patient quality.⁶⁵ The implementation of the IPPS included both a complex transition that phased in the new payment rates at national, regional and hospital-specific rates, and blended the old and new payment rates over a four-year period. A transition from a limited selection of MS-DRGs to many MS-DRGs also could be considered.

A bundled payment system will likely require a lengthy phase-in where current provider-specific payments based on the existing prospective payment systems are utilized in the blends. The trade-off between payment accuracy (using a high percentage of provider specific amounts) and aligning incentives within the bundle must be carefully considered.

⁶³ Center for Post-acute Studies (2009). *Bundling Payment for Post-acute Care: Building Blocks and Policy Options*. (Washington, DC: National Rehabilitation Hospital). Available at: <http://www.postacuteconference.org>

⁶⁴ DeJong G. (2010). Bundling acute and postacute payment from a culture of compliance to a culture of innovation and best practice. *Physical Therapy* 90(5): 661.

⁶⁵ Jha AK, Orav J, Dobson A, Book RA, Epstein AM. (2009.) Measuring efficiency: The association of hospital costs and quality of care. *Health Affairs* 28(3): 897-906.

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For example, Exhibit 6.1 shows the phase-in schedule for operating payments when the IPPS was implemented in 1983. Phase-ins typically blend old payments with new payments. Exhibit 6.2 presents the original IPPS payment blend schedule. As experience with prospective payments has been gained, transitions and blends typically include prior payment amounts and national payment rates (with less reliance on regional rates).

Exhibit 6.1: Payment Phase-in/Transitions Implemented for Operating Payments in IPPS Legislation

Payment Phase-In/Transition: Three year phase-in with varying proportions of hospital-specific national and regional payment rates: <ul style="list-style-type: none">• Hospital-specific amounts• Federal rates<ul style="list-style-type: none">○ 18 regional rates<ul style="list-style-type: none">▪ Nine census divisions, each with one urban and one rural rate○ Two national rates (urban and rural)• Phase-in by hospital fiscal year (FY)
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Exhibit 6.2: Original IPPS Operating Payment Blend Schedule (1983-1986)

Period Beginning On or After	Hospital-Specific Portion	Federal Portion	Regional/National Split
October 1, 1983	75%	25%	(100% regional; 0% national)
October 1, 1984	50%	50%	(75% regional; 25% national)
October 1, 1985	25%	75%	(50% regional; 50% national)
October 1, 1986	0%	100%	(0% regional; 100% national)

The use of demonstrations or pilot studies to observe and document the payment concept could help better inform a strategy for phase-in and blend of payment rates. The IPPS was informed by the New Jersey DRG payment demonstration experience and a decade of DRG development work. However, even with this extensive experience, Congress incorporated a lengthy transition into the initial IPPS legislation. Given the dislocation that designing a bundled payment system around MS-DRGs could create in the post-acute care sector, a blended approach could protect post-acute care providers until a uniform patient severity adjusted payment system could be implemented.

Gainsharing

Gainsharing refers to an arrangement between a physician and a hospital to share in the cost savings that result from specific actions to improve the efficiency of care delivery.⁶⁶ Financial gainsharing among providers can facilitate a shared stake in the patient’s outcome and foster mutual accountability. For example, under the Medicare ACE Demonstration, Hillcrest Medical Center in Tulsa, Oklahoma has a Board of Managers that meets quarterly and includes a “quality committee,” which monitors the quality data used to trigger

⁶⁶ American Academy of Orthopaedic Surgeons. Gainsharing position statement. Available online at: <http://www.aaos.org/about/papers/position/1171.asp>

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payments to hospitals, and a “gainsharing committee,” which ensures adherence to gainsharing requirements. Doctors may voluntarily participate in implementing efficiency and quality improvements if they share in provider incentive payments.

Overall, a gainsharing policy can encourage providers to participate in a bundled payment program by reducing their risk, thus limiting their incentives to stint on care.⁶⁷ Incentives to skimp on care are inherent in any fixed-length episode payment system because there is no payment for any additional services. With gainsharing, providers would share with Medicare any savings achieved if spending fell below the target, thereby financially incenting them to participate in bundling.

Pay-for-Performance (P4P)

This approach involves specific payments or bonuses for achieving specified outcomes to improve quality. P4P can help counter the incentives inherent in fixed payments such as bundled payment to compromise the quality of care and increase the number of units paid for (e.g., bundles, in this case). While P4P as a component of a payment system has strong initial appeal, few programs have been formally evaluated. Those that have been evaluated have shown mixed results.⁶⁸ However, adjustment of payments for performance on quality measures is critical for any episode-based payment program that seeks to substantially improve the quality of care and hold providers accountable for outcomes under any incentives that might prompt providers to withhold needed care. These types of payment adjustments for quality performance could be applied to bundled payments based on delivery of recommended services or attainment of desired clinical outcomes during the episode.

Quality Measurement and Reporting

Just as with payments, quality measure development efforts for bundled payments must produce quality metrics that reflect the entire duration of the bundle.⁶⁹ Episode-based payment reforms can potentially pair higher incentives with better quality performance to reduce costs while improving quality.⁷⁰ Very few, if any, quality measures are episode-specific, but some existing quality measures can be applied from other settings and purposes to episode-based payment. (See Appendix F for a list of relevant quality measures).

Current CMS quality measure reporting programs, as they apply to specific settings included within the payment bundle and relate diagnostically to the MS-DRGs selected for payment bundling, could be modified to span the episode. Examples include the hospital

⁶⁷ Sood N, Huckfeldt PJ, Escarce JJ, et al. (2011). Medicare’s bundled payment pilot for acute and postacute care: Analysis and recommendations on where to begin. *Health Affairs* 30(9): 1708-1717.

⁶⁸ Mechanic RE, Altman SH. (2009). Payment reform options: Episode payment is a good place to start. *Health Affairs* 28(2): w262-w271.

⁶⁹ McClellan M. (2011). Reforming payments to healthcare providers: The key to slowing healthcare cost growth while improving quality? *Journal of Economic Perspectives* 25(2): 78.

⁷⁰ Birkmeyer JD, Gust C, Baser O, et al. (2010). Medicare payments for common inpatient procedures: Implications for episode-based payment bundling. *Health Services Research* 45(6): 1783-1795.

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Inpatient Quality Reporting (IQR), Outpatient Quality Reporting (OQR), Physician Quality Reporting System (PQRS), and the quality measurement systems specific to each post-acute care setting. The BPCI initiative does not require any additional quality reporting measures but includes quality metrics from the systems described above.

Waivers

In order for a bundled payment system to work, a number of risk reduction strategies would be beneficial but are currently precluded under Medicare for the BPCI initiative. These include:

- Limiting choice of provider
- Limiting cases within MS-DRGs to those physicians who have a contract with the bundled payment entity
- Incentivizing the patient by eliminating the co-pay for using an approved provider in the bundle
- Employing restrictions to the types of care that are included within the bundle
- Allowing bundled payment entities to negotiate the design and terms of the payment system with payers in order to better meet local needs and adapt to local infrastructure
- Considering a shared savings model without downside risk to the hospital or convener beyond the proposed discount
- Restrictions specific to each prospective payment (e.g., homebound requirement in HHAs, three-day stay rule for SNFs, 60 percent rule for IRFs, and 25-day average length of stay rule for LTCHs)

These types of restrictions, which do not apply to other risk-based payment systems such as the Medicare Advantage program, can create difficulties for providers who are trying to innovate around new clinical processes and use the providers in their networks most efficiently.

Episode Volume

In addition to payment adjustments, procedural volume is an important component of provider financial risk. Procedural volume is considered to be a contributor to and an indicator of clinical outcomes—the higher the volume, the more likely the physicians and care delivery teams are to achieve strong clinical outcomes (quality). Volume is also important to providers in terms of financial stability.

A national bundled payment system could pose a substantial financial risk to low-volume providers without protections such as outlier payments, risk corridors, and other strategies to slowly phase-in or transition from fee-for-service to bundled payments.

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Exhibit 6.3 shows the percent of providers who have a specific number of episodes by MS-DRG family. For example, we found that 42.9 percent of providers had more than 250 episodes of major joint replacement (MS-DRGs 469 and 470), while only 1.6 percent of providers had over 250 episodes for coronary bypass with cardiac catheterization (MS-DRGs 233 and 234). There is considerable variability in episode volume across providers and the number of providers with fewer than 100 episodes is quite large for many MS-DRG families. (This table should be interpreted with some caution, as it is based on a 5 percent sample of beneficiaries and may not be entirely representative across providers.)

Exhibit 6.3: Percent of Providers by Episode Volume by MS-DRG Family for 30-day Fixed-length Episodes (2007-2009)

MS-DRG Family	Number of Episodes						
	None	1 to 49	50 to 99	100 to 149	150 to 199	200 to 249	250+
Acute ischemic stroke w use of thrombolytic agent (61, 62, 63)	83.7%	14.2%	1.7%	0.4%	0.0%	0.0%	0.0%
Intracranial hemorrhage or cerebral infarction (64, 65, 66)	15.9%	14.9%	13.9%	15.1%	7.6%	8.4%	24.1%
Nonspecific cva & precerebral occlusion w/o infarct (67,68)	71.5%	24.5%	3.5%	0.4%	*	0.0%	*
Chronic obstructive pulmonary disease (190, 191, 192)	10.9%	8.6%	9.2%	12.5%	8.2%	9.7%	41.0%
Simple pneumonia & pleurisy (193, 194, 195)	8.4%	6.6%	7.0%	12.2%	8.4%	11.5%	45.9%
Cardiac valve & oth maj cardiothoracic proc w card cath (216, 217, 218)	80.6%	12.5%	3.7%	2.3%	0.5%	0.1%	0.3%
Cardiac valve & oth maj cardiothoracic proc w/o card cath (219, 220, 221)	77.1%	10.5%	5.4%	3.5%	1.2%	1.2%	1.1%
Coronary bypass w ptca (231, 232)	93.1%	6.6%	0.3%	0.0%	0.0%	0.0%	0.0%
Coronary bypass w cardiac cath (233, 234)	72.0%	9.3%	6.9%	6.3%	2.2%	1.8%	1.6%
Coronary bypass w/o cardiac cath (235, 236)	75.5%	11.4%	6.2%	4.2%	1.1%	0.9%	0.7%
Perc cardiovasc proc w drug-eluting stent (247)	60.1%	6.1%	5.8%	5.7%	3.0%	4.3%	14.9%
Heart failure & shock (291, 292, 293)	9.4%	6.7%	7.4%	10.7%	7.2%	9.6%	49.1%
Bilateral or multiple major joint procedures of lower extremity (461,462)	81.1%	14.1%	2.3%	1.6%	0.3%	0.2%	0.4%
Revision of hip or knee replacement (466,467,468)	59.4%	24.1%	8.4%	4.7%	1.3%	0.8%	1.2%
Major joint replacement or reattachment of lower extremity (469, 470)	19.5%	9.5%	7.2%	9.1%	5.0%	6.8%	42.9%
Hip & femur procedures except major joint (480, 481, 482)	25.7%	16.9%	13.4%	15.5%	7.9%	8.1%	12.6%

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

* Indicates cell size fewer than 11 observations.

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In addition, we developed a statistical estimate to predict the volume of cases at which the average Medicare episode payment is relatively stable (meaning that an outlier case would not substantially affect the average value). Across all MS-DRGs, our estimates are consistent with a volume of approximately 200 cases.⁷¹

Previous Medicare demonstrations provided a guideline for the volume of episodes necessary to absorb the potential risk of payment bundling. In the Medicare ACE Demonstration, CMS required applicants to meet a minimum volume threshold of 100 Medicare cardiac surgeries (a combination of CABG and valve procedures), 200 Medicare percutaneous transluminal coronary angioplasties (PTCA), and 90 Medicare joint replacements (hip and knee procedures combined) per year.

These volume thresholds are also consistent with the opinions expressed by prospective BPCI applicants. One interviewee—a network of multiple hospitals—was considering MS-DRGs, or MS-DRG families, with approximately 200 cases. For those MS-DRGs considered to be a specialty, or where the hospital network had clinical programs in place to re-engineer the care delivery process, the threshold was under 200. Another prospective applicant—a SNF with multiple facilities—was considering 200-300 cases, but was unable to reach this threshold without combining a wide variety of MS-DRGs. Generally, individual MS-DRGs were not considered to be high enough in volume to reach this threshold and MS-DRGs would need to be aggregated to a higher level (such as MS-DRG families or MDCs) to mitigate financial risk due to payment bundling.

GEOGRAPHIC CONSIDERATIONS

The influence of regional variation on payment bundling will need to be addressed, with regard to the number of episodes, the mix of providers within an episode, and the most common care pathways followed by patients. For example, hospital readmission days of care per 1,000 fee-for-service Medicare beneficiaries by CMS region vary from 20.1 in Region 10 to 54.1 in Region 2 (see Exhibit 4.7). Bundling may be a tool that can be used to drive out unwarranted variation after adjusting for factors beyond the control of providers.

Many of the BPCI initiative applicants we interviewed expressed concern that their local provider networks in place were not yet strong enough to support care coordination and management of transitions across settings under a bundled payment. This issue is magnified as beneficiaries move in and out of different HRRs (or other geographic units) during the course of an episode of care. The wide variation in average Medicare episode payments across HRRs (see Exhibits 4.5 and 4.6 and Appendix D, Exhibits D.7 and D.8) also suggests that the costs of care delivered in one patient episode across multiple HRRs will be difficult to manage. Responsibility for care delivered in a different region of the country places considerable risk on providers without the clinical, financial, and administrative

⁷¹ Assuming a normal distribution, we estimated the number of cases for each MS-DRG at which there was less than a one percent chance of a random case increasing the average Medicare episode payment by more than one percent (the minimum discount required by the BPCI initiative).

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capacity to control costs at such a distance and without ongoing relationships with local providers.

EVALUATION CRITERIA FOR IMPLEMENTING A NATIONAL PROGRAM

CMS's determination of whether or not to expand a pilot initiative on payment bundling would likely depend on whether the pilot has achieved its goals. The success of payment bundling can be evaluated using the following criteria in Exhibit 6.4.

Exhibit 6.4: Criteria for Evaluating the Success of a National Payment Bundling Pilot

Evaluation Category	Criteria
Administrative concerns	Easy to understand Simple to administer
Goals	Reductions in cost Reductions in readmissions and poor outcomes Improvements in quality, outcomes, care coordination, and patient satisfaction
Adverse outcomes	Volume increases (more bundles) Financial sustainability of providers

Given the size and complexity of the issues raised by payment bundling, MedPAC originally recommended an incremental approach to implementation of a payment bundling program that culminated in a national pilot. According to MedPAC, the “objective of the demonstration should be to determine whether bundled payment across an episode of care can improve coordination of care, reduce the incentive for providers to furnish services of low value, improve providers’ efficiency, and reduce Medicare spending while not otherwise adversely affecting the quality or outcomes of care.”⁷²

In addition to determining whether payment bundling achieved the goals of improved quality of care and decreased Medicare expenditures, it will be important to identify the difficulties that arose in implementing the program and the extent to which any unintended consequences occurred. A major unintended consequence anticipated by MedPAC and others is the potential for provider entities to increase the volume of bundles produced in order to increase total revenue (as the payment per bundle will be discounted).⁷³

⁷² Medicare Payment Advisory Commission (2008, June). Report to the Congress: Reforming the delivery system. (Washington, DC: MedPAC).

⁷³ Mechanic RE (2011). Opportunities and challenges for episode-based payment. *New England Journal of Medicine* 365(9): 777-779.

Chapter 7: Conclusion

A Medicare payment system for bundling will need to carefully consider the issues raised in this report. The person-level linked Medicare claims files currently available can support such an effort. The use of a lengthy transition/blend process could ensure adequate time for providers to respond to new payment incentives as they develop solutions to the care re-engineering questions posed in this report. And as with payment for any sized bundle, the unintended provision of more bundles would likely occur unless carefully monitored with quality and outcome measures.

Summary of Findings

If a national payment bundling program is to be designed and implemented, policymakers will need to design a complete payment system framework, as it is unlikely a national program would use provider-specific historic benchmarks for episode costs (such as under the BPCI program). To design a payment system, it will likely be necessary to determine the *cost* to providers of delivering care within an episode, rather than using the current Medicare payment levels to predict payment.

In order to design and implement a pilot initiative on payment bundling, expand a pilot initiative into a national payment bundling program, or decide whether to participate, CMS, other policymakers, and providers should consider the findings of this report summarized below in Exhibit 7.1.

Chapter 7: Conclusion

Exhibit 7.1: Summary of Findings

Defining the Bundle

- Conditions well-suited to payment bundling should be prevalent and/or expensive to the Medicare program, have limited variation in episode payments, and have evidence-based clinical guidelines.
- Episode length should be considered based on the nature of the clinical condition and the balance between risk to providers and opportunity for clinical interventions and/or efficiency gains.
- Providers, services, and patients should be evaluated for inclusion in an episode-based payment system based on clinical criteria and their likely impact on variation in episode payments.

Pricing the Bundle

- Payment bundles should be risk-adjusted for factors that cause substantial variation in episode payments, such as beneficiary demographic and clinical characteristics as well as facility characteristics.
- Episode payments will require an outlier policy to protect patient quality of care and mitigate financial risk, and may also require risk corridors, stop-loss provisions, and other protections in order to succeed.
- The inclusion or exclusion of IME, DSH, and other add-on payments in the price of the bundle should be carefully considered, as these payments have major implications for the financial sustainability of teaching hospitals and safety-net providers.

Managing the Bundle

- Providers should examine patient pathways to understand care across the continuum to better target clinical interventions.
- Hospital readmissions double the average Medicare episode payment across MS-DRGs; providers will need to target readmission reduction efforts under payment bundling, as the risk of readmission differs across beneficiary demographic and clinical characteristics as well as condition.
- As the first post-acute care setting to which a beneficiary is discharged from the hospital has a major impact on Medicare episode payment, hospitals will need to carefully consider patient placement in discharge planning efforts.
- To better focus care management efforts, providers will need to understand the distribution of Medicare episode payments across settings.
- Providers need to consider issues such as designation of a single entity to accept the payment bundle, risk management, clinical and administrative processes, network formation and data capabilities in preparing for payment bundling.

Other Program Design Issues

- While the use of provider-specific historical benchmarks as the basis for payment (such as under the BPCI initiative) takes financial risk into account, a national program based on a single, national payment rate will need to incorporate more generally applicable risk adjustment methodologies.
- Any national program should be designed to protect beneficiaries against stinting through payment mechanisms, such as risk adjustment, outlier payments and/or gainsharing, as well as episode-specific quality and outcome measures and patient assessment tools.
- The importance of episode volume should be considered, as many providers do not have the volume of services needed to manage the risk of bundled payments.
- In order to better coordinate patient care, providers will likely require waivers to current Medicare requirements that impede their ability to manage care across settings.

Chapter 7: Conclusion

Limitations and Considerations for Future Research

Ultimately, the question that needs to be answered is as follows:

Can preliminary Medicare payment bundling efforts be scaled such that they are universally applicable?

Achieving scalability in the near future is unlikely, given the difficulty many providers had with submitting applications to the BPCI initiative. It may be that a series of hybrid bundling programs will need to be developed that blend old payments with new bundled payments (or only bundle limited clinical conditions) as inexperienced organizations work their way through the payment bundle development process. One extreme form of risk adjustment is cost-based payments, and blended payments based in large part upon existing payment methods may be needed to appropriately “grow” bundling to the national level while maintaining payment protections for conveners and providers. Complex transition strategies will undoubtedly be necessary to adapt payment bundling to our health care system, where health care capabilities are, at heart, a local phenomenon and enhanced data capabilities are just now being considered.

The exploratory regression models we developed to predict a beneficiary and facility level risk-adjusted payment are based on *revenues* rather than costs, and are therefore creating a certain level of bias in the predicted payments we estimate. Constructing and analyzing a cost-based episode database would be a useful next step in understanding how a bundled payment system would be appropriately risk-adjusted.

Future research could be to help identify the characteristics of episodes that are prone to higher readmission rates, such as patient demographic or clinical factors, patient adherence to a prescribed health care regimen upon discharge from the index hospital admission, or systematic geography-related issues.

Appendix A

The Center for Medicare & Medicaid Innovation (CMMI) Bundled Payments for Care Improvement (BPCI) Initiative

Appendix A: The BPCI Initiative

Bundled Payments for Care Improvement (BPCI) Initiative

A national pilot program on payment bundling of acute and post-acute care was originally mandated in Section 3023 of the Affordable Care Act. According to the legislation, the pilot program was intended to be operational as of January 1, 2013; however, the Centers for Medicare & Medicaid Services (CMS) delayed implementation of the national program. In its stead, the Center for Medicare & Medicaid Innovation (CMMI) is in the process of implementing a program with a similar goal: the Bundled Payments for Care Improvement (BPCI) initiative. The program was first announced in August 2011, and the deadline for applications was June 28, 2012.

Under the BPCI initiative, there are four models under which convener organizations (third parties that take risk for the bundled payment or provide administrative and technical assistance to organizations under the bundled payment) and providers are allowed to propose payment bundles. Providers are able to select the Medicare Severity Diagnosis-Related Groups (MS-DRGs) or MS-DRG families, as well as the length of the episode, in their proposals to CMS. Bundled payments will be negotiated with CMS based on provider-specific historical benchmarks, and providers are required to offer CMS a minimum discount that varies depending on the model and the episode length.

BPCI MODEL DEFINITIONS

Model 1 (inpatient stay only): Hospitals receive a discounted payment, but physicians receive full fee-for-service rates. CMS requires the minimum discount to Medicare to increase from zero percent during the first six months to 2 percent in year three of the bid. All MS-DRGs are discounted, but gainsharing is only required on certain MS-DRGs.

Model 2 (inpatient stay plus post-discharge services): Hospitals, physicians, and post-acute care providers receive fee-for-service rates that are retrospectively reconciled against a target price. CMS requires a 3 percent minimum discount to Medicare for 30 to 89 days after discharge and a 2 percent discount for an episode that is 90 days or longer.

Model 3 (post discharge services only): Hospitals, physicians, and post-acute care providers receive fee-for-service rates that are retrospectively reconciled against a target price. The applicant proposes the discount amount to Medicare.

Model 4 (inpatient stay only): A payment amount is established prospectively for the admitting hospital, and the hospital distributes payments to physicians. The applicant proposes the discount amount to Medicare, at a minimum of 3 percent.

For a more complete description, see the CMS fact sheet on the BPCI initiative.¹

¹ Centers for Medicare and Medicaid Services (2011, August 23). Fact sheet: Bundled payments for care improvement initiative. Available online at: <http://innovations.cms.gov/Files/fact-sheet/Bundled-Payment-Fact-Sheet.pdf>

Appendix B: Analytic Methodology

Appendix B

Analytic Methodology

Appendix B: Analytic Methodology

Exhibit B.1: Differences between AHA/AAMC Episodes and BPCI Initiative Post-acute Care Episodes

Episode Metric	AHA/AAMC		BPCI	
	Descriptive	Multivariate		
Goal of bundled payment analyses	Policy	Policy	Pricing	
Episode Payment	Medicare episode payments include IME, DSH, and capital	No	Yes	No
	Medicare episode payments include beneficiary cost-sharing (co-payments and deductibles) and third party payments	No	Yes	Yes (4/1/12)
	Payments are adjusted for wage index and standardized to 2009 dollars	Yes	Yes	No
Episode Composition	Includes fixed-length episode, starting day after hospital discharge	Yes	Yes	No
	Excludes Medicare Advantage – removed if enrolled at least one month	Yes	Yes	Yes
	Includes episodes only when Medicare is primary payer	Yes	Yes	Yes
	Includes ESRD patients*	No	No	No
	Includes hospice care	Yes	Yes	No
	Includes patients who died during Index	Yes	Yes	Yes
	Includes all readmissions, without exclusions	Yes	Yes	No
	Includes Chronic Condition Warehouse (CCW) flags	Yes	Yes	No
	Includes Hierarchical Condition Category (HCC) flags	Yes	Yes	No
	Contains look-back period for risk adjustment	Yes (90 days)	Yes (90 days)	No
	Includes Inpatient Prospective Payment System (IPPS) outlier payments	Yes	Yes	Yes
	Contains “clean period”	No	No	No

* ESRD patients are identified by “Medicare Status” in the CMS claims: “11” = “Aged with ESRD;” “21” = “Disabled with ESRD;” and “31” = “ESRD only.”

Appendix B: Analytic Methodology

Exhibit B.2: Number of Unique Episodes and Medicare Episode Payment by Seven-, 15-, 30-, 60-, and 90-day Fixed-length Episodes (2007-2009)

Episode Length	Number of Episodes	Total Medicare Episode Payment
7-Day	29,835,000	\$319,828,173,380
15-Day	28,278,760	\$348,816,900,360
30-Day	26,138,800	\$382,017,208,440
60-Day	23,240,020	\$413,680,903,620
90-Day	21,106,940	\$424,870,715,940

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries.

Exhibit B.3: Berenson-Eggers Type of Service (BETOS) Categories

(1) EVALUATION AND MANAGEMENT

- M1A = Office visits - new
- M1B = Office visits - established
- M2A = Hospital visit - initial
- M2B = Hospital visit - subsequent
- M2C = Hospital visit - critical care
- M3 = Emergency room visit
- M4A = Home visit
- M4B = Nursing home visit
- M5A = Specialist - pathology (HCPCS moved to T1G in 2003)
- M5B = Specialist - psychiatry
- M5C = Specialist - ophthalmology
- M5D = Specialist - other
- M6 = Consultations

(2) PROCEDURES

- P0 = Anesthesia
- P1A = Major procedure - breast
- P1B = Major procedure - colectomy
- P1C = Major procedure - cholecystectomy
- P1D = Major procedure - turp
- P1E = Major procedure - hysterectomy
- P1F = Major procedure - explor/decompr/excis disc
- P1G = Major procedure - Other
- P2A = Major procedure, cardiovascular-CABG
- P2B = Major procedure, cardiovascular-Aneurysm repair
- P2C = Major Procedure, cardiovascular-Thromboendarterectomy
- P2D = Major procedure, cardiovascular-Coronary angioplasty (PTCA)
- P2E = Major procedure, cardiovascular-Pacemaker insertion
- P2F = Major procedure, cardiovascular-Other
- P3A = Major procedure, orthopedic - Hip fracture repair
- P3B = Major procedure, orthopedic - Hip replacement
- P3C = Major procedure, orthopedic - Knee replacement
- P3D = Major procedure, orthopedic - other

Appendix B: Analytic Methodology

(2) PROCEDURES (continued)

- P4A = Eye procedure - corneal transplant
- P4B = Eye procedure - cataract removal/lens insertion
- P4C = Eye procedure - retinal detachment
- P4D = Eye procedure - treatment of retinal lesions
- P4E = Eye procedure - other
- P5A = Ambulatory procedures - skin
- P5B = Ambulatory procedures - musculoskeletal
- P5C = Ambulatory procedures - groin hernia repair
- P5D = Ambulatory procedures - lithotripsy
- P5E = Ambulatory procedures - other
- P6A = Minor procedures - skin
- P6B = Minor procedures - musculoskeletal
- P6C = Minor procedures - other (Medicare fee schedule)
- P6D = Minor procedures - other (non-Medicare fee schedule)
- P7A = Oncology - radiation therapy
- P7B = Oncology - other
- P8A = Endoscopy - arthroscopy
- P8B = Endoscopy - upper gastrointestinal
- P8C = Endoscopy - sigmoidoscopy
- P8D = Endoscopy - colonoscopy
- P8E = Endoscopy - cystoscopy
- P8F = Endoscopy - bronchoscopy
- P8G = Endoscopy - laparoscopic cholecystectomy
- P8H = Endoscopy - laryngoscopy
- P8I = Endoscopy - other
- P9A = Dialysis services (Medicare Fee Schedule)
- P9B = Dialysis services (Non-Medicare Fee Schedule)

(3) IMAGING

- I1A = Standard imaging - chest
- I1B = Standard imaging - musculoskeletal
- I1C = Standard imaging - breast
- I1D = Standard imaging - contrast gastrointestinal
- I1E = Standard imaging - nuclear medicine
- I1F = Standard imaging - other
- I2A = Advanced imaging - CAT/CT/CTA: brain/head/neck
- I2B = Advanced imaging - CAT/CT/CTA: other
- I2C = Advanced imaging - MRI/MRA: brain/head/neck
- I2D = Advanced imaging - MRI/MRA: other
- I3A = Echography/ultrasonography - eye
- I3B = Echography/ultrasonography - abdomen/pelvis
- I3C = Echography/ultrasonography - heart
- I3D = Echography/ultrasonography - carotid arteries
- I3E = Echography/ultrasonography - prostate, transrectal
- I3F = Echography/ultrasonography - other
- I4A = Imaging/procedure - heart including cardiac catheter
- I4B = Imaging/procedure - other

Appendix B: Analytic Methodology

(4) TESTS

T1A = Lab tests - routine venipuncture (non Medicare fee schedule)
T1B = Lab tests - automated general profiles
T1C = Lab tests - urinalysis
T1D = Lab tests - blood counts
T1E = Lab tests - glucose
T1F = Lab tests - bacterial cultures
T1G = Lab tests - other (Medicare fee schedule)
T1H = Lab tests - other (non-Medicare fee schedule)
T2A = Other tests - electrocardiograms
T2B = Other tests - cardiovascular stress tests
T2C = Other tests - EKG monitoring
T2D = Other tests - other

(5) DURABLE MEDICAL EQUIPMENT

D1A = Medical/surgical supplies
D1B = Hospital beds
D1C = Oxygen and supplies
D1D = Wheelchairs
D1E = Other DME
D1F = Prosthetic/Orthotic devices
D1G = Drugs Administered through DME

(6) OTHER

O1A = Ambulance
O1B = Chiropractic
O1C = Enteral and parenteral
O1D = Chemotherapy
O1E = Other drugs
O1F = Hearing and speech services
O1G = Immunizations/Vaccinations

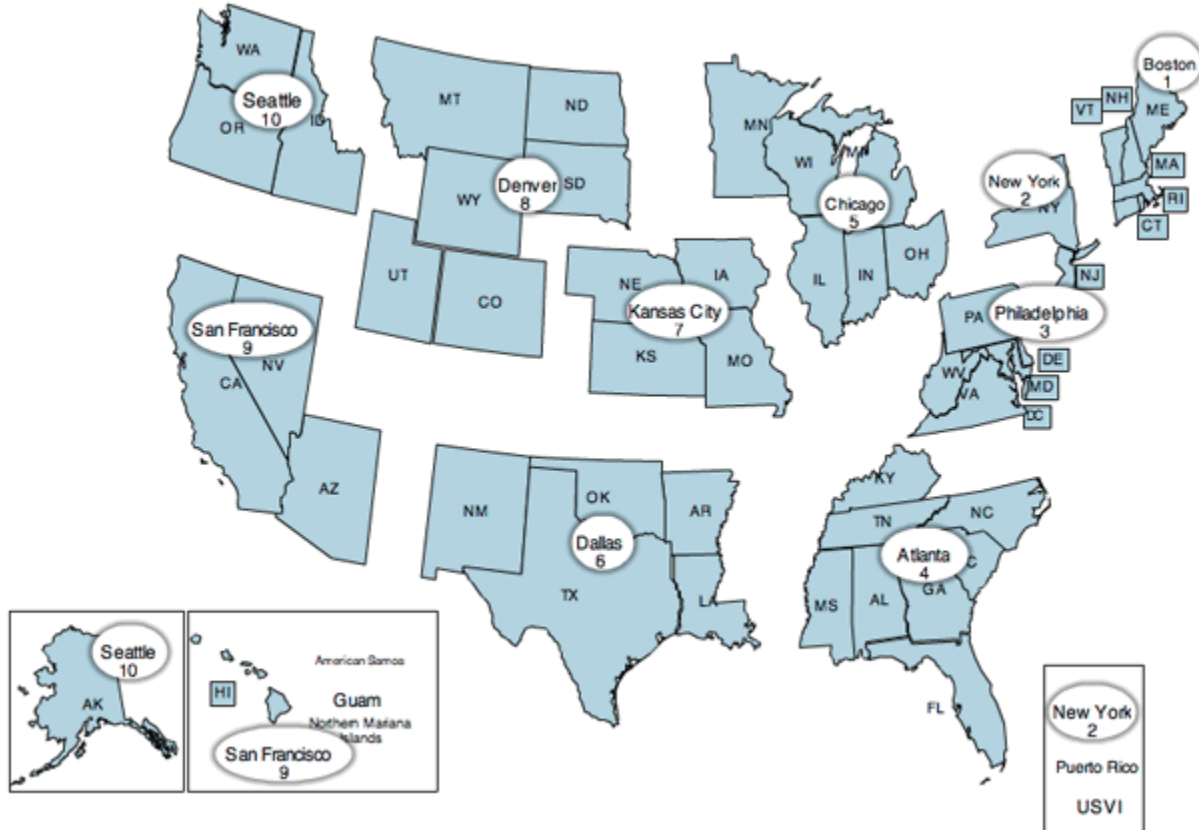
(7) EXCEPTIONS/UNCLASSIFIED

Y1 = Other - Medicare fee schedule
Y2 = Other - non-Medicare fee schedule
Z1 = Local codes
Z2 = Undefined codes

Source: Centers for Medicare & Medicaid Services, Healthcare Common Procedure Coding System (HCPCS), 2009.

Appendix B: Analytic Methodology

Exhibit B.4: Map of 10 CMS Regions



Source: Centers for Medicare & Medicaid Services

Exhibit B.5: List of States by 10 CMS Regions

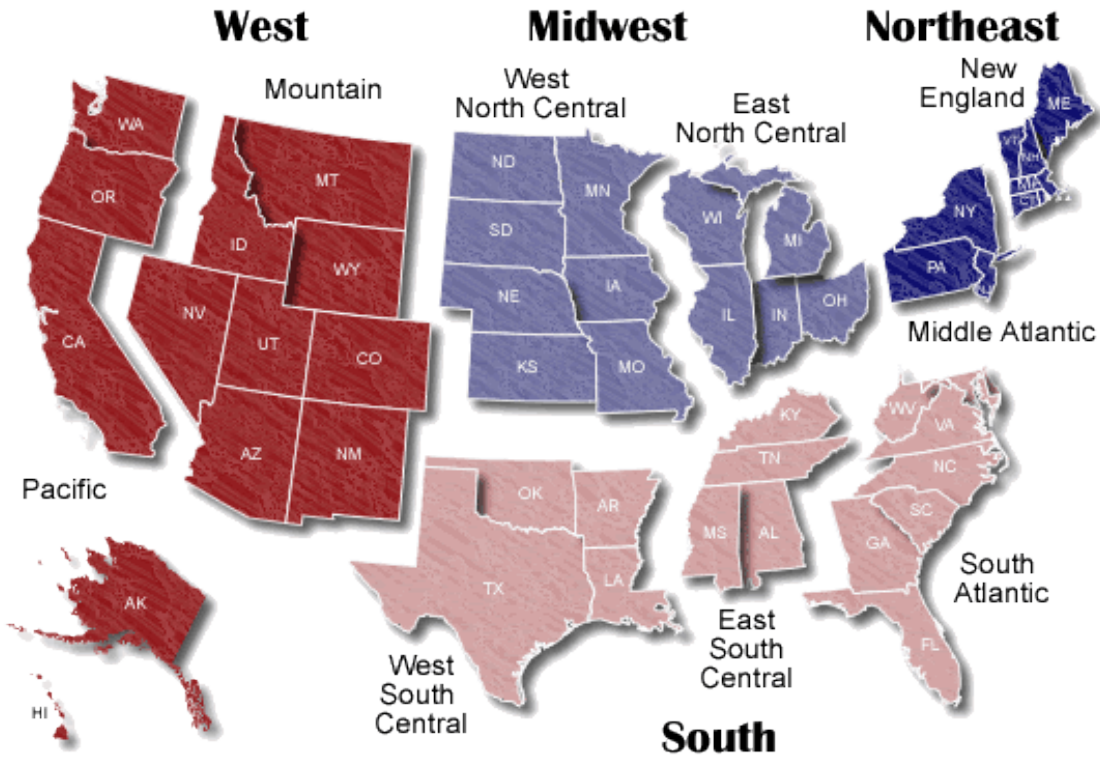
Region 1-Boston	Region 3-Philadelphia	Region 5-Chicago	Region 7-Kansas City	Region 9-San Francisco
Connecticut	Delaware	Illinois	Iowa	Arizona
Maine	District of Columbia	Indiana	Kansas	California
Massachusetts	Maryland	Michigan	Missouri	Hawaii
New Hampshire	Pennsylvania	Minnesota	Nebraska	Nevada
Rhode Island	Virginia	Ohio		American Samoa
Vermont	West Virginia	Wisconsin		Guam

Region 2-New York	Region 4-Atlanta	Region 6-Dallas	Region 8-Denver	Region 10-Seattle
New Jersey	Alabama	Arkansas	Colorado	Alaska
New York	Florida	Louisiana	Montana	Idaho
Puerto Rico	Georgia	New Mexico	North Dakota	Oregon
Virgin Islands	Kentucky	Oklahoma	South Dakota	Washington
	Mississippi	Texas	Utah	
	North Carolina		Wyoming	
	South Carolina			
	Tennessee			

Appendix B: Analytic Methodology

Exhibit B.6: Map of Nine Census Regions

U.S. Census Regions



Map by the Indiana Business Research Center, Kelley School of Business, Indiana University

Appendix B: Analytic Methodology

Exhibit B.7: List of States by Nine Census Regions

Region 1: New England	Region 4: West North Central	Region 6: East South Central	Region 9: Pacific
Connecticut	Iowa	Alabama	Alaska
Maine	Kansas	Kentucky	California
Massachusetts	Minnesota	Mississippi	Hawaii
New Hampshire	Missouri	Tennessee	Oregon
Rhode Island	Nebraska		Washington
Vermont	North Dakota	Region 7: West South Central	
	South Dakota	Arkansas	
Region 2: Middle Atlantic		Louisiana	
New Jersey	Region 5: South Atlantic	Oklahoma	
New York	Delaware	Texas	
Pennsylvania	District of Columbia		
	Florida	Region 8: Mountain	
Region 3: East North Central	Georgia	Arizona	
Indiana	Maryland	Colorado	
Illinois	North Carolina	Idaho	
Michigan	South Carolina	New Mexico	
Ohio	Virginia	Montana	
Wisconsin	West Virginia	Utah	
		Nevada	
		Wyoming	

Appendix B: Analytic Methodology

Exhibit B.8: Chronic Condition Flags Contained in CCW Data

Acute Myocardial Infarction
Alzheimer's Disease
Alzheimer's Disease and Related Disorders or Senile Dementia
Atrial Fibrillation
Cataract
Chronic Kidney Disease
Chronic Obstructive Pulmonary Disease
Colorectal Cancer
Depression
Diabetes
Endometrial Cancer
Female Breast Cancer
Glaucoma
Heart Failure
Hip/Pelvic Fracture
Ischemic Heart Disease
Lung Cancer
Osteoporosis
Prostate Cancer
Rheumatoid Arthritis/ Osteoarthritis
Stroke/Transient Ischemic Attack

Appendix B: Analytic Methodology

Exhibit B.9: Principles for American Academy of Orthopaedic Surgeons (AAOS) Guideline Development

STEP 1: FRAME THE GUIDELINE'S SCOPE

The first step in developing a clinical practice guideline is framing its scope. Guideline developers are faced with the challenge of wanting to include everything of clinical interest in a guideline and the need for timely publication of that guideline. This balance is at the forefront of framing a guideline's scope. Here are some things to consider when thinking about what a guideline should and should not address:

1. Guidelines that include information from about 100 published articles will require 6-8 months to complete (not including review, which adds an additional seven months to development). The more articles that are included, the longer it will take to complete the guideline.
2. In general, it is best to consider diagnosis and treatment in two separate guidelines, not in a single guideline.
3. Stay away from framing questions about the natural history of a disease. This information can be covered in the introduction to the guideline.
4. We have adopted "first principles" of analysis to assist you in defining a guideline's scope (See below)

First Principles of Evidence-Based Analysis

Below are our "first principles" of evidence-based analysis:

- Obtaining a careful history and physical underlies good clinical practice. The process of obtaining a history and physical supplies the information for the formation of diagnostic and treatment questions fundamental to the practice of Evidence-based Medicine. **(The implication is that we will not conduct systematic reviews to validate recommendations for a history and physical).**
- Treatments should improve on the natural history of a disorder, which in many cases is recovery without treatment. **(The implication is that we will include only controlled trials when evaluating conditions that improve without treatment).**
- Patient-oriented outcomes take precedence over intermediate/surrogate outcomes.
- Validated outcomes measures take precedence over non-validated outcomes measures.
- **Retrospective case series studies are excluded.**
- The level of evidence for an underpowered study is inconclusive unless that study is used in a de novo meta analysis by the guideline unit.

Source: American Academy of Orthopaedic Surgeons (2009). Introductory information for work group members participating in guideline development. Available online at: http://www.aaos.org/research/guidelines/IntroPktMembers_05_05_09.pdf

Appendix B: Analytic Methodology

Exhibit B.10: Criteria for Inclusion in the National Guideline Clearinghouse (NGC)

Note: NGC is re-evaluating the definition and inclusion criteria described below. This work will be informed by a number of efforts, such as review of the literature, guidance from the NGC/National Quality Measures Clearinghouse (NQMC) Editorial Board, previous and ongoing studies of the Institute of Medicine (IOM) and others.

Definition of Clinical Practice Guideline

NGC employs the definition of clinical practice guideline developed by the IOM.

Clinical practice guidelines are systematically developed statements to assist practitioner and patient decisions about appropriate health care for specific clinical circumstances. [Institute of Medicine. (1990). *Clinical Practice Guidelines: Directions for a New Program*, M.J. Field and K.N. Lohr (eds.) Washington, DC: National Academy Press. page 38].

Criteria for Inclusion of Clinical Practice Guidelines in NGC

All of the criteria below must be met for a clinical practice guideline to be included in NGC.

1. The clinical practice guideline contains systematically developed statements that include recommendations, strategies, or information that assists physicians and/or other health care practitioners and patients to make decisions about appropriate health care for specific clinical circumstances.
2. The clinical practice guideline was produced under the auspices of medical specialty associations; relevant professional societies, public or private organizations, government agencies at the Federal, State, or local level; or health care organizations or plans. A clinical practice guideline developed and issued by an individual not officially sponsored or supported by one of the above types of organizations does not meet the inclusion criteria for NGC.
3. Corroborating documentation can be produced and verified that a systematic literature search and review of existing scientific evidence published in peer reviewed journals was performed during the guideline development. A guideline is not excluded from NGC if corroborating documentation can be produced and verified detailing specific gaps in scientific evidence for some of the guideline's recommendations.
4. The full text guideline is available upon request in print or electronic format (for free or for a fee), in the English language. The guideline is current and the most recent version produced. Documented evidence can be produced or verified that the guideline was developed, reviewed, or revised within the past five years.

Source: Agency for Healthcare Research and Quality. National Guideline Clearinghouse: Inclusion Criteria. Available online at: <http://guideline.gov/about/inclusion-criteria.aspx>

Appendix C

Defining the Bundle

Appendix C: Defining the Bundle

Exhibit C.1: MS-DRG Families by Inclusion in Prior or Ongoing Medicare Payment Bundling Demonstrations and Initiatives

MS-DRG Family	Medicare Participating Heart Bypass Center Demonstration ¹	Medicare Acute Care Episode (ACE) Demonstration ²	Medicare Gainsharing Demonstration ³	BPCI Initiative ⁴
Acute ischemic stroke w use of thrombolytic agent (61, 62, 63)				X
Intracranial hemorrhage or cerebral infarction (64, 65, 66)				
Nonspecific cva & precerebral occlusion w/o infarct (67,68)				X
Chronic obstructive pulmonary disease (190, 191, 192)				
Simple pneumonia & pleurisy (193, 194, 195)				X
Cardiac valve & oth maj cardiothoracic proc w card cath (216, 217, 218)		X	X	
Cardiac valve & oth maj cardiothoracic proc w/o card cath (219, 220, 221)		X	X	
Coronary bypass w ptca (231, 232)	X	X	X	X
Coronary bypass w cardiac cath (233, 234)	X	X	X	X
Coronary bypass w/o cardiac cath (235, 236)	X	X	X	X
Perc cardiovasc proc w drug-eluting stent (247)		X		
Heart failure & shock (291, 292, 293)				X
Major joint replacement or reattachment of lower extremity (469, 470)		X		X
Bilateral or multiple major joint procedures of lower extremity (461,462)		X		X
Revision of hip or knee replacement (466,467,468)		X		X
Hip & femur procedures except major joint (480, 481, 482)				X

¹ Cromwell J, Dayhoff DA, McCall NT, et al. (1998). Medicare Participating Heart Bypass Center Demonstration - Volume I Final Report. Prepared for HCFA: p. I-3. Available online at: http://www1d.cms.gov/Medicare/Demonstration-Projects/DemoProjectsEvalRpts/Downloads/Medicare_Heart_Bypass_Volume1.pdf

² Centers for Medicare and Medicaid Services. *Diagnosis Related Groups Included in Acute Care Episode Demonstration*. Available online at: http://www.cms.gov/Medicare/Demonstration-Projects/DemoProjectsEvalRpts/downloads/DRG_Listing.pdf

³ Centers for Medicare and Medicaid Services. (2011). CMS Report to Congress - Medicare Gainsharing Demonstration: Report to Congress on Quality Improvement and Savings. Appendix A: List of Included Procedures: p. 19. Available online at: https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/Reports/downloads/Buczko_Gain_Sharing_Final_Report_May_2011.pdf

⁴ Reported by potential BPCI applicants during select interviews. See Chapter 2: Analytic Methodology for a description of interviewees.

Appendix C: Defining the Bundle

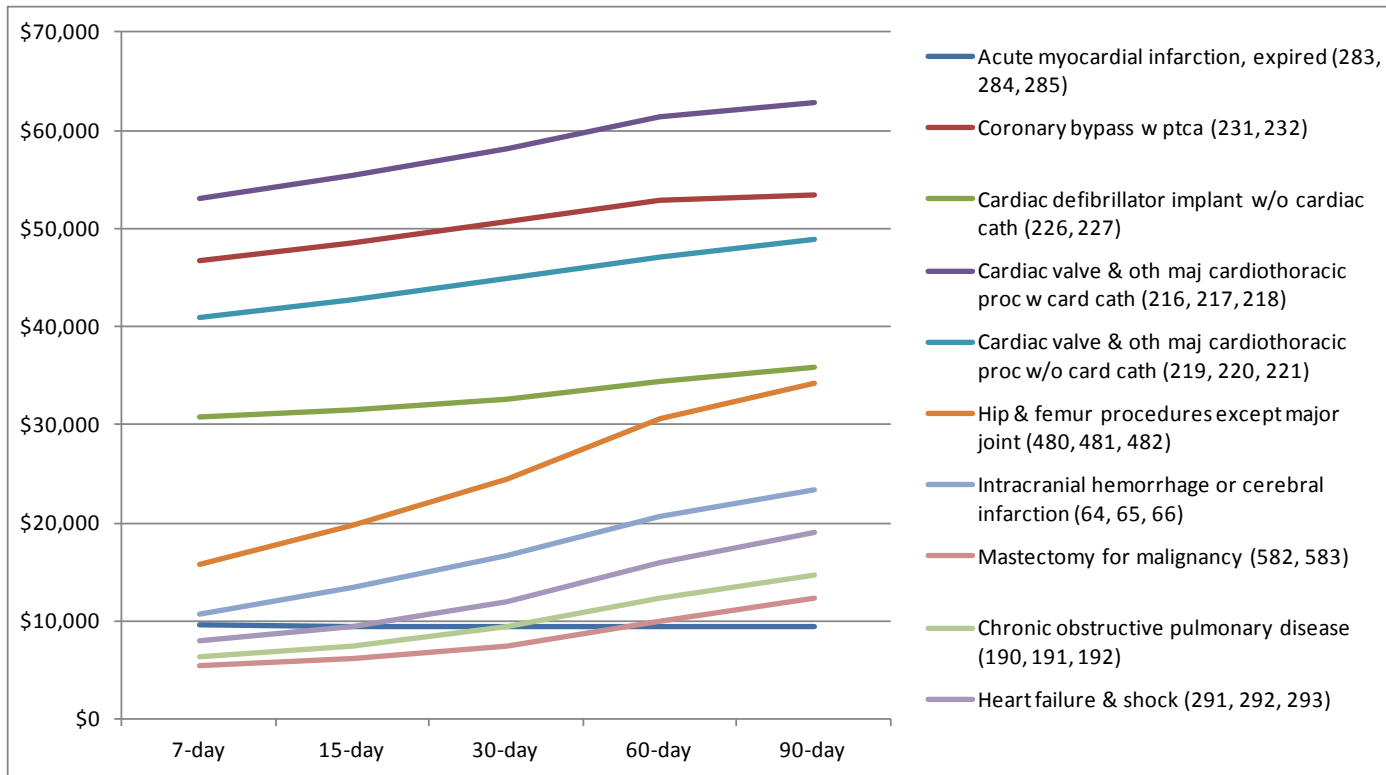
Exhibit C.2: Average Medicare Episode Payment (Including Index Hospital Admission) for Select MS-DRGs across Seven-, 15-, 30-, 60-, and 90-day Fixed-length Episodes (2007-2009)

MS-DRG	Average Medicare Episode Payment					Percent Change 7 to 90 Days
	7-Day	15-Day	30-Day	60-Day	90-Days	
247: Perc cardiovasc proc w drug-eluting stent w/o MCC	\$12,142	\$12,706	\$13,568	\$14,885	\$16,021	31.9%
470: Major joint replacement or reattachment of lower extremity w/o MCC	\$14,375	\$16,679	\$18,901	\$20,859	\$22,111	53.8%
481: Hip & femur procedures except major joint w CC	\$15,267	\$19,301	\$24,201	\$30,136	\$33,986	122.6%
192: Chronic obstructive pulmonary disease w/o CC/MCC	\$4,857	\$5,708	\$7,133	\$9,285	\$11,347	133.6%
194: Simple pneumonia & pleurisy w CC	\$6,862	\$8,207	\$10,177	\$12,851	\$14,952	117.9%
291: Heart failure & shock w MCC	\$9,970	\$11,898	\$14,928	\$19,559	\$23,139	132.1%

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix C: Defining the Bundle

Exhibit C.3: Trend in Average Medicare Episode Payment for Select MS-DRG Families for Seven-, 15-, 30-, 60-, and 90-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix C: Defining the Bundle

Exhibit C.4: Comparison of Average Medicare Episode Payment and Coefficient of Variation (CV) for Select MS-DRG Families for Seven-, 15-, 30-, 60-, and 90-day Fixed-length Episodes (2007-2009)

MS-DRG Family	7-Day		15-Day			30-Day			60-Day			90-Day		
	Average Episode Payment	CV of Total Episode Payment	Average Episode Payment	Percent Change	CV of Total Episode Payment	Average Episode Payment	Percent Change	CV of Total Episode Payment	Average Episode Payment	Percent Change	CV of Total Episode Payment	Average Episode Payment	Percent Change	CV of Total Episode Payment
Acute ischemic stroke w use of thrombolytic agent (61, 62, 63)	\$17,193	0.38	\$20,672	20.2%	0.46	\$24,599	19.0%	0.56	\$29,542	20.1%	0.65	\$32,478	9.9%	0.68
Intracranial hemorrhage or cerebral infarction (64, 65, 66)	\$10,612	0.54	\$13,400	26.3%	0.63	\$16,681	24.5%	0.71	\$20,644	23.8%	0.79	\$23,396	13.3%	0.84
Nonspecific cva & precerebral occlusion w/o infarct (67,68)	\$7,095	0.59	\$8,531	20.2%	0.69	\$10,533	23.5%	0.76	\$13,214	25.4%	0.85	\$15,053	13.9%	0.92
Chronic obstructive pulmonary disease (190, 191, 192)	\$6,347	0.52	\$7,506	18.3%	0.66	\$9,382	25.0%	0.79	\$12,336	31.5%	0.91	\$14,761	19.7%	0.96
Simple pneumonia & pleurisy (193, 194, 195)	\$7,110	0.56	\$8,431	18.6%	0.66	\$10,381	23.1%	0.82	\$13,148	26.6%	0.91	\$15,275	16.2%	0.96
Cardiac valve & oth maj cardiothoracic proc w card cath (216, 217, 218)	\$53,006	0.37	\$55,308	4.3%	0.37	\$58,075	5.0%	0.39	\$61,354	5.6%	0.42	\$62,865	2.5%	0.43
Cardiac valve & oth maj cardiothoracic proc w/o card cath (219, 220, 221)	\$40,902	0.43	\$42,706	4.4%	0.43	\$44,926	5.2%	0.45	\$47,042	4.7%	0.49	\$48,926	4.0%	0.52
Coronary bypass w ptca (231, 232)	\$46,671	0.34	\$48,460	3.8%	0.35	\$50,720	4.7%	0.37	\$52,836	4.2%	0.42	\$53,424	1.1%	0.43
Coronary bypass w cardiac cath (233, 234)	\$35,596	0.36	\$37,461	5.2%	0.38	\$39,646	5.8%	0.42	\$42,255	6.6%	0.48	\$44,018	4.2%	0.52
Coronary bypass w/o cardiac cath (235, 236)	\$26,682	0.41	\$28,026	5.0%	0.42	\$29,534	5.4%	0.45	\$31,435	6.4%	0.51	\$32,622	3.8%	0.55
Perc cardiovasc proc w drug-eluting stent (247)	\$12,142	0.25	\$12,706	4.6%	0.32	\$13,568	6.8%	0.40	\$14,966	10.3%	0.50	\$16,111	7.6%	0.56
Heart failure & shock (291, 292, 293)	\$7,890	0.64	\$9,493	20.3%	0.72	\$12,006	26.5%	0.80	\$15,921	32.6%	0.87	\$19,060	19.7%	0.92
Bilateral or multiple major joint procedures of lower extremity (461,462)	\$25,009	0.27	\$28,084	12.3%	0.29	\$30,281	7.8%	0.33	\$32,057	5.9%	0.37	\$33,071	3.2%	0.40
Revision of hip or knee replacement (466,467,468)	\$19,069	0.35	\$21,415	12.3%	0.39	\$24,121	12.6%	0.45	\$26,891	11.5%	0.49	\$28,835	7.2%	0.56
Major joint replacement or reattachment of lower extremity (469, 470)	\$14,868	0.31	\$17,269	16.2%	0.36	\$19,631	13.7%	0.42	\$21,992	12.0%	0.49	\$23,362	6.2%	0.55
Hip & femur procedures except major joint (480, 481, 482)	\$15,706	0.34	\$19,664	25.2%	0.37	\$24,432	24.2%	0.38	\$30,516	24.9%	0.42	\$34,238	12.2%	0.47
Overall	\$10,720	1.02	\$12,335	15.1%	0.99	\$14,615	18.5%	0.98	\$17,800	21.8%	0.99	\$20,129	13.1%	1.01

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

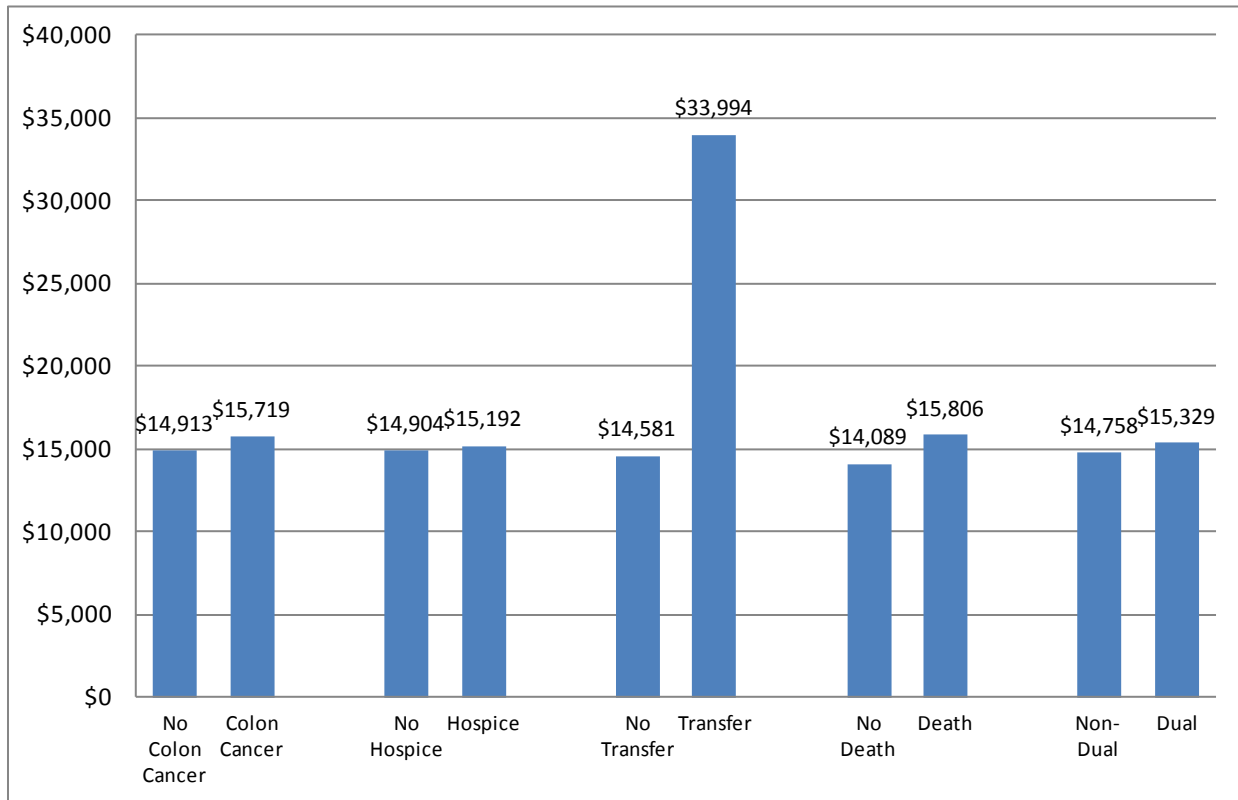
Appendix C: Defining the Bundle

Exhibit C.5: MedPAC Framework for Identifying Potentially Preventable Readmissions

Reason for initial admission	Medical	Potentially Preventable Ex: Admissions for diabetes following discharge for AMI Exception: Unrelated acute events Ex: Admission for trauma following discharge for AMI	Not Potentially Preventable Ex: Admissions for appendectomy following discharge for pneumonia Exception: Prior discharge diagnosis was reason for surgery Ex: Admission for appendectomy following discharge for abdominal pain
	Surgical	Potentially Preventable Ex: Admissions for angina following discharge for PTCA Exception: Unrelated acute events Ex: Admissions for eye infection following discharge for PTCA	Not Potentially Preventable Ex: Admissions for cholecystectomy following discharge for CABG Exception: Surgery for complications of surgery Ex: Admission for PTCA following discharge for CABG

Source: Medicare Payment Advisory Commission (2007, June). Report to the Congress: Promoting greater efficiency in Medicare. (Washington, DC: MedPAC).

Exhibit C.6: Average Medicare Episode Payment by Clinical and Demographic Characteristics for Exclusion or Adjustment for MS-DRG 291 for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix C: Defining the Bundle

Exhibit C.7: Comparison of Average Medicare Episode Payment with and without Transfer by Select MS-DRG Families for 30-day Fixed-length Episodes (2007-2009)

MS-DRG Family	Average Medicare Episode Payment			Ratio*
	Total	No Transfer	With Transfer	
Acute ischemic stroke w use of thrombolytic agent (61, 62, 63)	\$24,599	\$24,351	\$36,130	1.48
Intracranial hemorrhage or cerebral infarction (64, 65, 66)	\$16,681	\$16,412	\$31,244	1.90
Nonspecific cva & precerebral occlusion w/o infarct (67,68)	\$10,533	\$9,960	\$22,213	2.23
Chronic obstructive pulmonary disease (190, 191, 192)	\$9,382	\$9,272	\$24,565	2.65
Simple pneumonia & pleurisy (193, 194, 195)	\$10,381	\$10,221	\$25,900	2.53
Cardiac valve & oth maj cardiothoracic proc w card cath (216, 217, 218)	\$58,075	\$57,894	\$109,226	1.89
Cardiac valve & oth maj cardiothoracic proc w/o card cath (219, 220, 221)	\$44,926	\$44,793	\$81,378	1.82
Coronary bypass w ptca (231, 232)	\$50,720	\$50,548	\$104,383	2.07
Coronary bypass w cardiac cath (233, 234)	\$39,646	\$39,582	\$64,498	1.63
Coronary bypass w/o cardiac cath (235, 236)	\$29,534	\$29,456	\$93,825	3.19
Perc cardiovasc proc w drug-eluting stent (247)	\$13,568	\$13,537	\$32,480	2.40
Heart failure & shock (291, 292, 293)	\$12,006	\$11,675	\$29,661	2.54
Bilateral or multiple major joint procedures of lower extremity (461,462)	\$30,281	\$30,199	\$42,698	1.41
Revision of hip or knee replacement (466,467,468)	\$24,121	\$24,065	\$31,601	1.31
Major joint replacement or reattachment of lower extremity (469, 470)	\$19,631	\$19,578	\$25,662	1.31
Hip & femur procedures except major joint (480, 481, 482)	\$24,432	\$24,390	\$35,764	1.47
Overall	\$14,615	\$13,680	\$26,241	1.92

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

* Ratio is average Medicare episode payment with transfer divided by average Medicare episode payment with no transfer.

Exhibit C.8: Comparison of Average Medicare Episode Payments by Beneficiary Demographic and Clinical Characteristics by Dual Eligibility Status for 30-day Fixed-length Episodes (2007-2009)

	Non-Dual Eligible		Dual Eligible	
	Percent of Episodes	Average Medicare Episode Payment	Percent of Episodes	Average Medicare Episode Payment
Age				
64 and Younger	9.0%	\$14,818	36.0%	\$13,657
65 to 69	13.8%	\$14,788	11.2%	\$15,052
70 to 74	16.0%	\$14,903	11.5%	\$14,994
75 to 79	18.3%	\$15,100	11.9%	\$14,892
80 to 84	19.1%	\$14,857	12.1%	\$14,645
85 and Older	23.8%	\$14,170	17.2%	\$14,003
Gender				
Female	59.5%	\$14,303	66.3%	\$13,904
Male	40.5%	\$15,362	33.7%	\$15,060

Appendix C: Defining the Bundle

	Non-Dual Eligible		Dual Eligible	
	Percent of Episodes	Average Medicare Episode Payment	Percent of Episodes	Average Medicare Episode Payment
Race				
Asian	0.5%	\$15,848	2.6%	\$14,906
Black	7.7%	\$15,260	22.9%	\$14,887
Hispanic	0.9%	\$14,922	5.6%	\$14,288
Native American	0.4%	\$14,286	1.0%	\$13,853
Other	0.8%	\$15,242	1.3%	\$14,729
Unknown	0.1%	\$15,407	0.2%	\$15,311
White	89.7%	\$14,675	66.4%	\$14,061
Region				
Atlanta	22.8%	\$14,410	25.6%	\$13,884
Boston	5.2%	\$14,618	5.9%	\$13,628
Chicago	19.5%	\$14,455	15.6%	\$14,173
Dallas	11.2%	\$15,126	13.2%	\$14,909
Denver	2.9%	\$14,600	1.7%	\$14,053
Kansas City	5.3%	\$14,287	4.4%	\$13,755
New York	9.0%	\$14,950	10.4%	\$14,063
Philadelphia	12.0%	\$15,483	9.1%	\$15,144
San Francisco	8.1%	\$15,143	11.4%	\$14,939
Seattle	2.7%	\$14,022	2.1%	\$13,577
Readmission				
No	85.2%	\$12,925	81.8%	\$12,263
Yes	14.8%	\$25,104	18.2%	\$23,390
Number of Chronic Conditions				
0	1.7%	\$11,420	2.3%	\$10,160
1	4.2%	\$10,900	4.7%	\$9,699
2	8.3%	\$12,000	6.8%	\$11,243
3	11.9%	\$12,875	9.0%	\$12,130
4	14.3%	\$13,843	11.2%	\$13,220
5	15.0%	\$14,710	13.0%	\$14,057
6	14.2%	\$15,642	13.6%	\$14,794
7	11.7%	\$16,361	13.1%	\$15,534
8	8.4%	\$16,869	10.7%	\$16,080
9	5.3%	\$17,420	7.4%	\$16,715
10	2.8%	\$17,806	4.6%	\$17,297
11	1.3%	\$17,873	2.3%	\$17,608
12	0.5%	\$18,373	0.9%	\$17,871
13	0.1%	\$19,418	0.2%	\$19,563
14+	0.0%	\$18,448	0.1%	\$19,873
Overall	100.0%	\$14,732	100.0%	\$14,294

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

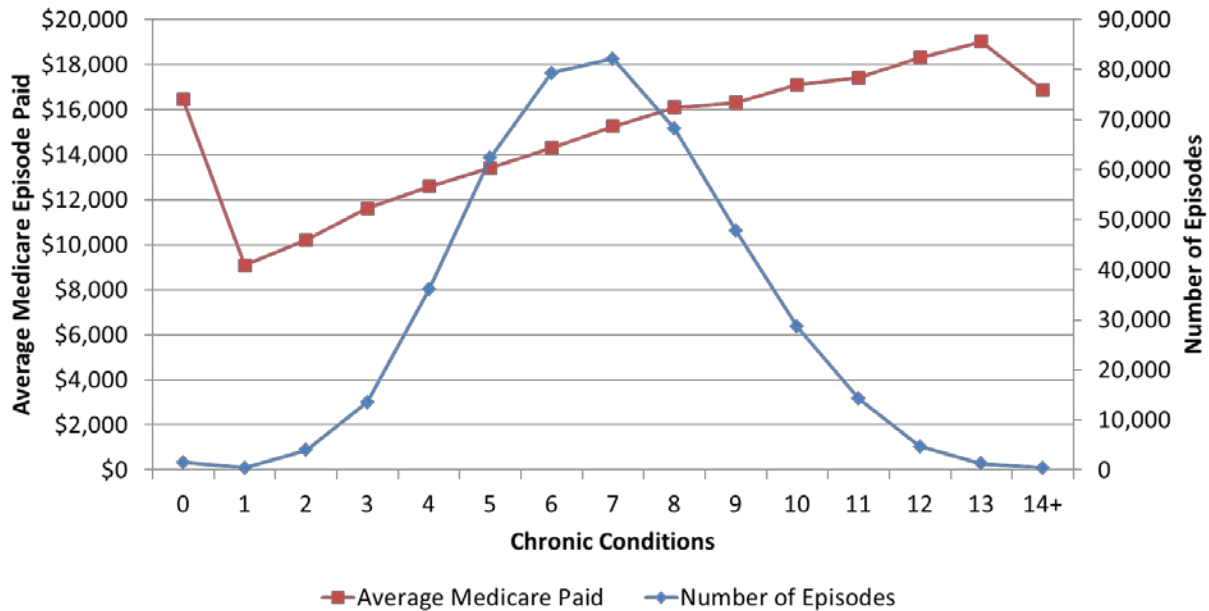
Appendix D: Pricing the Bundle

Appendix D

Pricing the Bundle

Appendix D: Pricing the Bundle

Exhibit D.1: Number of Episodes and Average Medicare Episode Payment by Number of Chronic Conditions for MS-DRG 291 for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix D: Pricing the Bundle

Exhibit D.2A: Average Medicare Episode Payment by DSH Patient Percentage for MS-DRG 470 for 30-day Fixed-length Episodes (2007-2009)

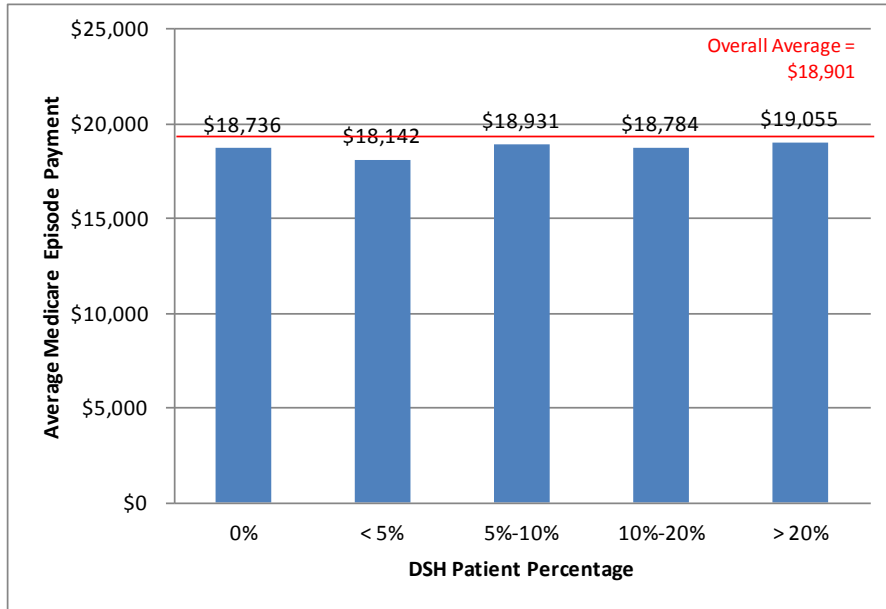
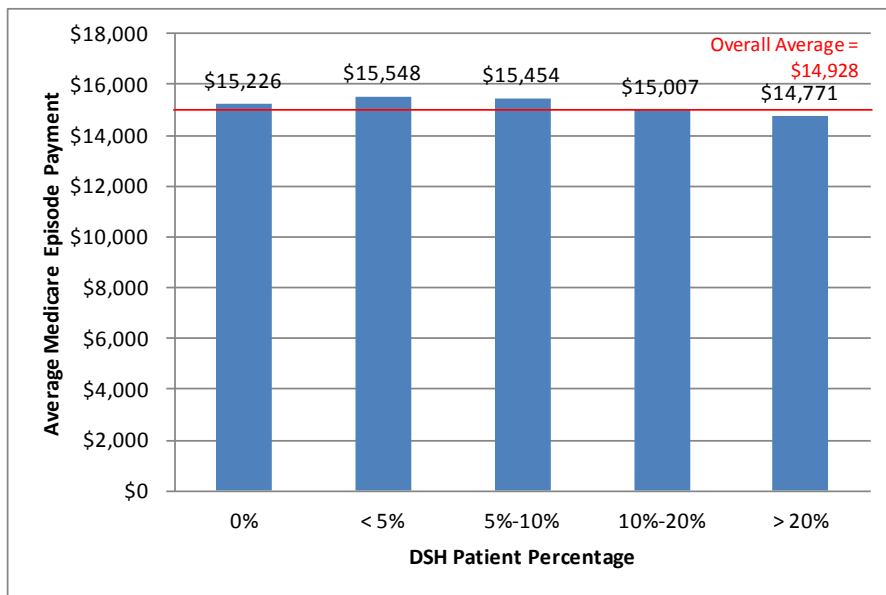


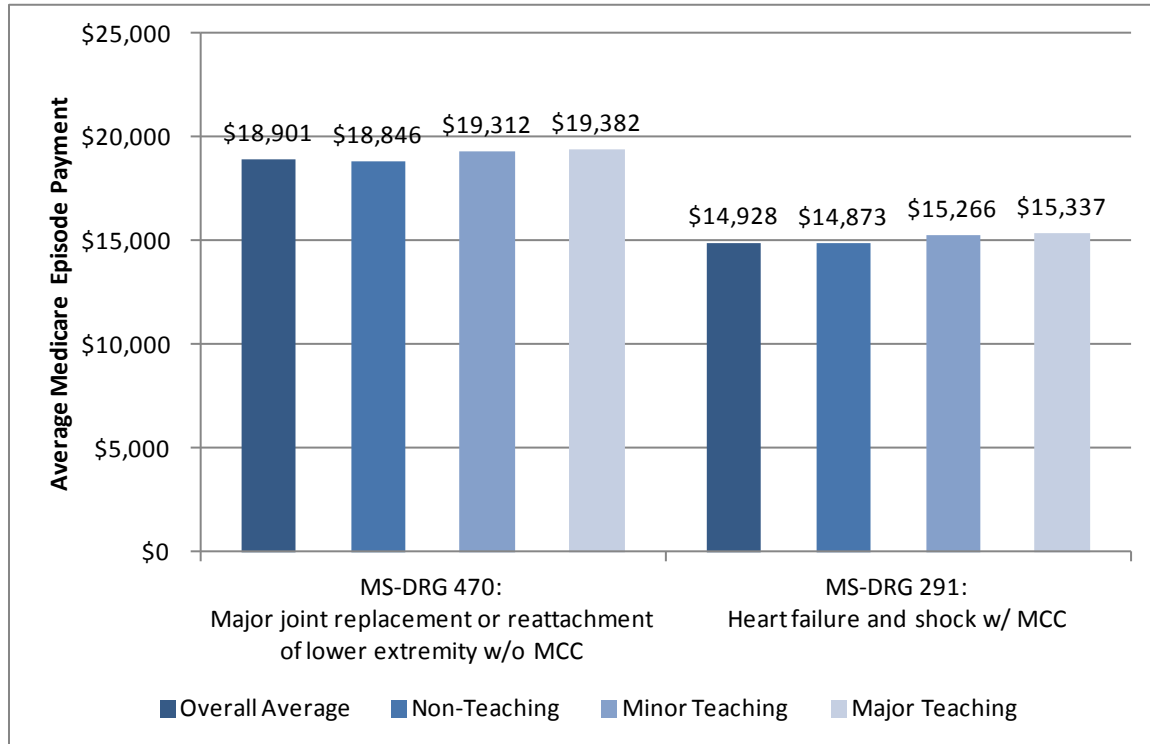
Exhibit D.2B: Average Medicare Episode Payment by DSH Patient Percentage for MS-DRG 291 for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix D: Pricing the Bundle

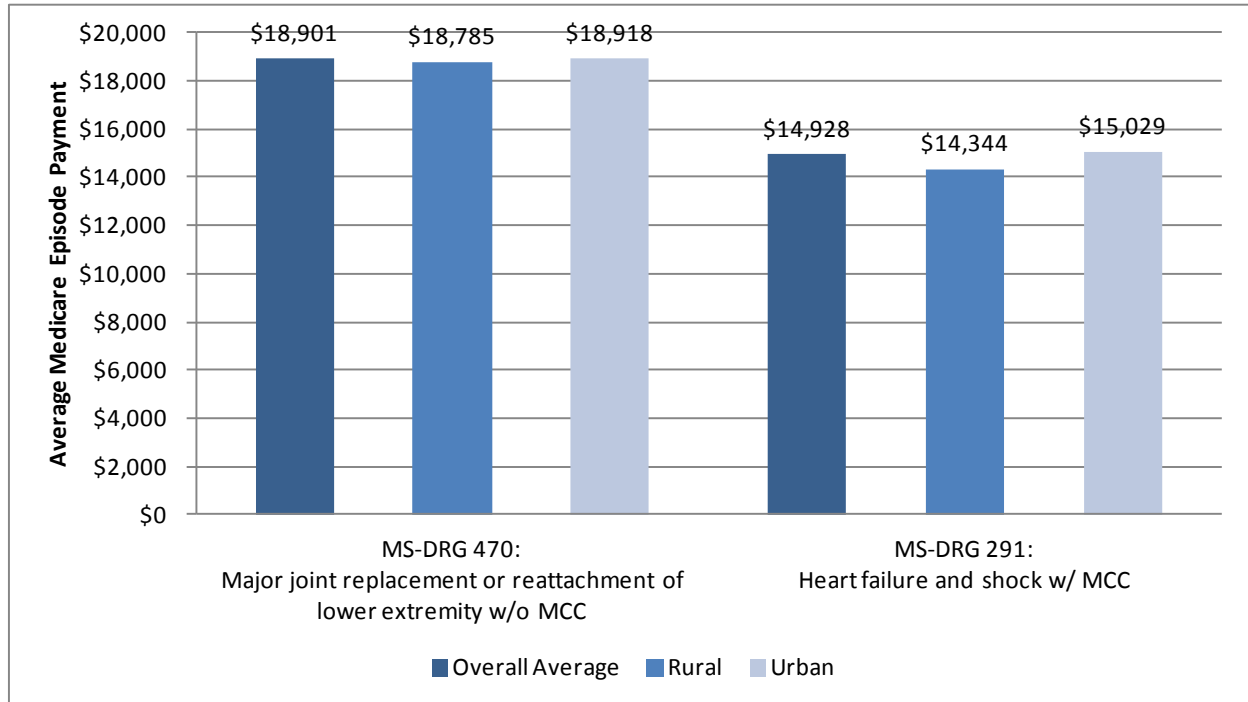
Exhibit D.3: Average Medicare Episode Payment by Teaching Status by MS-DRG for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix D: Pricing the Bundle

Exhibit D.4: Average Medicare Episode Payment by Urban/Rural Status by MS-DRG for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix D: Pricing the Bundle

Exhibit D.5A: Average Medicare Episode Payment by *Bed Size* for MS-DRG 470 for 30-day Fixed-length Episodes (2007-2009)

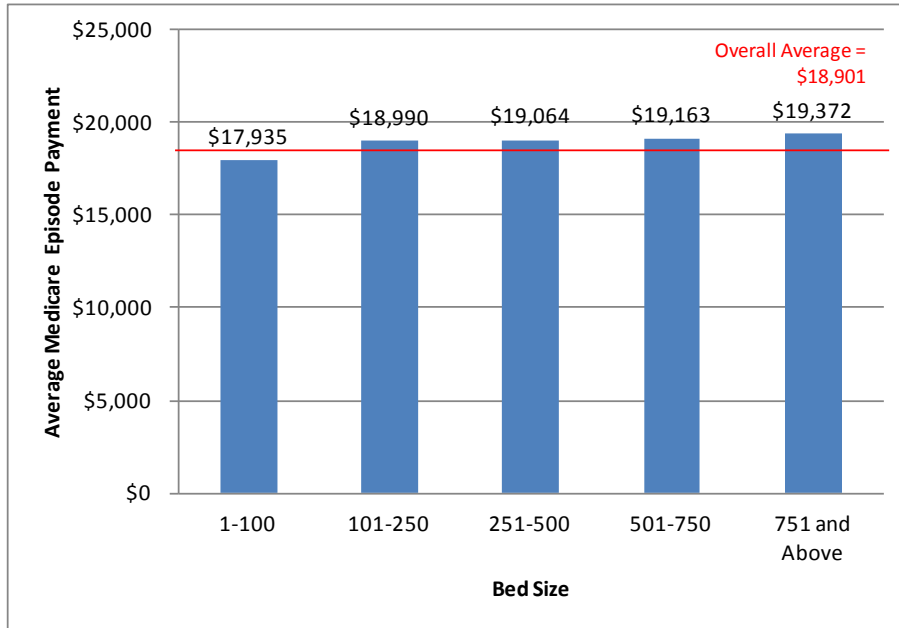
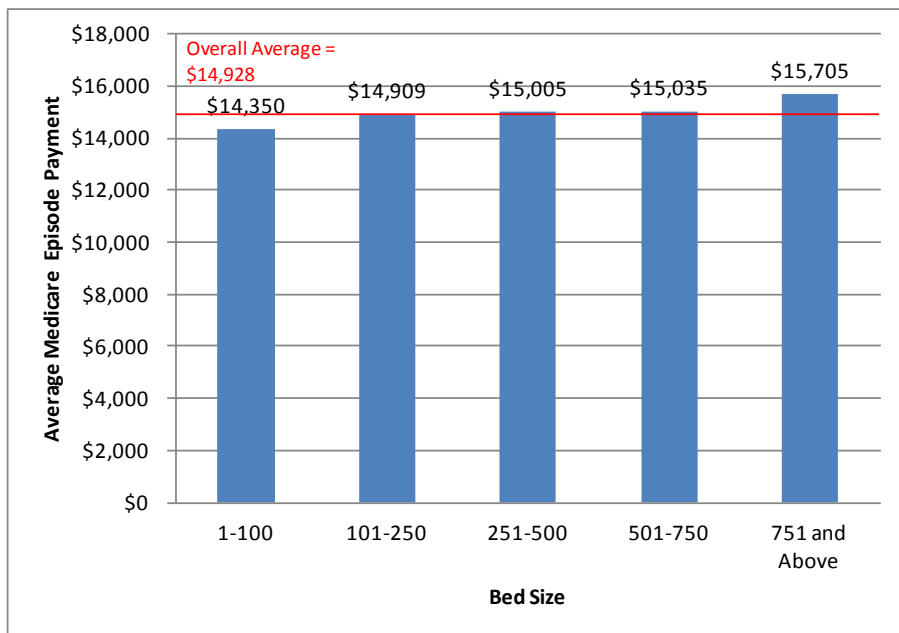


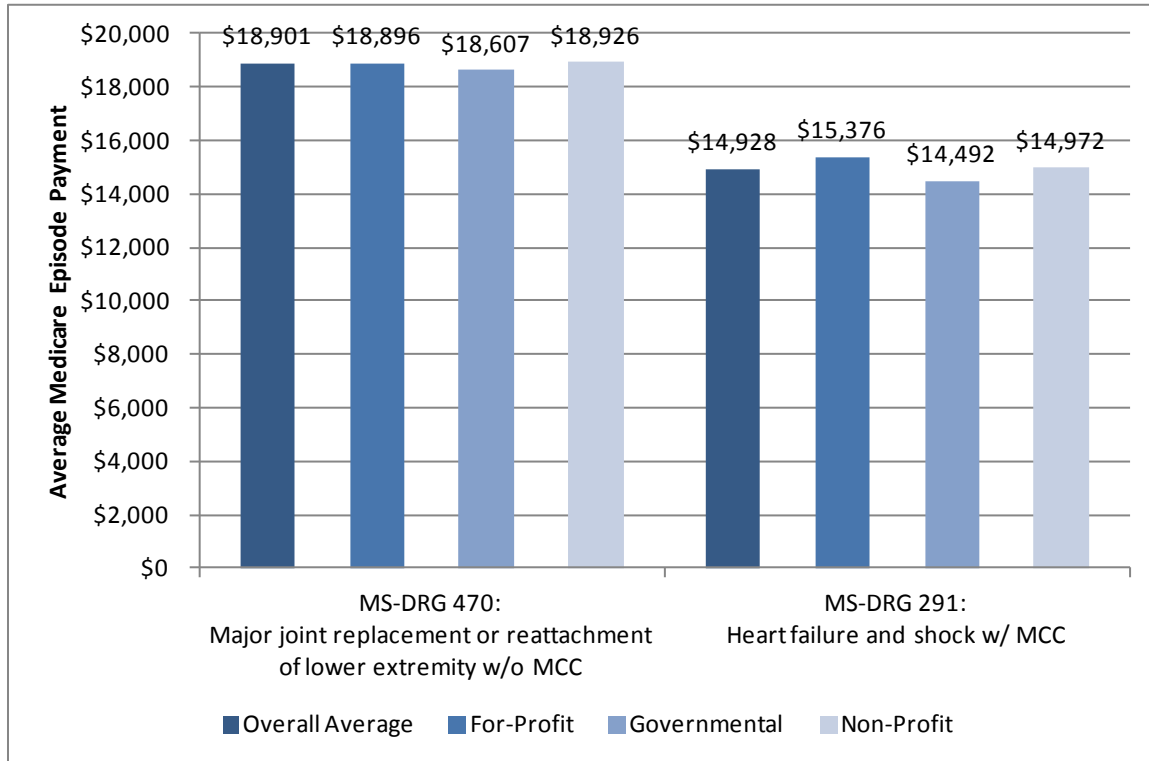
Exhibit D.5B: Average Medicare Episode Payment by *Bed Size* for MS-DRG 291 for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix D: Pricing the Bundle

Exhibit D.6: Average Medicare Episode Payment by Ownership Status by MS-DRG for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix D: Pricing the Bundle

Exhibit D.7: Comparison of Average Medicare Episode Payment by Wage Index Adjustment in Two HRRs for MS-DRG 291 for 30-day Fixed-length Episodes (2007-2009)

HRR City	Number of Episodes	Wage Adjusted	Wage Neutral	Ratio of Wage Adjusted to Wage Neutral
		Average Medicare Episode Payment	Average Medicare Episode Payment	
Joliet, IL	1,120	\$13,624	\$13,948	0.98
Macon, GA	1,280	\$13,884	\$13,146	1.06

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Exhibit D.8: Comparison of Average Medicare Episode Payment by Wage Index Adjustment in Two HRRs for Patient Pathways “A-C” and “A-H-C” for MS-DRG 291 for 30-day Fixed-length Episodes (2007-2009)

Pathway	HRR City	Number of Episodes	Wage Adjusted	Wage Neutral	Ratio of Wage Adjusted to Wage Neutral
			Average Medicare Episode Payment	Average Medicare Episode Payment	
A-C	Joliet, IL	260	\$7,801	\$7,973	0.98
A-C	Macon, GA	520	\$7,614	\$7,290	1.04
A-H-C	Joliet, IL	160	\$9,844	\$10,130	0.97
A-H-C	Macon, GA	80	\$8,902	\$8,382	1.06

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix D: Pricing the Bundle

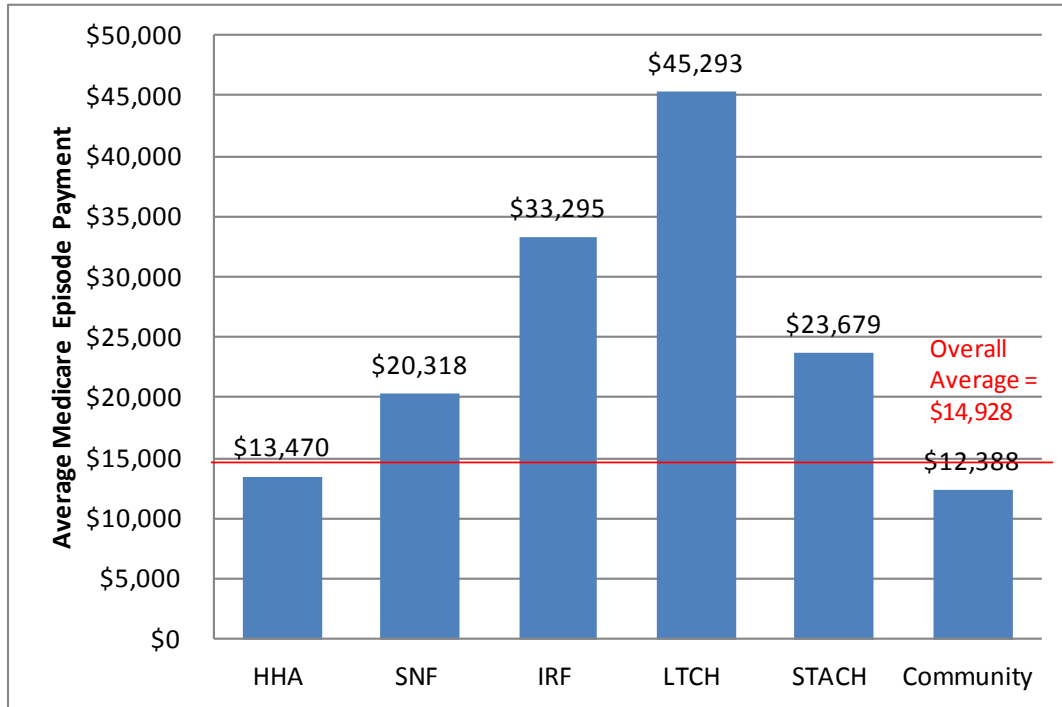
Exhibit D.9: Distribution of Medicare Episode Payment by CMS Region for 30-day Fixed-length Episodes (2007-2009)

CMS Region	50 th Percentile	Average Medicare Episode Payment
470: Major joint replacement or reattachment of lower extremity w/o MCC		
Region 1-Boston	\$19,405	\$20,201
Region 2-New York	\$20,804	\$21,290
Region 3-Philadelphia	\$18,293	\$20,195
Region 4-Atlanta	\$17,014	\$19,161
Region 5-Chicago	\$16,279	\$18,195
Region 6-Dallas	\$16,274	\$19,461
Region 7-Kansas City	\$15,204	\$17,683
Region 8-Denver	\$14,864	\$17,158
Region 9-San Francisco	\$15,404	\$17,858
Region 10-Seattle	\$14,156	\$16,243
Total	\$16,761	\$18,901
291: Heart failure & shock w MCC		
Region 1-Boston	\$11,878	\$15,261
Region 2-New York	\$13,100	\$16,330
Region 3-Philadelphia	\$12,058	\$15,982
Region 4-Atlanta	\$11,127	\$14,467
Region 5-Chicago	\$11,157	\$14,639
Region 6-Dallas	\$11,158	\$15,107
Region 7-Kansas City	\$11,045	\$13,988
Region 8-Denver	\$10,160	\$12,949
Region 9-San Francisco	\$10,747	\$14,759
Region 10-Seattle	\$9,437	\$12,422
Total	\$11,358	\$14,928

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix D: Pricing the Bundle

Exhibit D.10: Difference between Overall Average Medicare Episode Payment and Average Medicare Episode Payment by First-setting for MS-DRG 291 for 30-day Fixed-length Episodes (2007-2009)



Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix D: Pricing the Bundle

Exhibit D.11: Multivariate Regression Variable Definitions

Variable	Description
MS-DRGs	All MS-DRGs are included
Age	Age band of the beneficiary (see Exhibit D.13 for grouping)
Sex	Gender of the beneficiary
Race	Race of the beneficiary
Chronic Conditions	Chronic condition flags for the beneficiary
HCC Count	HCC count for the beneficiary
Functional Ability Score	A combination of eight variables from OASIS, MDS, or IRF-PAI assessment tools. Ranges from zero (low functional ability) to 56 (high functional ability)
Live Alone	Indicator whether or not the beneficiary lives alone
Dual Eligibility	Dual eligibility flag for the beneficiary
IME	Intern/resident-to-bed ratio of the anchor hospital. For the regressions we used the logarithm of 1 + this ratio
DSH	DSH patient percentage of the anchor hospital. For the regressions we used the logarithm of 1 + this percentage
Index Outlier Payment	Outlier payment made to the index hospital. For the regressions we used the logarithm of 1 + (Index Outlier payment divided by the total episode payment)
Look back CCU*	Indicator whether or not the beneficiary had any CCU days during the look back period
Look back ICU*	Indicator whether or not the beneficiary had any ICU days during the look back period
Episode Death	Whether or not the beneficiary died during the episode
Region	CMS region indicators
Urban/Rural	Urban/Rural indicator of the anchor hospital
Bed Size	Bed size of the anchor hospital. We converted this to a categorical variable (see Exhibit D.13 for grouping)
Unique Physician Count	Number of unique physicians seen by beneficiary during the episode
First PAC Setting	First formal post-acute care setting following discharge from the index hospitalization, including HHA, SNF, IRF, LTCH, and all other

Source: Dobson | DaVanzo.

*Look back period refers to the 60 days prior to the index hospitalization.

Appendix D: Pricing the Bundle

Exhibit D.12: Progression of R² Value with Addition of Variables in Model A, Model B, and Model C (Episodes with Functional Ability vs. Episodes without Functional Ability)

		Episodes with Functional Ability	Episodes without Functional Ability	All Episodes
Number of Observations		490,413	801,939	1,292,352
Regression Model	Variables	Cumulative R²*	Cumulative R²*	Cumulative R²*
Model A	MS-DRG	0.413	0.585	0.511
	Age, Sex, Race	0.414	0.590	0.514
	Chronic Conditions	0.422	0.599	0.528
	HCC Count	0.429	0.603	0.534
	Functional Ability and Live Alone	0.538	0.604	0.647
	Dual Eligibility	0.538	0.604	0.647
	IME, DSH, Index Outlier Payment	0.553	0.637	0.669
Model B	Look Back CCU, ICU, and Episode Death	0.554	0.638	0.669
	Region	0.555	0.639	0.669
	Rural	0.555	0.639	0.669
	Bed Size	0.555	0.639	0.670
	Unique Physician Count	0.684	0.742	0.762
Model C	First PAC	0.737	0.760	0.781

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

* The adjusted-R², which accounts for degrees of freedom, was nearly identical to the R² values presented and follows the same trend.

Appendix D: Pricing the Bundle

Exhibit D.13: Model B Payment Adjustment Factors

Categorical Variables	Adjustment Factor	Significance	Categorical Variables	Adjustment Factor	Significance
Age Band			Miscellaneous		
64 or Younger	1.063	0.000	Live Alone	1.028	0.000
65 to 69	1.044	0.000	Dual Eligible	0.987	0.000
70 to 74	1.027	0.000	Died During Episode	1.047	0.000
75 to 79	1.017	0.000	Look Back		
80 to 84	1.007	0.000	Had CCU Days	1.022	0.000
85 or Older	1.000	n/a	Had ICU Days	1.037	0.000
Race			Region		
Asian	1.015	0.000	New England	0.946	0.000
Black	1.013	0.000	Middle Atlantic	0.948	0.000
Hispanic	1.007	0.001	South Atlantic	1.000	n/a
Native American	1.000	0.000	East North Central	0.986	0.000
Other	1.012	0.000	East South Central	1.007	0.000
Unknown	1.025	0.000	West North Central	1.037	0.000
White	1.000	n/a	West South Central	1.052	0.000
Gender			Mountain	1.019	0.000
Male	1.000	n/a	Pacific	1.018	0.000
Female	0.985	0.000	Puerto Rico	1.190	0.000
Chronic Conditions			Urban/Rural		
Cataract	0.941	0.000	Urban	1.000	n/a
CHF*COPD	1.000	n/a	Rural	1.054	0.000
CHF*RENAL	0.992	0.000	Bed Size		
Depression	0.964	0.000	0 to 99 Beds	1.043	0.000
Diabetes	0.936	0.000	100 to 249 Beds	1.000	n/a
Diabetes*CHF	0.982	0.000	250 to 499 Beds	0.978	0.000
Glaucoma	0.942	0.000	500 to 749 Beds	0.964	0.000
Osteoporosis	0.962	0.000	More than 750 Beds	0.953	0.000
Functional Ability Score			HCC Count		
No Score	1.000	n/a	0	0.982	0.000
0	1.409	0.000	1	1.000	n/a
4	1.409	0.000	2	1.013	0.000
8	1.526	0.000	3	1.023	0.000
12	1.524	0.000	4	1.037	0.000
16	1.529	0.000	5	1.054	0.000
20	1.534	0.000	6	1.085	0.000
24	1.482	0.000	7	1.111	0.000
28	1.414	0.000	8	1.172	0.000
32	1.292	0.000	9 or More	0.828	0.149
36	1.192	0.000	Continuous Variables		
40	1.198	0.000	IME	Adjustment Factor	Significance
44	1.157	0.000	IME	0.308	0.000
48	1.111	0.000	DSH	0.569	0.000
52	1.080	0.000	Index Outlier Amount	-0.049	0.000
56	1.111	0.000	Unique Physicians	0.430	0.000

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Paid is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Note: For the sake of brevity, this table contains only a selection of payment adjustment factors for the chronic condition, functional ability and MS-DRG variables.

Appendix D: Pricing the Bundle

Exhibit D.14: Percent of Hospitals by Ratio of Predicted Payment to Actual Payment for Model B

Hospital Type	Ratio of Predicted Payment to Actual Payment									
	< 0.80	0.80-0.85	0.85-0.90	0.90-0.95	0.95-1.00	1.00-1.05	1.05-1.10	1.10-1.15	1.15-1.20	> 1.20
Total	6.2%	5.5%	11.4%	18.5%	25.0%	19.9%	8.8%	2.9%	0.9%	0.9%
Urban/Rural										
Urban	4.6%	3.6%	8.5%	16.8%	26.2%	23.6%	10.9%	3.6%	1.2%	1.0%
Rural	10.2%	10.3%	18.7%	22.6%	22.0%	10.8%	3.6%	1.0%	0.2%	0.7%
Teaching Status										
Major Teaching	4.1%	1.0%	3.1%	3.7%	9.8%	25.8%	24.4%	17.3%	7.8%	3.1%
Minor Teaching	3.5%	1.4%	3.4%	12.8%	30.0%	28.7%	16.0%	3.4%	0.3%	0.4%
Non-Teaching	7.3%	7.3%	15.0%	22.1%	25.2%	16.4%	4.7%	0.9%	0.3%	0.8%

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix D: Pricing the Bundle

Exhibit D.15: Impact on Select Hospital Types for Model B

Hospital Type	Number of Providers	Number of Episodes	Average Medicare Episode Payment	Average Model B Payment	Average Model B Impact	Percent Impact	Model B Impact SD	Predictive Ratio Before Outlier	Predictive Ratio
Total	3,472	1,292,353	\$18,776	\$18,776	\$0	0.0%	\$9,799	1.01	1.00
Urban/Rural									
Urban	2,477	1,100,307	\$19,259	\$19,404	\$145	0.8%	\$10,213	1.01	1.01
Rural	995	192,046	\$16,011	\$15,180	-\$831	-5.2%	\$6,909	0.99	0.95
Control Type									
For-Profit	715	179,729	\$18,447	\$18,083	-\$364	-2.0%	\$8,788	0.99	0.98
Governmental	505	139,349	\$19,181	\$19,273	\$91	0.5%	\$10,996	1.00	1.00
Non-Profit	1,829	840,579	\$18,728	\$18,784	\$56	0.3%	\$9,779	1.02	1.00
Unknown	423	132,696	\$19,099	\$19,141	\$41	0.2%	\$9,882	1.01	1.00
Region									
New England	141	69,443	\$18,629	\$18,518	-\$110	-0.6%	\$9,032	1.02	0.99
Middle Atlantic	403	186,455	\$19,192	\$19,579	\$387	2.0%	\$11,282	1.03	1.02
South Atlantic	592	279,713	\$18,769	\$18,633	-\$136	-0.7%	\$9,478	1.00	0.99
East North Central	499	226,861	\$18,499	\$18,528	\$29	0.2%	\$9,569	1.02	1.00
East South Central	333	107,473	\$17,877	\$17,748	-\$129	-0.7%	\$9,589	1.01	0.99
West North Central	275	95,482	\$18,053	\$17,977	-\$76	-0.4%	\$9,467	1.02	1.00
West South Central	525	144,881	\$19,462	\$19,369	-\$93	-0.5%	\$9,720	0.99	1.00
Mountain	233	57,449	\$18,677	\$18,603	-\$74	-0.4%	\$9,673	1.01	1.00
Pacific	420	120,968	\$19,424	\$19,493	\$69	0.4%	\$9,565	1.00	1.00
Puerto Rico	51	3,628	\$16,238	\$15,557	-\$681	-4.2%	\$7,258	0.99	0.96
Teaching Status									
Major Teaching	295	191,961	\$23,069	\$24,667	\$1,598	6.9%	\$14,969	1.03	1.07
Minor Teaching	763	445,482	\$19,103	\$19,284	\$181	0.9%	\$9,612	1.02	1.01
Non-Teaching	2,414	654,910	\$17,295	\$16,703	-\$592	-3.4%	\$7,736	0.99	0.97
DSH Patient Percentage									
DSH Pct = 0%	15	355	\$19,512	\$15,840	-\$3,672	-18.8%	\$6,109	0.85	0.81
DSH Pct < 5%	137	34,497	\$17,457	\$16,453	-\$1,004	-5.8%	\$7,438	0.98	0.94
DSH Pct 5% - 10%	300	125,664	\$18,091	\$17,603	-\$489	-2.7%	\$8,423	1.00	0.97
DSH Pct 10% - 20%	960	388,046	\$17,728	\$17,478	-\$250	-1.4%	\$8,516	1.01	0.99
DSH Pct > 20%	2,060	743,791	\$19,499	\$19,761	\$261	1.3%	\$10,689	1.01	1.01
Bed Size									
0 to 99 Beds	1,276	150,338	\$15,519	\$14,595	-\$924	-6.0%	\$6,447	0.99	0.94
100 to 249 Beds	1,351	470,574	\$17,696	\$17,288	-\$408	-2.3%	\$8,165	1.00	0.98
250 to 499 Beds	675	468,220	\$19,469	\$19,671	\$202	1.0%	\$10,271	1.02	1.01
500 to 749 Beds	133	137,698	\$21,991	\$23,097	\$1,106	5.0%	\$13,072	1.03	1.05
More than 750 Beds	37	65,523	\$22,298	\$23,579	\$1,281	5.7%	\$14,115	1.03	1.06
First PAC Setting									
HHA	3,351	195,250	\$18,284	\$19,736	\$1,451	7.9%	\$8,133	1.13	1.08
SNF	3,323	245,391	\$26,476	\$27,177	\$701	2.6%	\$12,533	1.05	1.03
IRF	2,534	41,782	\$41,477	\$42,170	\$693	1.7%	\$20,261	0.92	1.02
LTCH	1,859	12,337	\$73,660	\$80,154	\$6,494	8.8%	\$42,679	0.73	1.09
Other	3,469	797,593	\$14,489	\$13,781	-\$708	-4.9%	\$6,289	0.99	0.95

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare "allowed" amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix D: Pricing the Bundle

Exhibit D.16: Model C Payment Adjustment Factors

Categorical Variables	Adjustment Factor	Significance	Categorical Variables	Adjustment Factor	Significance
Age Band			Miscellaneous		
64 or Younger	1.065	0.000	Live Alone	1.010	0.000
65 to 69	1.046	0.000	Dual Eligible	0.986	0.000
70 to 74	1.028	0.000	Died During Episode	1.056	0.000
75 to 79	1.016	0.000	Region		
80 to 84	1.006	0.000	New England	0.936	0.000
85 or Older	1.000	n/a	Middle Atlantic	0.945	0.000
Race			South Atlantic	1.000	n/a
Asian	1.019	0.000	East North Central	0.979	0.000
Black	1.013	0.000	East South Central	1.003	0.022
Hispanic	1.012	0.000	West North Central	1.024	0.000
Native American	1.000	0.000	West South Central	1.028	0.000
Other	1.015	0.000	Mountain	1.007	0.000
Unknown	1.029	0.000	Pacific	1.014	0.000
White	1.000	n/a	Puerto Rico	1.195	0.000
Gender			Urban/Rural		
Male	1.000	n/a	Urban	1.000	n/a
Female	0.987	0.000	Rural	1.051	0.000
Chronic Conditions			Bed Size		
Cataract	0.939	0.000	0 to 99 Beds	1.042	0.000
CHF*COPD	1.000	n/a	100 to 249 Beds	1.000	n/a
CHF*RENAL	0.993	0.000	250 to 499 Beds	0.979	0.000
Depression	0.962	0.000	500 to 749 Beds	0.967	0.000
Diabetes	0.932	0.000	More than 750 Beds	0.957	0.000
Diabetes*CHF	0.984	0.000	First PAC Setting		
Glaucoma	0.942	0.000	HHA	0.710	0.000
Osteoporosis	0.959	0.000	SNF	1.000	n/a
Look Back			IRF	1.182	0.000
Had CCU Days	1.023	0.000	LTCH	1.523	0.000
Had ICU Days	1.036	0.000	Other	0.842	0.000
Functional Ability Score			HCC Count		
No Score	1.000	n/a	0	0.982	0.000
0	1.288	0.000	1	1.000	n/a
4	1.338	0.000	2	1.013	0.000
8	1.426	0.000	3	1.022	0.000
12	1.397	0.000	4	1.033	0.000
16	1.408	0.000	5	1.045	0.000
20	1.389	0.000	6	1.068	0.000
24	1.332	0.000	7	1.094	0.000
28	1.327	0.000	8	1.146	0.000
32	1.297	0.000	9 or More	0.895	0.357
36	1.301	0.000	Continuous Variables		
40	1.273	0.000	IME	0.321	0.000
44	1.253	0.000	DSH	0.559	0.000
48	1.247	0.000	Index Outlier Amount	-0.046	0.000
52	1.217	0.000	Unique Physicians	0.408	0.000
56	1.211	0.000			

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments. Note: For the sake of brevity, this table contains only a selection of payment adjustment factors for the chronic condition, functional ability and MS-DRG variables.

Appendix D: Pricing the Bundle

Exhibit D.17: Percent of Hospitals by Ratio of Predicted Payment to Actual Payment for Model C

Hospital Type	Ratio of Predicted Payment to Actual Payment									
	< 0.80	0.80-0.85	0.85-0.90	0.90-0.95	0.95-1.00	1.00-1.05	1.05-1.10	1.10-1.15	1.15-1.20	> 1.20
Total	6.2%	5.8%	11.8%	19.0%	24.1%	19.6%	8.6%	2.9%	0.9%	1.0%
Urban/Rural										
Urban	4.4%	3.9%	8.7%	16.9%	26.0%	23.1%	10.9%	3.9%	1.2%	1.1%
Rural	10.5%	10.6%	19.7%	24.4%	19.5%	11.0%	2.7%	0.6%	0.3%	0.8%
Teaching Status										
Major Teaching	4.1%	1.4%	1.7%	3.7%	12.5%	24.4%	27.8%	14.9%	5.4%	4.1%
Minor Teaching	3.5%	0.9%	4.5%	12.8%	27.5%	32.2%	13.9%	3.4%	0.8%	0.4%
Non-Teaching	7.2%	7.9%	15.4%	22.9%	24.4%	15.0%	4.6%	1.3%	0.4%	0.8%

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare “allowed” amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix D: Pricing the Bundle

Exhibit D.18: Impact on Select Hospital Types for Model C

Hospital Type	Number of Providers	Number of Episodes	Average Medicare Episode Payment	Average Model C Payment	Average Model C Impact	Percent Impact	Model C Impact SD	Predictive Ratio Before Outlier	Predictive Ratio
Total	3,472	1,292,353	\$18,776	\$18,776	\$0	0.0%	\$10,734	1.02	1.00
Urban/Rural									
Urban	2,477	1,100,307	\$19,259	\$19,415	\$156	0.8%	\$11,224	1.02	1.01
Rural	995	192,046	\$16,011	\$15,116	-\$894	-5.6%	\$7,250	0.99	0.94
Control Type									
For-Profit	715	179,729	\$18,447	\$18,202	-\$244	-1.3%	\$10,140	1.00	0.99
Governmental	505	139,349	\$19,181	\$19,277	\$96	0.5%	\$12,021	1.01	1.00
Non-Profit	1,829	840,579	\$18,728	\$18,750	\$22	0.1%	\$10,534	1.02	1.00
Unknown	423	132,696	\$19,099	\$19,193	\$94	0.5%	\$11,320	1.02	1.00
Region									
New England	141	69,443	\$18,629	\$18,572	-\$57	-0.3%	\$9,915	1.03	1.00
Middle Atlantic	403	186,455	\$19,192	\$19,452	\$260	1.4%	\$11,143	1.03	1.01
South Atlantic	592	279,713	\$18,769	\$18,548	-\$221	-1.2%	\$10,182	1.00	0.99
East North Central	499	226,861	\$18,499	\$18,553	\$54	0.3%	\$10,925	1.02	1.00
East South Central	333	107,473	\$17,877	\$17,749	-\$128	-0.7%	\$11,112	1.02	0.99
West North Central	275	95,482	\$18,053	\$17,916	-\$137	-0.8%	\$10,178	1.02	0.99
West South Central	525	144,881	\$19,462	\$19,696	\$234	1.2%	\$11,540	1.02	1.01
Mountain	233	57,449	\$18,677	\$18,703	\$26	0.1%	\$11,387	1.02	1.00
Pacific	420	120,968	\$19,424	\$19,428	\$4	0.0%	\$10,267	1.00	1.00
Puerto Rico	51	3,628	\$16,238	\$15,163	-\$1,075	-6.6%	\$6,461	0.97	0.93
Teaching Status									
Major Teaching	295	191,961	\$23,069	\$24,597	\$1,528	6.6%	\$16,144	1.03	1.07
Minor Teaching	763	445,482	\$19,103	\$19,319	\$216	1.1%	\$10,653	1.03	1.01
Non-Teaching	2,414	654,910	\$17,295	\$16,700	-\$595	-3.4%	\$8,526	1.00	0.97
DSH Patient Percentage									
DSH Pct = 0%	15	355	\$19,512	\$16,299	-\$3,213	-16.5%	\$5,512	0.88	0.84
DSH Pct < 5%	137	34,497	\$17,457	\$16,375	-\$1,082	-6.2%	\$7,862	0.98	0.94
DSH Pct 5% - 10%	300	125,664	\$18,091	\$17,557	-\$535	-3.0%	\$9,090	1.00	0.97
DSH Pct 10% - 20%	960	388,046	\$17,728	\$17,466	-\$261	-1.5%	\$9,272	1.02	0.99
DSH Pct > 20%	2,060	743,791	\$19,499	\$19,778	\$278	1.4%	\$11,759	1.02	1.01
Bed Size									
0 to 99 Beds	1,276	150,338	\$15,519	\$14,549	-\$970	-6.2%	\$6,722	0.99	0.94
100 to 249 Beds	1,351	470,574	\$17,696	\$17,290	-\$406	-2.3%	\$8,898	1.01	0.98
250 to 499 Beds	675	468,220	\$19,469	\$19,678	\$209	1.1%	\$11,369	1.02	1.01
500 to 749 Beds	133	137,698	\$21,991	\$23,116	\$1,125	5.1%	\$14,518	1.03	1.05
More than 750 Beds	37	65,523	\$22,298	\$23,579	\$1,281	5.7%	\$15,026	1.03	1.06
First PAC Setting									
HHA	3,351	195,250	\$18,284	\$17,749	-\$535	-2.9%	\$6,759	1.01	0.97
SNF	3,323	245,391	\$26,476	\$27,362	\$886	3.3%	\$10,915	1.06	1.03
IRF	2,534	41,782	\$41,477	\$48,121	\$6,645	16.0%	\$21,808	1.09	1.16
LTCH	1,859	12,337	\$73,660	\$109,655	\$35,995	48.9%	\$61,038	1.18	1.49
Other	3,469	797,593	\$14,489	\$13,443	-\$1,047	-7.2%	\$5,705	0.97	0.93

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. Medicare Episode Payment is the Medicare "allowed" amount, and includes care from all facility-based and ambulatory care settings, as well as IME, DSH, beneficiary co-payments, capital, and other third party payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix E: Managing the Bundle

Appendix E

Managing the Bundle

Appendix E: Managing the Bundle

Exhibit E.1: Top 10 Chronic Conditions Ranked by Total Medicare Episode Payment for Each First-setting for 30-day Fixed-length Episodes (2007-2009)

Primary Chronic Condition	Overall	HHA	SNF	IRF	LTCH	STACH	Community
CHF*COPD	1	1	1	1	1	1	1
DIABETES*CHF	2	2	3	3	2	2	2
Osteoporosis	3	3	2	2	4	3	3
Rheumatoid Arthritis/Osteoarthritis	4	4	4	4	6	6	4
CHF*RENAL	5	6	5	5	5	5	6
Chronic Obstructive Pulmonary Disease	6	5	6	6	3	4	5
Ischemic Heart Disease	7	7	15	14	13	8	7
Heart Failure	8	9	8	10	10	9	10
Depression	9	10	13	12	9	7	8
Lung Cancer	10	8	11	11	12	10	9

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Exhibit E.2: Average Medicare Episode Payment by Readmission Status for Select MS-DRGs for 30-day Fixed-length Episodes (2007-2009)

MS-DRG	Average Medicare Episode Payment		Percent Increase With Readmission
	Without Readmission	With Readmission	
247: Perc cardiovasc proc w drug-eluting stent w/o MCC	\$12,301	\$23,527	91.3%
470: Major joint replacement or reattachment of lower extremity w/o MCC	\$18,128	\$29,803	64.4%
481: Hip & femur procedures except major joint w CC	\$23,034	\$32,262	40.1%
192: Chronic obstructive pulmonary disease w/o CC/MCC	\$5,514	\$14,977	171.6%
194: Simple pneumonia & pleurisy w CC	\$8,492	\$19,243	126.6%
291: Heart failure & shock w MCC	\$12,075	\$23,844	97.5%

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments.

Appendix E: Managing the Bundle

Exhibit E.3: Average and Percent Medicare Episode Payment by Select Service for MS-DRG 470 by First-setting for 30-day Fixed-length Episodes (2007-2009)

First-setting	Number of Episodes	Index Hospitalization	HHA	SNF	IRF	LTCH	STACH	OP	Physician	Total
HHA	362,440	\$9,442 63.4%	\$2,883 19.3%	\$35 0.2%	\$12 0.1%	* *	\$348 2.3%	\$41 0.3%	\$1,906 12.8%	\$14,901 100%
SNF	440,340	\$9,776 45.0%	\$799 3.7%	\$7,807 35.9%	\$57 0.3%	\$10 0.0%	\$687 3.2%	\$59 0.3%	\$2,367 10.9%	\$21,742 100%
IRF	133,960	\$9,536 34.5%	\$1,135 4.1%	\$681 2.5%	\$12,272 44.4%	\$19 0.1%	\$701 2.5%	\$51 0.2%	\$2,989 10.8%	\$27,617 100%
LTCH	1,160	\$10,625 24.3%	\$226 0.5%	\$679 1.6%	* *	\$25,069 57.3%	\$1,593 3.6%	\$104 0.2%	\$4,710 10.8%	\$43,772 100%
STACH	2,440	\$9,880 39.6%	\$636 2.6%	\$826 3.3%	* *	* *	\$8,693 34.8%	\$179 0.7%	\$3,401 13.6%	\$24,957 100%
Community	128,920	\$9,671 67.3%	\$288 2.0%	\$377 2.6%	\$913 6.4%	* *	\$552 3.8%	\$67 0.5%	\$2,287 15.9%	\$14,372 100%
Total	1,140,340	\$9,622 50.9%	\$1,398 7.4%	\$3,160 16.7%	\$1,574 8.3%	\$36 0.2%	\$565 3.0%	\$53 0.3%	\$2,253 11.9%	\$18,901 100%

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments. Total includes services from other care settings, including ER, OP Therapy, Hospice, and Other IP.

* Indicates cell size fewer than 11 observations.

Exhibit E.4: Average and Percent Medicare Episode Payment by Select Service for MS-DRG 291 by First-setting for 30-day Fixed-length Episodes (2007-2009)

First-setting	Number of Episodes	Index Hospitalization	HHA	SNF	IRF	LTCH	STACH	OP	Physician	Total
HHA	62,680	\$6,340 47.1%	\$1,683 12.5%	\$232 1.7%	\$46 0.3%	* *	\$2,241 16.6%	\$322 2.4%	\$2,214 16.4%	\$13,470 100%
SNF	93,520	\$6,899 34.0%	\$140 0.7%	\$7,319 36.0%	\$46 0.2%	\$41 0.2%	\$2,501 12.3%	\$270 1.3%	\$2,799 13.8%	\$20,318 100%
IRF	4,800	\$7,624 22.9%	\$632 1.9%	\$927 2.8%	\$15,778 47.4%	* *	\$3,499 10.5%	\$153 0.5%	\$4,189 12.6%	\$33,295 100%
LTCH	3,760	\$8,150 18.0%	\$85 0.2%	\$580 1.3%	* *	\$25,673 56.7%	\$4,153 9.2%	\$99 0.2%	\$6,107 13.5%	\$45,293 100%
STACH	14,020	\$6,435 27.2%	\$187 0.8%	\$570 2.4%	\$360 1.5%	\$326 1.4%	\$11,506 48.6%	\$353 1.5%	\$3,540 15.0%	\$23,679 100%
Community	193,600	\$6,257 50.5%	\$136 1.1%	\$196 1.6%	\$119 1.0%	\$46 0.4%	\$2,411 19.5%	\$781 6.3%	\$2,158 17.4%	\$12,388 100%
Total	444,660	\$6,538 43.8%	\$344 2.3%	\$1,706 11.4%	\$252 1.7%	\$268 1.8%	\$2,526 16.9%	\$480 3.2%	\$2,357 15.8%	\$14,928 100%

Source: Dobson | DaVanzo analysis of research-identifiable 5 percent SAF for all sites of service, 2007-2009, wage index adjusted by setting and geographic region, and standardized to 2009 dollars. All episodes have been extrapolated to reflect the universe of Medicare beneficiaries. Medicare Episode Payment includes care from all facility-based and ambulatory care settings and excludes beneficiary co-payments. IME, DSH, copay, capital, and other third party have been removed from payments. HH PPS payments do not include payments for Part D drug or DME services that are provided under SNF, IRF, and LTCH PPS payments. Total includes services from other care settings, including ER, OP Therapy, Hospice, and Other IP.

* Indicates cell size fewer than 11 observations.

Appendix F: Quality Measures

Appendix F

Quality Measures by Program

Appendix F: Quality Measures

Exhibit F.1: Medicare Acute Care Episode (ACE) Demonstration Measures

- Measure 1: Prophylactic antibiotic received within 1 hour prior to surgical incision
 - Measure 2: Prophylactic antibiotic selection for surgical patients
 - Measure 3: Prophylactic antibiotics discontinued within 24 hours after surgery end time for hip and knee replacement and 48 hours for CABG and valve procedure groups
 - Measure 4: Surgery patients who received appropriate venous thromboembolism prophylaxis within 24 hours prior to surgery to 24 hours after surgery end
- *Patient Safety Indicators (PSIs) – Measures 5-7*
- Measure 5: Postoperative Hemorrhage/Hematoma (PSI 9)
 - Measure 6: Postoperative Physiologic and Metabolic Derangement (PSI 10)
 - Measure 7: Post-operative Sepsis (PSI 13)
 - Measure 8: Inpatient Mortality
 - Measure 9: Use of Internal Mammary Artery (IMA) in an isolated CABG
 - Measure 10: Anti-Platelet Medication Prescribed at Discharge
 - Measure 11: Surgical Re-exploration in Isolated CABG Patients during Stay
 - Measure 12: Percent of PCI Procedures with Angiographic Success and No Death, MI, or Emergent/salvage CABG during Admission
 - Measure 13: Revascularization Rates by Number of Vessels and Percent of CABG Procedures Performed Off Pump
 - Measure 14: Post-Operative Stroke
 - Measure 15: Percent of ACE Demonstration Cardiovascular Procedures that are Re-dos or Revisions within Six Months
 - Measure 16: 30-Day Post-Surgery Mortality
 - Measure 17: 30-Day Post-Discharge Readmission Rate
 - Measure 18: Change in Mix of MS-DRG Assignments
 - Measure 19: Severity of Beneficiaries Receiving a Hip or Knee Replacement/Revision
 - Measure 20: Average and Median Length of Stay
 - Measure 21: Percent Medicare Outlier Patients
 - Measure 22: Percent Discharge Destination is acute care hospital transfer or post-acute care transfer

Appendix F: Quality Measures

Exhibit F.2: Hospital Inpatient Quality Reporting (IQR) FY 2011 Sample Measures - AMI

Measure	Description	IQR Classification
AMI-1	Aspirin at Arrival	Required
AMI-2	Aspirin Prescribed at Discharge	Required
AMI-3	ACEI or ARB for LVSD	Required
AMI-4	Adult Smoking Cessation Advice/Counseling	Required
AMI-5	Beta-Blocker Prescribed at Discharge	Required
AMI-7	Median Time to Fibrinolysis	CMS Informational
AMI-7a	Fibrolytic Therapy Received Within 30 Minutes of Hospital Arrival	Required
AMI-8	Median Time to Primary PCI	Required
AMI-8a	Timing of Receipt of Primary Percutaneous Coronary Intervention (PCI)	Required
AMI-9	Inpatient Mortality	CMS Informational
AMI-10	Statin Prescribed at Discharge	Required
AMI-T1a	LDL-Cholesterol Assessment	CMS Voluntary (will be retired and not applicable for 2012)
AMI-T2	Lipid-Lowering Therapy at Discharge	CMS Voluntary (will be retired and not applicable for 2012)

Exhibit F.3: Sample Hospital Outpatient Department (HOP) Quality Data Reporting Program (QDRP) Measures (FY 2011)

Measure	Description	HOP QDRP
OP-1	Median Time to Fibrinolysis	Required
OP-2	Fibrolytic Therapy Received Within 30 Minutes	Required
OP-3	Median Time to Transfer to Another Facility for Acute Coronary Intervention	Required
OP-4	Aspirin at Arrival	Required
OP-5	Median Time to ECG	Required
OP-6	Timing of Antibiotic Prophylaxis	Required
OP-7	Prophylactic Antibiotic Selection for Surgical Patients	Required
OP-8	MRI Lumbar Spine for Low Back Pain	Automatically Captured
OP-9	Mammography Follow-up Rates	Automatically Captured
OP-10	Abdomen CT – Use of Contrast Material	Automatically Captured
OP-11	Thorax CT – Use of Contrast Material	Automatically Captured
OP-12	The Ability for Providers with HIT to Receive Laboratory Data Electronically Directly into Their Qualified/Certified EHR System as Discrete Searchable Data	Required
OP-13	Cardiac Imaging for Preoperative Risk Assessment for Non-Cardiac Low- Risk Surgery	Automatically Captured
OP-14	Simultaneous Use of Brain Computed Tomography (CT) and Sinus CT	Automatically Captured
OP-15	Use of Brain CT in the Emergency Department (ED) for Atraumatic Headache	Automatically Captured

Appendix F: Quality Measures

Exhibit F.4: Current Nursing Home Quality Measures

Short-Stay Quality Measures

- The Percentage of Residents on a Scheduled Pain Medication Regimen on Admission Who Report a Decrease in Pain Intensity or Frequency
- Percent of Residents who Self-Report Moderate to Severe Pain
- Percent of Residents with Pressure Ulcers that are New or Worsened
- Percent of Residents Assessed and Given, Appropriately, the Seasonal Influenza Vaccine
- Percent of Residents Assessed and Given, Appropriately, the Pneumococcal Vaccine

Long-Stay Quality Measures

- Percent of Residents Experiencing One or More Falls with Major Injury
- Percent of Residents who Self-Report Moderate to Severe Pain
- Percent of High-Risk Residents with Pressure Ulcers
- Percent of Long Stay Residents Assessed and Given, Appropriately, the Seasonal Influenza Vaccine
- Percent of Long Stay Residents Assessed and Given, Appropriately, the Pneumococcal Vaccine
- Percent of Long-stay Residents with a Urinary Tract Infection
- Percent of Low-Risk Residents Who Lose Control of their Bowels or Bladder
- Residents Who Have/Had a Catheter Inserted and Left in Their Bladder
- Percent of Residents Who Were Physically Restrained
- Percent of Residents Whose Need for Help with Daily Activities Has Increased
- Percent of Long-stay Residents Who Lose Too Much Weight
- Percent of Residents Who have Depressive Symptoms