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Bundling Post-Acute Care Services into MS-DRG Payments

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Objective: A bundled hospital payment system that encompasses both acute and post-acute care has been proposed as a means of creating financial incentives in the Medicare fee-for-service system to foster care coordination and to improve the current disorganized system of post care. The objective of this study was to evaluate the statistical stability of alternative designs of a hospital payment system that includes post-acute care services to determine the feasibility of using a combined hospital and post-acute care bundle as a unit of payment.

Methods: The Medicare Severity-Diagnosis Related Groups (MS-DRGs) were subdivided into clinical subclasses that measured a patient's chronic illness burden to test whether a patient's chronic illness burden had a substantial impact on post-acute care expenditures. Using Medicare data the statistical performance of the MS-DRGs with and without the chronic illness subclasses was evaluated across a wide range of post-acute care windows and combinations of post-acute care service bundles using both submitted charges and Medicare payments.

Results: The statistical performance of the MS-DRGs as measured by R^2 was consistently better when the chronic illness subclasses are included indicating that MS-DRGs by themselves are an inadequate unit of payment for post-acute care payment bundles. In general, R^2 values increased as the post-acute care window length increased and decreased as more services were added to the post-acute care bundle.

Discussion: The study results suggest that it is feasible to develop a payment system that incorporates significant post-acute care services into the MS-DRG inpatient payment bundle. This expansion of the basic DRG payment approach can provide a strong financial incentive for providers to better coordinate care potentially leading to improved efficiency and outcome quality.

Keywords: MS-DRGs, IPPS, episodes, episode payment, bundled payment, Patient Centered Episodes, PCEs, Clinical Risk Groups, CRGs

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Introduction

The successful implementation of the Medicare Severity-Diagnosis Related Group (MS-DRG) based inpatient prospective payment system (IPPS) in 1983 demonstrated that bundling all inpatient services into a single per case payment amount created an effective incentive for hospitals to utilize resources efficiently. The all inclusive per case DRG payment shifted the financial risk for use of bed days and diagnostic and therapeutic services during the hospital stay from Medicare to the hospital, thereby creating a strong financial incentive for efficiency. The incentive structure within IPPS could be expanded to encompass post discharge services as well as the professional services (Medicare Part B) delivered during the hospital stay.

A bundled payment that includes post-acute care services would greatly increase the financial incentive to improve coordination of inpatient and post-acute care, thereby improving both efficiency and quality. The Medicare Payment Advisory Commission (MedPAC) noted that a bundled payment that includes all services rendered during the post-acute care period would create the incentive for providers to deliver "the right mix of services at the right time" (MedPAC, June 2008). Further, the Medicare Improvements for Patients and Providers Act of 2008 requires the Centers for Medicare & Medicaid Services (CMS) to establish a physician feedback program in which physicians would receive confidential information on their resource use based on episodes of care. Section 3003 of the Patient Protection and Affordable Care Act of 2010 requires that "The Secretary shall develop an episode grouper that combines separate but clinically related items and services into an episode of care for an individual, as appropriate." For FY2014, CMS has proposed adding to the Hospital IQR Program an episode based measure of Medicare spending per beneficiary:

> "We are proposing an episode that runs from three days prior to an inpatient PPS hospital admission (the index admission) through 90 days post-hospital discharge. We are proposing to include the time period 90 days post-hospital discharge in order to emphasize the importance of care transitions and care coordination in improving patient care."

Federal Register, May 5, 2011

In August, 2011, CMS invited providers to propose bundled payment arrangements under one of four potential models, with Models 2 and 3 being most relevant to this article. Model 2 is based on bundled payments that include both the inpatient stay and post-acute care, while Model 3 only includes post-acute care. Both models are based on MS-DRGs selected by the applicant and can include physician's services and readmissions as well as other services as proposed by the applicant. The applicant offers a target price for the bundle. This price is a discount from the historical total fee-for-service payments for the post-acute care bundle. Medicare will make fee-for-service payments that will be retrospectively reconciled against the

target price. Any reduction in payments below the target price will be shared with the participants.

While there have been previous bundled payment demonstration projects, such as the Acute Care Episode (ACE) demonstrations, these projects have been narrow in scope. In order to include a wider range of both medical and surgical cases, a number of payment design questions need to be addressed.

A Bundle Payment System for Post-Acute Care

In the bundled payment demonstration projects, CMS has essentially required hospitals to build their bundled payment proposals based on MS-DRGs as the unit of payment. Most of the details of the structure of the bundled payment arrangement were largely left up to the hospital to propose. Any proposed bundled payment arrangement needs to address several key issues.

Unit of Payment

The unit of payment must address the patient characteristics that impact both acute and post-acute care expenditures. Patients who are more severely ill should have higher payments to compensate providers for the higher costs associated with the treatment of these patients. Failure to provide higher payments for severely ill patients would create the financial incentive for providers to avoid treating these patients. In the IPPS, the unit of payment is the DRG that explicitly recognizes patients with high severity of illness.

Post-Acute Care Window

The length of the post-acute care time period included in the bundled payment must be determined. The post-acute care window can be established as a predetermined fixed period of time or as a variable length period, based on the point in time when the treatment for the problem that initiated the hospitalization has been completed.

Service Scope

The precise services included in the bundled payment amount must be determined. There are a wide variety of post-acute care services ranging from durable medical equipment and retail pharmacy to skilled nursing facility and readmissions. The bundled payment amount can vary dramatically depending on services included in the post-acute care bundle.

Outlier Payments

Outlier payments protect providers from an extreme financial loss from an individual patient. The outlier payment provisions of the Medicare inpatient prospective payment system were a key component of its ultimate success. Outlier payments are essentially an insurance provision that minimizes the financial incentive for providers to avoid treating patients who are at risk for incurring high costs.

Payment Adjustments

In the Medicare inpatient prospective payment system there are payment adjustments for factors, such as geographic wage variation, medical education costs, and disproportionate share, that reflect reasons for higher hospital costs beyond the clinical characteristic of the patients being treated. While a geographic wage adjustment needs to be part of any post-acute care bundle payment, it is not clear whether medical education and disproportionate share payment adjustments would be necessary for the payment of post-acute care services. In a bundled payment system there are also unique adjustments that need to be considered, such as adjustments for truncated post-acute care windows for patients who die during the post-acute care window or for whom the window is prematurely ended for other reasons, such as disenrollment.

Payment Weights

Since the payment bundling demonstration is based on MS-DRGs as the basic unit of payment, each post-acute care bundle will have a payment weight that is a measure of the relative costliness of the bundle. The design of the IPPS permitted the separation of the computation of the payment weights and the underlying DRG clinical model. This allowed the DRG clinical model to remain relatively stable while the payment weights changed to reflect changing practice patterns. It also allowed a straightforward empirical calculation of the payment weights to be based on the national average expenditures in each DRG. A bundled payment system should be an extension of the IPPS approach and have empirically derived payment weights computed based on the national average expenditures in each post-acute payment bundle (unit of service).

Non-susceptibility to Manipulation

The patient characteristic used in the unit of payment should not be susceptible to up-coding, resulting in artificially higher payments. If subtle or ambiguous distinctions in the coding system result in significant changes in the assignment of the unit of payment, the bundled payment system will be prone to up-coding. In addition, if minor distinctions in treatment choice are used in assigning the unit of payment, the bundled payment system will be prone to manipulation. For example, if pharmaceutical data were used in the assignment of the unit of payment and the use of inexpensive, low risk drugs resulted in significant changes in the assignment of the unit of payment, the bundled payment system would be prone to manipulation.

Administratively Feasible

Any bundled payment system will present significant challenges for existing claims processing systems. The bundled payment system must be administratively feasible in the context of existing claims processing systems and hospital information systems. To the extent possible, the bundled payment system should only require data elements that are routinely collected and familiar to the industry.

Understandable

The bundled payment system, especially the unit of payment, should be understandable and clinically relevant. The ultimate objective of any payment reform is to motivate behavioral change that leads to lower costs, better care coordination, and better quality. Providers will be better able to achieve these objectives if the payment methodology is expressed in a clinically meaningful manner that communicates actionable information, in a form and at a level of detail sufficient to achieve sustainable behavior changes. One of the key attributes of IPPS was that the DRGs as the unit of payment were readily understandable and clinically relevant.

This article will primarily address the issues of the unit of payment, post-acute care window, and service scope. Specifically, it will address the following questions:

1. Can MS-DRGs be used as the unit of payment for hospital-bundled payments or do other patient attributes need to be taken into account in order to provide accurate payment?
2. How does the inclusion of longer length post-acute care periods in the bundled payment impact the accuracy of the bundled payment?
3. How does the inclusion of specific services (e.g., physician office visits, readmissions, etc.) impact the accuracy of the bundled payment?

The answers to these three questions will substantially impact the design of any hospital-based bundled payment system. In the context of the answers to these questions, the other key issues for a bundled payment system will be addressed in the discussion section. The bundled payments addressed in this article are post-acute care bundles or episodes following a hospitalization, and for brevity will be referred to as the bundled payment system. This article will provide hospitals that are planning to enter into bundled payment arrangements with CMS or other payers an assessment of the impact of the key payment design issues that must be addressed.

Methods

Unit of Payment

The MS-DRGs focus primarily on the time-limited treatment of acute illnesses (e.g., pneumonia) or acute deteriorations of chronic illnesses (e.g., acute exacerbations of heart failure). The MS-DRGs attach less significance to relatively serious but stable chronic conditions. However, during the post-acute care period, the patient's chronic illness burden is likely to be one of the primary determinants of resource use rather than the acute illnesses that precipitated the hospitalization. It is reasonable to hypothesize that the impact of the patient's chronic illness burden will increase, and the impact of patient acuity as measured by MS-DRGs will decrease, as the post-acute care period is lengthened (Averill, Goldfield, Hughes, Eisenhandler, & Vertrees, 2009). In order to test this hypothesis, a measure of patient chronic illness burden was needed.

The Clinical Risk Groups (CRGs) were used to define chronic illness burden (Hughes et al., 2004). CRGs are a categorical clinical model that uses a patient's claims history to assign patients to a single, mutually exclusive, category that reflects the chronic illness burden of the patient and predicts the level of expected future resource use. Like DRGs, each CRG is composed of a base CRG that describes the patient's most significant chronic conditions and a severity of illness level (e.g., a patient with diabetes and heart failure is at severity level 3).

Since MS-DRGs and CRGs are independent categorical clinical models, each patient can be assigned to both an MS-DRG and a CRG. This allows each MS-DRG to be further subdivided into additional categories based on the CRG assignment of the patient. The CRG classification contains CRG categories expressed at a level of detail ranging from 1,080 to 38 CRG categories. When aggregated into fewer categories, some clinical precision is sacrificed, but with only a slight loss of predictive performance (Hughes et al., 2004). Because all the patients in the study required hospitalization, implying a minimum level severity of illness, the 38 CRG categories were further consolidated into 19 CRG categories. These 19 CRG categories are referred to as Aggregated CRGs (ACRGs) and range from patients with no significant chronic disease to patients with multiple major chronic diseases at high severity. The MS-DRGs and CRGs were combined together by subdividing each MS-DRG into the 19 ACRG subgroups. Essentially, the MS-DRGs are used to identify the reason for hospitalization and the ACRGs are used to differentiate patients in terms of their chronic disease burden. The addition of the CRG categories to the MS-DRGs provides a basis for testing whether a measure of chronic illness burden needs to be added to the MS-DRGs in order to produce accurate bundled payments.

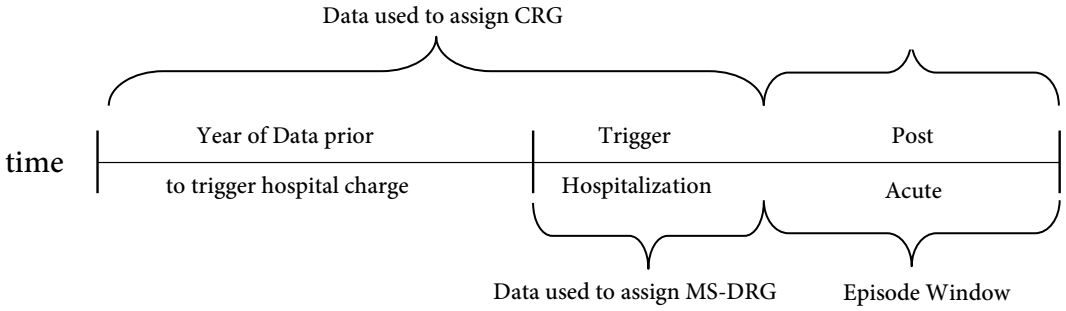
The projected expenditures in a bundle for a patient would simply be the historical average expenditures in the MS-DRG/ACRG category to which the patient is assigned. The combination of the base MS-DRG (reason for hospitalization), MS-DRG severity level (acuity), and ACRG (chronic illness burden) identify the patient categories that define the unique types of payment bundles and are referred to as Patient Centered Episodes (PCEs).

This study examined 167 MS-DRGs of the 744 V.27 MS-DRGs. These MS-DRGs were selected, because they were high volume and clinically would be expected to have a reasonably stable post-acute care pattern of care. The 167 MS-DRGs constitute 73.4 percent of Medicare inpatient admissions. In this study, the PCEs were comprised of each of the 167 MS-DRGs subdivided into 19 ACRG categories. (167 MS-DRGs x 19 CRG categories = 3,173 possible PCEs). However, not all of the ACRGs are applicable to all the MS-DRGs. For example, patients in the MS-DRG for heart failure will never be assigned to the ACRG for patients with no significant chronic disease, since heart failure is a significant chronic disease. Of the 3,173 possible PCEs, 3,010 PCEs where actually used.

As illustrated in Exhibit 1, the ACRG is assigned using the diagnoses and procedures present during the trigger hospitalization, plus any diagnosis and procedures that occurred up to one year prior to the date of hospital admission. The MS-DRG assignment is based on the data during the trigger hospital stay. The resources that are included in the post-acute care payment

bundle are those resources that were delivered during the post-acute care window starting on the day following hospital discharge.

Exhibit 1. Data Used to Assign CRGs and MS-DRGs



SOURCE: Medicare Claims Data, April 2006–June 2009.

Post-Acute Care Window

Fixed post-hospitalization time periods (the post-acute care window) of 15, 30, 60 and 90 days were evaluated. Services that occurred within the post-acute care window were included in the payment bundle.

Measuring Resource Use

The data used in this study were Medicare data that included two different methods of measuring resource use: provider charges and actual payments. The charges submitted by the provider on the claim were used for the charge variable. The payment variable was computed as shown in Exhibit 2. Each of these measures of resource use has advantages and disadvantages. Charges likely reflect with more accuracy the relative costliness of individual services. Medicare payments reflect the cost of the services to the program as well as reflecting the outcome of political processes. Since neither is clearly "correct" for all circumstances, the analyses were done separately for provider charges and Medicare payments.

Readmissions

Hospital admissions that occurred during the post-acute care window of a prior hospitalization were considered a readmission, and were included in the payment bundle of the prior admission. However, readmissions can have a substantial impact on post-acute costs. In order to avoid having the post-acute care cost dominated by a completely unrelated readmission (a subsequent admission for injuries incurred in a traffic accident), a definition of a plausibly related readmission was developed. Any readmission with an MS-DRG in the same major diagnostic category (MDC) as the MS-DRG of the trigger hospitalization was considered plausibly related to the trigger hospitalization, and was included in the payment bundle. The one exception to this rule was a list of 49 MS-DRGs that were always considered plausibly related to any admission that initiated a payment bundle. This list was developed by the project clinical

team, and contains MS-DRGs that are infections and complications of care that could plausibly be related to the care in the admission that initiated the payment bundle. If an unrelated readmission occurred during a post-acute care window, the original payment bundle was truncated and a new payment bundle based on the readmission was begun.

Exhibit 2. Determination of the Payment Variable

Hospital	Amount paid with disproportionate share, indirect medical education, new technology add-on amount, and capital removed, *plus* beneficiary coinsurance payment *plus* beneficiary deductible payment
Outpatient	Amount paid, *plus* beneficiary coinsurance payment *plus* beneficiary deductible payment
SNF	Amount paid, *plus* beneficiary coinsurance payment *plus* beneficiary deductible payment
Other part B	Allowed charge
DME	Allowed charge
Home health	Amount paid
Hospice	Amount paid

SOURCE: Medicare Claims Data, April 2006–June 2009.

Truncated Payment Bundles

Those beneficiaries who died during the post-acute care window, or who had an unrelated readmission occur during the post-acute care window, were excluded from the analysis. One of the objectives of the analysis is to evaluate the impact of post-acute care windows of different lengths. As the length of the window increases, the number of patients experiencing truncated payment bundles due to death or an unrelated readmission increases. In order to keep the number of patients constant across windows of varying lengths, only patients whose payment bundle was not truncated for 90 days following the trigger for hospitalization were included in the analysis.

Hospital Transfers

If the trigger hospitalization resulted in a transfer to another acute care hospital, the trigger hospitalization and the transfer hospitalization were combined to create a single continuous hospitalization. Admissions to inpatient rehabilitation hospitals and acute long-term care hospitals were not distinguishable from acute care hospitals, and were treated as inpatient admissions. In general, such admissions would follow an acute hospitalization so they would be combined with the acute hospitalization to create a single continuous hospitalization.

Resource Outliers

Records that had charges or payments for the trigger hospitalization less than $200 were removed from the analysis database. No other trimming of the data based on the value of the reported charges or payments was performed.

Service Scope

A payment bundle can be comprised of different combinations of services. Nine categories of service were identified. These nine categories could be included or excluded in any combination to create payment bundles with different scopes of service. There were too many possible combinations to examine each individually, so services were sequentially added to the payment bundle to create larger bundles. This required that the order of adding services to the bundle be specified. Services that are both common and relatively inexpensive, relative to the trigger hospitalization, were added to the bundle first followed by services that are less common and expensive. The order used was inpatient facility (Part A for the trigger hospitalization), inpatient Part B, hospital outpatient Part B, other Part B, durable medical equipment (DME), home health (HH), skilled nursing facility (SNF), hospice, and readmission (Part A for the readmission).

Predicting Resource Use

The data were divided into a calibration database and an evaluation database. The calibration database was used to compute the average resource use in each PCE. The average resource use in each PCE in the calibration database was used to predict resource use for patients in the evaluation database. The data in the calibration and evaluation databases were made budget neutral by multiplying the average resource use from the calibration database by a budget neutrality factor.

Measuring Statistical Performances

Reduction in variance as measured by the R^2 statistic was used to evaluate the performance of the PCEs. R^2 measures the ability of a classification system to estimate expected resource use accurately. The R^2 values were computed based on the data in the evaluation database using the predicted values from the calibration database. In the context of a payment system, this is important, because it relates to the level of payment accuracy and provider financial risk. While reduction in variance is an important evaluation criteria, any classification system used as the unit of payment in a bundled payment system must also be evaluated in terms of administrative feasibility, clinical meaningfulness, non-susceptibility to manipulation (up-coding) and ability to identify low and high severity patients. The ability to identify low and high severity patients is essential in order to prevent the financial incentive for hospitals to seek out or avoid specific types of patients.

Data

The data used for this research included Medicare fee-for-service beneficiaries who were continuously enrolled in Medicare from 4/1/2006 though 6/30/2009 or to the date of their death. The trigger event was limited to hospitalizations for the 167 selected MS-DRGs. The data were from nine states: California, Florida, Virginia, New Jersey, Washington, Minnesota, Kansas,

Louisiana, and Colorado. Beneficiaries were only included in the analysis database if they had three years plus nine months of exposure, including one year prior and 180 days following any hospitalization that was used as a trigger event. After applying the truncation, transfer and resource outlier rules, and limiting the trigger hospitalizations to those that completed a full 90 day post-acute period, the number of trigger hospitalizations assigned to the 167 MS-DRGs was 851,512 for charges and 851,456 for payments. The data were randomly split into two equal sized databases, one for calibration and the other for evaluation. The percent of payment bundles that had post-acute care services by type of service was 61.9, 96.9, 36.5, 27.6, 21.6, 1.8, and 13.0 percent for hospital outpatient Part B, other Part B, durable medical equipment, home health, skilled nursing facility, hospice, and readmissions, respectively.

Results

Exhibit 3 contains the R^2 for charges and payments expressed as a percent. Each row in the table specifies a different configuration of services that are included in the service scope. The Xs in the first nine columns specify the services included in each row. The top eight rows start with the inpatient services and sequentially add post-acute services to the payment bundle. The bottom seven rows focus on only post-acute care services and start with hospital part B services, and sequentially, add additional services to the payment bundle. The last sixteen columns contain the R^2 for charges and for payments for post-acute care windows of 15, 30, 60, and 90 days for the MS-DRGs only and for PCEs (MS-DRGs plus ACRGs).

R^2 for Charges

From Exhibit 3, the most basic payment bundle is the inpatient Part A, plus the physician Part B inpatient fees. The MS-DRG R^2 for this basic bundle is 38.4 and it increases to 41.0 for PCEs. As expected, the addition of the ACRGs to the MS-DRGs did not provide a substantial increase in R^2 for inpatient services. As additional post-acute care services are added to the payment bundle, and the post-acute care window is extended from 15 days to 90 days, the R^2 for MS-DRGs decreases from 38.4 at 15 days to 33.4 at 90 days with the full bundle of post-acute care services and falls further to 21.5 when readmissions are added. In contrast, the PCE R^2 remains relatively constant in the range of 40.4 to 42.0. However, when readmissions are added, there is a significant drop in R^2 from 40.5 to 27.5 at 90 days. For the full bundle of services without readmissions at 90 days, the addition of ACRGs to the MS-DRGs increases the R^2 by 21.3 percent (33.4 to 40.5), and with readmissions increases the R^2 by 27.9 percent (21.5 to 27.5).

Exhibit 3. R^2 for Different Episode Windows and Service Scopes

	Services Included									Charges								Payments							
										MS-DRG only				PCE= MS-DRG + ACRG				MS-DRRG only				PCE= MS-DRG + ACRG			
	Hosp Part A	Hosp Part B	Other Part B	Hosp Outpat	DME	Home Health	SNF	Hospice	Readmission	Window				Window				Window				Window			
										15	30	60	90	15	30	60	90	15	30	60	90	15	30	60	90
Hosp + Post Acute	X	X								38.4	38.4	38.4	38.3	41.0	40.9	40.9	40.9	59.6	60.7	60.1	59.5	60.8	61.9	61.2	60.7
	X	X	X							38.2	38.1	37.7	37.4	40.9	40.7	40.5	40.4	58.2	59.0	55.5	51.9	59.5	60.4	57.2	54.2
	X	X	X	X						37.9	37.5	36.2	34.7	40.9	41.0	41.4	42.0	57.4	57.3	52.1	47.1	59.0	59.6	56.0	53.2
	X	X	X	X	X					37.9	37.5	36.2	34.7	41.0	41.1	41.4	42.0	57.3	57.2	51.8	46.6	59.0	59.5	55.8	52.9
	X	X	X	X	X	X				38.0	37.5	36.2	34.6	41.0	41.1	41.4	41.9	56.6	56.0	50.7	45.2	58.3	58.4	54.7	51.4
	X	X	X	X	X	X	X			37.6	36.8	35.1	33.5	40.7	40.5	40.4	40.6	53.6	48.0	38.6	33.3	55.5	50.8	42.5	38.2
	X	X	X	X	X	X	X	X		37.6	36.8	35.1	33.4	40.7	40.5	40.4	40.5	53.5	47.9	38.5	33.2	55.5	50.7	42.5	38.3
	X	X	X	X	X	X	X	X	X	32.4	28.9	23.1	21.5	35.5	32.4	27.7	27.5	46.7	39.2	29.8	24.7	48.8	42.0	33.7	29.6
Post Acute Only				X						4.8	6.4	7.8	8.6	20.8	28.3	35.1	37.8	3.7	4.9	6.7	7.7	15.5	20.8	28.0	32.3
			X	X						5.0	6.6	8.0	8.9	20.2	27.2	33.5	36.7	3.5	4.9	6.1	6.6	12.6	18.2	23.1	26.0
			X	X	X					5.0	6.6	8.0	8.9	20.2	27.3	33.6	36.8	3.4	4.8	6.1	6.7	12.5	18.1	23.1	26.1
			X	X	X	X				4.9	6.6	8.0	9.0	19.1	26.4	33.1	36.2	5.8	6.6	7.2	7.3	10.6	15.0	20.6	23.5
			X	X	X	X	X			8.0	9.6	10.3	10.6	17.7	23.2	29.0	32.3	19.5	18.7	16.4	14.8	23.1	23.1	21.8	21.3
			X	X	X	X	X	X		8.1	9.8	10.5	10.8	17.8	23.3	29.1	32.3	19.7	18.9	16.7	15.2	23.3	23.4	22.3	21.9
			X	X	X	X	X	X	X	1.9	2.8	3.4	4.8	4.5	6.5	8.7	12.3	9.1	10.4	10.4	9.8	11.6	14.0	15.1	15.4

SOURCE: Medicare Claims Data, April 2006–June 2009.

When inpatient services are excluded and only post-acute care services are included, the pattern is somewhat different. The R^2 for MS-DRG is substantially lower. As additional post-acute care services are added to the payment bundle, and the post-acute care window is extended from 15 days to 90 days, the R^2 for MS-DRGs increases from 4.8 at 15 days to 10.8 at 90 days with the full bundle of post-acute care services and falls back to 4.8 when readmissions are added. Similarly, the R^2 for PCEs increases from 20.8 at 15 days to 32.3 at 90 days with the full bundle of post-acute care services, and falls to 12.3 when readmissions are added. For the full bundle of post-acute services without readmissions at 90 days, the addition of ACRGs to the MS-DRGs increases the R^2 by 199.1 percent (10.8 to 32.3) and with readmissions increases the R^2 by 156.3 percent (4.8 to 12.3).

These results make intuitive sense. When inpatient services are included, there is a high R^2 associated with the MS-DRGs, which falls as the post-acute care bundle is expanded and lengthened. This reduction is only partially offset by the addition of the ACRGs to the MS-DRGs. When inpatient services are excluded, the R^2 increases as the payment bundle is expanded and lengthened. These results indicate that a patient's chronic disease burden has a greater impact on post-acute resource use when the services included in the payment bundle are expanded and the length of the post-acute care window is increased. Conversely, the impact of the acute disease that precipitated the hospitalization has a lesser impact on post-acute resource use as the services in the payment bundle expand and the length of the post-acute care window increases.

R^2 for Payments

From Exhibit 3, the same general pattern is repeated for payments. The MS-DRG R^2 for this basic payment bundle of inpatient Part A, plus the physician Part B inpatient fees, is 59.6 and shows only a minor increase to 60.8 for PCEs. The R^2 for payments is substantially higher than charges. This is expected, because the inpatient payment is based on the fixed MS-DRG payment amounts. It is not 100, because outliers and geographic wage adjustments were not included, and the bundle included physician payments. As additional post-acute care services are added to the payment bundle and the post-acute care window is extended from 15 days to 90 days, the R^2 for MS-DRGs decreases from 59.6 at 15 days to 33.2 at 90 days with the full bundle of post-acute care services, and falls further to 24.7 when readmissions are added. The R^2 for PCEs decreases from 60.7 at 15 days to 38.3 at 90 days with the full bundle of post-acute care services, and falls further to 29.6 when readmissions are added. For the full bundle of services without readmissions at 90 days, the addition of ACRGs to the MS-DRGs increases the R^2 by 15.4 percent (33.2 to 38.3), and with readmissions increases the R^2 by 4.9 percent (24.7 to 29.6).

Like charges, when inpatient services are excluded and only post-acute care services are included, the R^2 for MS-DRG is substantially lower. As additional post-acute care services are added to the payment bundle, and the post-acute care window is extended from 15 days to 90 days, the R^2 for MS-DRGs increases from 3.7 at 15 days to 15.2 at 90 days with the full bundle of

post-acute care services, and falls to 9.8 when readmissions are added. Similarly, the R^2 for PCEs increases from 15.5 at 15 days to 21.9 at 90 days with the full bundle of post-acute care services, and falls to 15.4 when readmissions are added. The one anomaly in the pattern is that MS-DRGs show a substantial increase in R^2 when SNF services are added, but PCEs show a slight decrease. Since patients are often transferred directly from an acute care hospital to a SNF, the acute disease of the patient (as measured by the MS-DRGs) may have a greater impact on SNF resource use than the patient's chronic illness burden as measured by ACRGs. It is unclear why the same effect was not observed with charges. For the full bundle of post-acute services without readmissions at 90 days, the addition of ACRGs to the MS-DRGs increases the R^2 by 44.1 percent (15.2 to 21.9) and with readmissions increases the R^2 by 57.1 percent (9.8 to 15.4).

Discussion

Based on the R^2 results MS-DRGs by themselves do not provide a sufficient basis for case mix adjusting post-acute care payments. As demonstrated by the addition of CRG subclasses to the MS-DRGs, a measure of the chronic illness burden of the patient needs to be added to the MS-DRGs in order to create accurate bundled payments. The R^2 for post-acute services for the PCEs increases as the length of the post-acute care window increases, but decreases as the services included in the payment bundle are expanded. Thus, longer post-acute windows are a feasible option. Expanding the post-acute bundle to include a wider scope of services causes a modest drop in R^2. The addition of readmission causes a significant drop in R^2.

The degree of variation in resource use is important, because it relates to provider financial risk. Within-category variation may mean there is more likely to be an opportunity to reduce costs. However, heterogeneity may pose a problem if the variation is associated with observable factors. The greater variation could create an opportunity to avoid identifiably higher cost patients. Specifically, as shown in this analysis, the ability to identify patients with a greater chronic illness burden is essential for predicting the need for post-acute care services. Patients with a high chronic illness burden are readily identifiable and, therefore, are at risk for being selectively avoided. The incentive to avoid high cost patients is especially high if readmissions are included in the payment bundle. Even if only potentially avoidable readmissions are included in the payment bundle, too much financial risk may be created, resulting in access problems for some subpopulations of beneficiaries.

The R^2 values for the post-acute care period were lower than those typically reported for MS-DRGs for inpatient data. This is not surprising, since post-acute care lacks any real care coordination and is heavily influenced by existing payment policies. As happened with DRGs, it is reasonable to expect that the system will be improved over time as data quality improves and as provider behavior becomes more rational in response to the new financial incentives. The critical issue is to create a reliable unit of payment so that other sources and causes of variation can be understood and controlled.

The PCE performance was achieved using MS-DRGs and CRGs as currently constituted with no modification. MS-DRGs were developed for inpatient care and CRGs were developed to predict year long periods of care across the full spectrum of care, and not just the post-acute period. Clearly, both systems could be optimized for the post-acute care period. For example, the craniotomy MS-DRGs include craniotomies for non-ruptured aneurysms and malignancies. While that may be reasonable for inpatient care, these two types of patients have very different post-acute courses of treatment. The PCEs used uniform consolidation CRGs across all MS-DRGs. The level of CRG aggregation as well as the length of the window could be varied depending on the reason for hospitalization.

The inclusions of readmissions in the post-acute care bundle caused a significant drop in R^2, implying a decrease in payment accuracy and an increase in provider risk. Any bundled post-acute care payment system will need to have an outlier policy. Unfortunately, the high cost of readmissions creates a direct relationship between the occurrence of a readmission and the categorization of a patient as an outlier. One approach could be to include only a portion of the MS-DRG payment for the readmission in the post-acute care bundle and have the remaining portion of the MS-DRG payment paid under IPPS. Another approach would be to exclude readmission from the post-acute care bundle, but have the payment for the post-acute care bundle decreased for hospitals with high risk adjusted readmission rates in a manner similar to the payment reductions for readmissions in the Accountable Care Act. A policy to balance readmissions and outlier payments will need to be developed. Done correctly, such a policy would incentivize hospitals to control readmissions while offering a significant degree of financial protection for providers.

MS-DRG payments have an indirect medical education and disproportionate share adjustment applied. Further research is needed to determine if such adjustments need to be applied to the post-acute portion of the bundled payment. The analysis excluded patients with truncated payment bundles due to death or an unrelated readmission. A payment policy similar to the IPPS proration transfer policy would need to be developed to handle payment for truncated payment bundles. Proration for patients who die is particularly challenging since end of life care can be resource intensive. Whether to recognize in the proration the additional service use for patients who die is a particularly difficult policy question that will need to be addressed.

Using CRGs to add additional subgroups to the MS-DRGs provides a natural extension of the basic IPPS structure. CRGs like MS-DRGs are a categorical clinical model. A key property of IPPS is that each patient is assigned to one and only one MS-DRG and each MS-DRG has an associated payment weight. Using CRGs to expand the MS-DRGs allows this property of IPPS to be replicated in a bundled payment system. Maintaining the unit of payment in terms of a categorical clinical model provides a transparent and clinically precise communication tool that will provide a meaningful basis for evaluating the processes of care and the associated financial impact of post-acute care practice patterns.

A bundled payment system can be implemented in a prospective or retrospective fashion. In a full prospective implementation, the bundle payment amount would be known at the time of hospitalization. The hospital or other entity would be responsible for paying for any post-acute care services delivered during the post-acute care period. In a retrospective implementation, Medicare would pay for post-acute care services based on existing Medicare payment methods and retrospectively reconcile the payments made for the post-acute care services with the bundled payment amount. Payments would be retrospectively adjusted if payments for the post-acute care services exceeded the bundled payment amount. The CMS bundled payment demonstrations are a retrospective implementation.

Determination of the chronic illness burden (the CRG) of the beneficiary requires access to the diagnoses reported from all sites of service prior to the hospitalization. With a lag of several months, Medicare has access to the complete claims history of each beneficiary allowing the assignment of the CRG. Thus, in a retrospective implementation, the CRG can be readily assigned for the purpose of determining the bundled payment amount. Similarly, in a prospective implementation, Medicare can determine the CRG assignment at the time of hospitalization. However, in a prospective implementation, the hospital would also need to have access to the CRG assignment at the time of hospitalization. Since hospitals do not have access to the claims history of beneficiaries, having the CRG assignment available to the hospital would require Medicare to put additional infrastructure in place that allows a hospital to query the Medicare fiscal intermediary and receive the current CRG assignment for the beneficiary. In a full prospective implementation, the hospital will receive the bundled payment and be responsible for paying for all services that are not directly delivered by the hospital. This, in essence, means that the hospital must act as a payer with all the claims processing infrastructure necessary to receive and pay bills. In general, hospitals have infrastructure in place for billing services, but have limited infrastructure for paying for services delivered by other providers. Thus, a significant expansion of hospital claims processing capabilities will be necessary for hospitals to manage under a fully prospective bundled payment system.

The addition of the CRG distinctions to the MS-DRGs essentially creates a two stage categorical clinical model. Combining two categorical models together makes the unit of payment more complex and potentially more prone to manipulation, such as up-coding. However, CRGs have extensive temporal rules to minimize opportunities for up-coding. Multiple occurrences of a diagnosis spanning a period of time are required for a diagnosis to be considered a chronic disease. Temporal rules relating procedures and diagnoses are used to eliminate certain diagnoses (angina prior to coronary bypass surgery is ignored). Prior treatment has minimal impact on CRG assignment. The exceptions being a history of a major surgical intervention (history of a heart transplant) or a therapy that is directly indicative of the stage of a disease (diabetic on dialysis). Pharmacy data can optionally be included in the data used to assign the CRG. However, the pharmacy data is only used to infer or confirm the existence of specific chronic diseases (use of insulin is used to infer diabetes). Unlike regression

based risk adjustment models, in which there is an implicit weighted counting of the number of different diagnoses to arrive at a risk score (more diagnoses tend to result in higher risk scores), the categorical structure of CRGs contains highly conditional hierarchical rules for assigning a CRG that require an additional diagnosis and have a meaningful, clinically relevant impact in the context of the beneficiary's primary diseases. Thus, the addition of CRGs to the MS-DRGs provides minimal opportunities for manipulation beyond those inherent in MS-DRGs.

The approach being taken in the CMS bundling project focuses on historical hospital-specific payments for the bundle. Thus, the bundled payment for a hospital is not being compared to other hospitals, but instead to itself over time. This approach is contrary to the basic principle of IPPS, which compares hospitals to the average performance across all hospitals. The R^2 calculations essentially assumed an IPPS type model, in which variability is measured relative to the overall performance across all hospitals and not relative to each hospital's prior performance.

Because the CRG approach subdivides each MS-DRG into up to 19 ACRGs resulting in 3,010 PCEs, it raises the question of whether the number of cells can produce an artificially high R^2. The R^2 that would be achieved by randomly splitting N observations into K groups is given by (Feldman, 1992):

$$\frac{(K-1)}{(N-1)}$$

Since there are 425,756 hospitalizations in the evaluation database that are used to form payment bundles, the R^2 that would artificially occur based solely on the number of cells is less than one percent (0.71). Thus, the R^2 produced by CRGs is due to the added explanatory power of CRGs and not merely an artificial effect of a large number of cells. The number of categories in the version of PCEs used for this analysis could potentially be reduced. For example, for the post-acute part of the payment, it might be possible to combine base MS-DRG and/or severity levels.

Summary

The approach used in this analysis meets most of the criteria required in a bundled payment system. The unit of payment explicitly recognizes patient severity of illness and chronic disease burden, thereby, minimizing the financial incentive for hospitals to seek out or avoid specific types of patients. Because it extends the basic clinical categorical structure of MS-DRGs, the approach is readily understandable and clinically relevant, thereby, providing a communications tool that links the clinical and financial aspects of care. Because the unit of payment is a categorical clinical model, the payment weights can be empirically derived based on the national average expenditures in each payment bundle. Since the only data used is routinely collected information, there are no administrative feasibility issues beyond those inherent in any bundling

system that includes post-acute care. Because of the extensive data verification logic embedded in CRGs, there should be minimal up-coding opportunities beyond those inherent in MS-DRGs. The use of fixed length post-acute care windows reduces the complexity of the system and makes it more understandable. With the possible exceptions of readmission, the full scope of post-acute care services can be included in the payment bundle. Outlier provisions and payment adjustments would need to be included in any operational bundled payment system, but were not evaluated in the analysis. The results demonstrate that a bundled payment system as structured in this analysis could provide the basis for an effective means of creating post-acute care payment bundles.

Conclusions

Bundling inpatient and post-acute care into a single unit of payment should be financially beneficial for any provider who can improve the present day, almost completely disorganized, "system" of post-acute care. The results from this analysis demonstrate that with the possible exception of readmissions, it is feasible to develop a payment system that incorporates significant post-acute care costs into the IPPS MS-DRG payment bundle. However, MS-DRGs by themselves are inadequate for creating post-acute care payment bundles, and additional differentiations based on the patient's chronic illness burden must be added to the MS-DRGs. Given current information technology, significant improvements in the delivery of post-acute care should be readily achievable, resulting in improvements in both efficiency and quality. A bundled payment system that includes post-acute care can be a simple, yet significant, extension of the IPPS bundling concept. While not a panacea, this approach has the potential to result in significant savings for Medicare, while simultaneously improving quality through better integration of acute and post-acute care services.

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