March 2012

Technical Appendices

Paying More for Primary Care: Can It Help Bend the Medicare Cost Curve?

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TECHNICAL APPENDIX A
DESCRIPTION OF THE HSC–CMWF SIMULATION MODEL

The simulation model, developed by the Center for Studying Health System Change (HSC) and Mathematica Policy Research and funded by The Commonwealth Fund (CMWF), was designed to evaluate the isolated impact of a specific change in payment policy—increasing the fees paid to primary care physicians (PCPs) for evaluation and management visits—on long-run Medicare costs. PCPs are defined as general practitioners, general internists, family practice physicians, and geriatricians (as well as nurse practitioners and physician assistants working with them).

The basic architecture of the model (shown in Exhibit A1 in the issue brief) was to estimate prediction models for 19 separate spending categories, covering all Medicare Part A and Part B services. Part D prescription drug claims were unavailable, and these costs are not included in total spending projections. The 19 spending categories were divided into two larger categories, eight "physician" and 11 "nonphysician" services. Total spending was calculated as the sum of these 19 components. Different procedures were used to make projections for each category of services. Physician categories followed BETOS classifications, with some modifications. (BETOS refers to the Berenson-Eggers Type of Service classification of physician procedure codes. For a description, see http://www.cms.gov/HCPCSReleaseCodeSets/20_BETOS.asp.) The construction of the 19 categories and the classification into the two groups were dictated in part by available data. Specifically, the physician categories were constructed for Medicare services for which available data permitted us to estimate physician supply equations. Nonphysician categories include nonphysician Part A services and some Part B services not paid on a relative value unit (RVU) basis, as well as some physician services that are paid on an RVU basis and covered by the BETOS classification system, but for which we lacked the ability to estimate supply equations. The 19 spending categories are described in Table 1.

Table 1. Description of Medicare Spending Categories

Spending category	Description
Physician spending categories	
Primary care E&M visits in outpatient settings	Evaluation and management (E&M) visits in outpatient settings (office, nursing homes, home visits) by primary care physicians (general practitioners, general internists, family practice physicians, and geriatricians) as well as nurse practitioners and physician assistants.
Preventive services	Preventive services paid by Medicare in 2000. These do not include the full range of preventive services paid during later years. Those additional services would be included in other physician categories.
Other E&M visits	Includes evaluation and management visits by PCPs in inpatient settings as well as all visits by specialists (non-PCPs), including consultations and emergency room visits.
Minor procedures	Based on BETOS category (apart from those included in preventive category). Includes eye procedures, ambulatory procedures, various oncology therapies, endoscopies, and dialysis services.
Major procedures	Based on BETOS category. Includes wide range of major procedures, most often surgical in nature. Includes eye, orthopedic, cardiovascular, and other services.
Standard imaging	Includes imaging using x-rays (radiographs) billed by physicians other than radiologists.
Advanced imaging	Includes CAT, MRI, echography, heart imaging including cardiac catheterization, and other procedures billed by physicians other than radiologists.
Diagnostic tests	Includes various diagnostic tests performed by physicians, but does not include clinical lab services.
Nonphysician services	
Part B drugs	Includes provider-administered drugs (e.g., chemotherapy drugs).
Clinical laboratory services	Primarily diagnostic tests that may take place in independent laboratories or in provider offices/facilities.
Services by radiologists	Because the CTS survey does not include radiologists in its sample, we included imaging costs by non-radiologists in our physician categories, and treat imaging services conducted by radiologists as a separate, nonphysician category (although the services included here are paid for on an RVU basis and are covered within the BETOS categorization).
Services by anesthesiologists	Like radiologists, anesthesiologists are not included in the CTS survey sample. Consequently, these services are treated as a nonphysician service, although they are covered by the BETOS categorization.
Other physician services	Includes services by pathologists as well as physician services for which RVUs are not assigned (e.g., carrier-priced services using new technologies).
Miscellaneous services	Includes Part B services that are not paid for on an RVU basis or provided by other types of providers (e.g., ambulance services).
Hospital outpatient services	Institutional outpatient providers include, for example, hospital outpatient departments, rural health clinics, renal dialysis facilities, outpatient rehabilitation facilities, comprehensive outpatient rehabilitation facilities, and community mental health centers. This category primarily includes facility charges, as professional charges are contained in other categories.
Inpatient care	Includes short-term acute, long-term, rehabilitation, and psychiatric hospital stays.
Skilled nursing facilities	Postacute care in nursing facilities following a hospital stay of three nights or longer, typically up to 60 days.
Home health and hospice	Includes skilled nursing, home health aides, physical therapy, speech therapy, occupational therapy, and medical social services visits at home. Hospice services are palliative in nature and are mostly provided in patients' homes, although inpatient respite care is included.
Durable medical equipment	Medical equipment used in the course of treatment or home care. Includes such items as crutches, knee braces, wheelchairs, hospital beds, and prostheses.

Two different data sets, both constructed by merging Community Tracking Study Physician Survey and Medicare claims data, were used. The first, described below, was used to estimate physician supply equations that generated parameters used to estimate physician category spending. The second data set was used to estimate parameters for predicting spending under nonphysician categories. Both were used also to benchmark and validate parameters, and the latter also provided baseline data for use in the simulation.

Estimating Physician Category Spending Prediction Parameters

Data

To estimate parameters used to predict physician spending, we employed a data set constructed by linking 2000–2001 and 2004–2005 Community Tracking Study (CTS) Physician Survey respondents with physician Medicare claims from CMS's Carrier files from 2000 and 2005, respectively. The CTS surveys are sampled primarily from 60 nationally representative sites. The sample includes nonfederal patient-care physicians who provide at least 20 hours of patient care per week. Physicians with little direct patient contact (e.g., radiologists, anesthesiologists, and pathologists) were excluded from the target physician population and not surveyed. More information concerning the surveys can be found at http://www.hschange.org/CONTENT/570/ and http://www.hschange.org/CONTENT/888/. The data set was the same used in Hadley et al., where further details are available.[1] Approximately 13,700 physician-year observations were used.

Variables

We created a series of intermediate working variables at the Medicare beneficiary level for each beneficiary treated by a CTS respondent. First, we calculated the quantity of services provided by each CTS physician respondent during the year, in each of the physician service categories. Quantity was measured by the number of relative value units (RVUs), which represent the time, effort, resources, and skill required to provide physician services. We also constructed a measure of beneficiary health from claims diagnostic information using scores from CMS's HCC risk adjustment model (see Pope et al. for more details).[2]

The physician supply models were estimated using the physician as the unit of analysis, with variables constructed from both claims data and the CTS survey. For each CTS physician respondent in 2000 and 2005, we calculated a set of variables specific to each physician category. The first two serve as dependent variables: 1) a dummy variable indicating whether the physician provided any services in the spending category, and 2) the average number of RVUs provided per beneficiary by the physician among beneficiaries who received services in the physician category during the year. Explanatory variables include the average health status (HCC score) for Medicare beneficiaries treated by the physician, a set of dummy variables indicating which CTS site the physician practices in, and a measure of Medicare fee differences.

The Medicare fee difference variable, which is key to the model, is adapted from a variable developed by Hadley et al.[3] It was calculated as the difference between payment for services under the Medicare physician fee schedule, and a hypothetical payment based on a fee schedule that more closely approximated the ideal resource-based, relative value system (RBRVS) payment. RBRVS was designed to have relative fees for services reflect the actual costs faced by a physician in providing them (including value of physician labor, practice expense, and malpractice insurance). The Medicare fee difference variable thus captures, both geographically and over time, variations in the generosity of Medicare fees relative to estimated costs of service provision. To construct this variable, we used hypothetical RBRVS payments defined by smaller geographic areas than those used by CMS, for more accurate representation of local input price differences, provided better data on some geographic cost components and RVU assignments, and eliminated components of the fee formula that are designed to achieve other social goals (such as support for

physicians in lower-cost and rural shortage areas). The fee variables vary cross-sectionally across counties and over time. The construction of this variable is based on a similar variable developed for Hadley et al.[4] Greater detail on construction of this variable is available at http://www.hschange.org/CONTENT/1115/1115appendices.pdf. The Medicare fee variable for a given service will vary depending on the mix of physician work and practice expense RVUs. Consequently, we created a unique fee variable for each of the physician service categories. These varied by the mix of physician work and practice expense RVUs provided in 2000 across the full sample of physicians within each physician category.[5]

One additional variable was created, but used only in physician service models other than the one for primary care evaluation and management visits. It captures the intensity of primary care evaluation and management (E&M) services provided per Medicare beneficiary in the county in which the physician was located.[6] It is measured by the average number of primary care E&M RVUs per beneficiary in the county where the physician practiced. That number is calculated from claims data.

Physician Supply Model Estimation

We estimated a set of two-part physician supply equations for each physician service category, using estimation procedures adapted from Hadley et al. The specification for the primary care E&M visit model takes the form[7]:

1) $Prob(\text{Primary Care E\&M visits provided}) = \beta_0 + \beta_1 \text{Medicare Fee Difference} + \beta_2 \text{Avg. Medicare Patient Health} + \beta_3 \text{Site Dummies} + \beta_4 \text{2005 Dummy} + \varepsilon$

2) $\text{Avg. Primary Care E\&M RVUs per Medicare beneficiaries treated, given any provided} = \delta_0 + \delta_1 \text{Medicare Fee Difference} + \delta_2 \text{Avg. Medicare Patient Health} + \delta_3 \text{Site Dummies} + \delta_4 \text{2005 Dummy} + \upsilon$

For this estimation we used a two-part general linear model (GLM) in which the first part is estimated using a logit function and the second part is characterized by a logarithmic link and a variance function that is proportional to the mean squared (gamma function).[8]

For the remaining seven physician service categories, the estimation procedures and specification are the same, except that each equation includes an additional explanatory term: the average primary care RVUs provided to Medicare FFS beneficiaries in the physician's county. With those added, growth in the number of primary care E&M visits provided per beneficiary enters into predictions for the growth of other physician service spending categories.

Calculation of parameters used in simulation. Projections of primary care E&M visit spending growth were based on two parameters: the elasticity of supply with respect to Medicare fees and a time trend parameter. For other physician categories, an additional parameter was used: the elasticity of supply with respect to the quantity of primary care E&M visit services provided in the county.

With each two-part model, we simulated the effect of a 10 percent increase in fees and calculated an estimate of the elasticity of physician supply with respect to Medicare fees. For all but the primary care category, we similarly calculated the elasticity of the quantity of services provided with respect to an increase in primary care services provided per beneficiary. Finally, we similarly calculated the difference between 2005 and 2000 predictions from the model year's dummy coefficient and calculated an annualized trend parameter (e.g., annual percentage change). Standard error estimates of elasticity and other parameters from the two-part models were generated using bootstrapping procedures.

Validating and benchmarking model predictions. Predictions from the models over the 2000–2005 period were compared against RVUs per beneficiary growth in each physician category. The growth in per-beneficiary RVUs was obtained from

MedPAC reports, and we used actual changes in Medicare fees over this period.[9] We did not expect the predictions to match the observed trends perfectly because the two elasticity parameters are essentially based on cross-sectional variations in Medicare fees or primary care E&M use. As a result, they are to be interpreted as long-run elasticities. We lack information as to how long it will take for physicians to adapt to changes in fees or primary care service intensity in their provision of the various physician service categories. For that reason, the benchmarking was used primarily to make adjustments to trend parameters.[10]

Estimating Nonphysician Spending Prediction Parameters

Data

We used a different extant data set to generate projections for nonphysician spending categories (and to provide baseline data for the simulation). Physician observations from the 2004–2005 CTS Physician Survey were used to identify all Medicare beneficiaries who received any service from a physician survey respondent during the three-year period from 2004 to 2006. Part A and Part B claims data obtained from those three years' linked beneficiaries (including services provided by physicians who were not respondents to the CTS survey) produced observations on approximately 2.7 million beneficiaries per year. We limited our simulation to those residing in the nationally representative 60 CTS sites, thereby reducing the number of beneficiaries to about 2.2 million per year. We then dropped those who were enrolled in Medicare Advantage plans during at least part of the year as well as those who aged into Medicare during the year, leaving approximately 1.7 million beneficiaries per year for purposes of the simulation.

Standardized costs. Because we are fundamentally interested in how the policy change will affect utilization patterns and total health care spending, rather than Medicare Trust Fund payments per se, we assigned a standardized cost to each service. Standardized costs include total medical costs (e.g., allowed charges), including Medicare costs, patient cost-sharing, and payments from third-party payers. Standardization assigns a common cost to each service, regardless of where it was provided (based on national averages or statutory rates before geographic adjustment) and regardless of whether the provider was in a special class that is able to receive extra payments (e.g., disproportionate share hospital (DSH) payments, indirect medical education (IME) payments to hospitals, or Medicare incentive payments to physicians practicing in shortage areas) or whether a provider was operating under a different payment rule from that applied to similar providers (e.g., critical-access hospitals versus other short-term acute-care hospitals). Standardization converts costs to represent what would be paid for a given type of service in a base year (2006 in our case), so that services can be compared over multiple years. Greater detail on how costs were standardized is presented in Technical Appendix B.

Nonphysician Supply Estimation

To generate parameter estimates to predict nonphysician service categories, we used the 2004–2006 linked data set. Average per-beneficiary standardized cost in the county of residence was calculated for each year and for each of the 19 service categories. We then calculated the percentage change from 2004 to 2005 and from 2005 to 2006 and pooled observations from those time periods. We then estimated a county–year level regression (N=740) in which the percentage change in nonphysician per-beneficiary standardized costs was regressed on the percentage change in each of the physician categories. Observations were weighted by county population.[11] Each of these 11 nonphysician regressions generated eight parameters, each associated with a physician category.[12]

We tested several alternative specifications for these models (e.g. log-linear), but selected this specification based on benchmarking using observations over the 2004–2006 period at the national as well as at the individual CTS site level.

Prediction of Future Spending

The Baseline Simulation Model

The simulation model was spreadsheet-based. We started with baseline numbers (average standardized costs per beneficiary by spending category) from 2006, our most recent year of data. Values were inflated to represent 2010 dollars, using the Consumer Price Index. To make physician category projections, we averaged annual fee changes (i.e., percentage increase in the physician conversion factor) over the past 10 years and used that figure as our nominal baseline fee increase. The projections were conducted in real (inflation-adjusted) terms, so we subtracted average increases in the Medicare Economic Index over the same period from average fee increases.

Using those baseline fee changes and estimated parameters, we simulated the growth in primary care E&M visits through 2020. For other physician categories, the same fee increases were assumed. However, in addition, the projected percentage change in primary care E&M visits per beneficiary was multiplied by the primary care intensity elasticity estimate as part of the projection. In this way, the growth in primary care evaluation and management visit services affects projections of each of the other physician service categories.

Once projections for physician spending categories were made, annual percentage changes were calculated and multiplied with corresponding coefficients from the nonphysician regressions. The resulting predicted change in nonphysician spending categories was consequently a direct function of changes in primary care E&M outpatient visits as well as an indirect function through the effect of primary care on other physician categories.

Baseline predictions were made through 2020. Total spending per Medicare beneficiary is calculated simply as the sum of the projected level of spending for each of the 19 service categories.

Policy Simulation

The policy simulation was constructed exactly like the baseline model, with the exception of a hypothetical permanent 10 percent nominal fee increase that takes effect in January 2011. That increase differs from the similar Affordable Care Act provision, which is in effect for only five years, from 2011 to 2015. We present results pertaining to the percentage change in per-beneficiary costs between 2010, the year prior to the policy change, and 2020. To account for the fact that we are assuming a 2.4 percent increase in the Medicare Economic Index (MEI), the 10 percent fee increase is expressed as a 7.6 percent inflation-adjusted increase. To account for the budgetary impact of the fee increase on top of the impact on the quantity of services provided, in the policy simulation we added a new spending category representing the extra cost from the 10 percent nominal fee increase.

We lack information on the prospective speed and pattern of responses to the fee change. The simulation assumes that it will take 10 years and that utilization changes resulting from the policy change will be linear over that period. However, those assumptions do not affect the total long-term impact of the policy change.

It is important to note that our purpose is not to generate the most realistic predictions of Medicare spending. Rather, we hold other factors constant so as to be able to investigate the effect of increasing primary care E&M visit fees at a rate faster than that of other fees. Consequently, we do not incorporate any of the significant Medicare physician fee changes that took effect in 2010 or beyond, health reform provisions, or any projections of future changes in the demographic and health characteristics of the Medicare-aged population.

All told, total Medicare spending projections were calculated on the basis of 27 equations (including two for each of the physician categories) and a total of 111 parameters. For all equations, alternative specifications were tested against benchmarking criteria based on observed trends in Medicare service use.

Precision and Sensitivity Analyses

Because the model rests in a number of independently estimated (albeit interrelated) equations, generating

confidence intervals for model estimates is difficult because we lack covariances across equations. However, we are able to report the precision of 2020 projections for each of the 19 service categories. We do so by using Monte Carlo techniques, based on estimated standard errors. Monte Carlo techniques also are used to generate a standard error for total Medicare service use. Standard errors on own and cross-price supply elasticities derived from physician service category equations were generated using bootstrap methods applied to the two-part models that generated the elasticity estimates. The prediction standard errors are shown in Table 2. Although the relative precision of predictions varies, it is noteworthy that the standard error is 5 percent of the predicted value for primary care E&M visits and less than 6 percent for total costs.

We also tested how sensitive model predictions were to changes in three sets of model parameters. First, we tested how altering the various trend parameters used in the model affects 2020 predictions. Altering these had effects on 2020 predictions roughly proportional to the change in trend parameters, but had but virtually no effect on the predicted impact of the policy intervention. Consequently, we do not report those results. Second, we tested how the supply elasticity for primary care cognitive services might affect results. Here we increased and decreased the elasticity estimate by one standard error, and recalculated the impact of the policy. Third, we increased and decreased the quasi–cross-price elasticities with respect to primary care cognitive services by one standard error in each of the other (non–primary care) physician equations. Since standard errors represent random variations, altering all seven of these parameters in the same direction would be unrealistic. Therefore, this sensitivity test likely overstates how

Table 2. 2020 Baseline Predictions and Standard Errors, by Service Category

Service category	2020 prediction	Standard error
Primary care E&M visits	524	27
Preventive services	40	12
Other E&M visits	1,683	107
Minor procedures	691	56
Major procedures	1,067	183
Standard imaging	380	58
Advanced imaging	574	98
Diagnostic tests	346	37
Part B drugs	1,026	131
Clinical laboratory services	226	11
Services by radiologists	342	26
Services by anesthesiologists	165	19
Other physician services	323	22
Miscellaneous services	411	40
Hospital outpatient services	1,831	136
Inpatient care	9,998	788
Skilled nursing facilities	3,029	316
Home health and hospice	1,689	177
Durable medical equipment	478	77
Total costs per beneficiary	24,798	1,404

sensitive results are to these parameter estimates. The results of the sensitivity tests are shown in Table 3.

The sensitivity test results show that altering the primary care elasticity estimate noticeably affects predictions of the impact that raising primary care fees will have on primary care and total cost. However, the conclusion remains that greater provision of primary care cognitive services will reduce total Medicare costs. Total costs will fall between 1.1 and 2.6 percent. Altering the seven cross-price elasticities as a set has a greater effect on predictions of total costs. Here, the range falls between no change and a decline of 4.3 percent. The pattern of results is opposite to that of the primary care elasticity. The reason for the discrepancy is that some of the cross-price elasticities are positive and some are negative, suggesting that primary care cognitive services complement some non–primary-care services, but substitute for others. Nevertheless, the conclusion of our various tests is that we can be reasonably confident in the basic direction of results: Greater fees for primary care evaluation and management visits will increase the number of those visits, and a greater supply of primary care visits will reduce total costs.

Table 3. Analysis of Sensitivity to Raising and Lowering Key Parameters by One Standard Error (SE)

	2020 predicted impact of 10% increase in primary care E&M visit fees	
	On primary care services	On total costs
Impact of changing the primary care own supply elasticity:		
Less 1 SE	5.0	−1.1
Model estimate	8.6	−1.9
Plus 1 SE	12.6	−2.6
Impact of changing all physician cross elasticities with respect to primary care:		
Less 1 SE	—	−4.3
Model estimate	—	−1.9
Plus 1 SE	—	0.0

NOTES

1 J. Hadley, J. D. Reschovsky, C. Corey et al., "Medicare Fees and the Volume of Physicians' Services," *Inquiry*, Winter 2009–2010 46(4):372–90.

2 G. C. Pope, J. Kautter, R. P. Ellis et al., "Risk Adjustment of Medicare Capitation Payments Using the CMS-HCC Model," *Health Care Financing Review*, Summer 2004 25(4):119–41.

3 Hadley, Reschovsky, Corey et al., "Medicare Fees," 2009–2010.

4 Ibid.

5 The professional liability insurance component did not figure into the calculation of this variable because we lacked data on ideal levels. Moreover, this component of the physician fee formula constitutes a very small portion of Medicare fees.

6 The Medicare fee difference variables constructed for each physician service category were too highly correlated with one another to be included in supply models as cross-price terms.

7 Alternative specifications were tested. However, this specification was selected because of its simplicity and the inability to incorporate other covariates into projections.

8 M. B. Buntin and A. M. Zaslavsky, "Too Much Ado About Two-Part Models and Transformation? Comparing Methods of Modeling Medicare Expenditures," *Journal of Health Economics*, May 2004 23(3):525–42.

9 MedPAC publishes trends by BETOS category in its March reports to Congress. Categories reported in

MedPAC tables did not perfectly match our modified BETOS categories, so some approximation was required.

[10] In the simulation model, we assume that long-run adjustments will be fully realized within 10 years, and in a linear manner. However, it is possible that the "long run" may be shorter or longer than 10 years and that adjustments will occur in a nonlinear progression. Although we are uncertain as to the pattern and length of time it will take to respond to the policy intervention, the final long-run impact of our policy change will not be sensitive to these assumptions.

[11] Several alternative specifications were tested, but this one gave the most consistent and reliable estimates.

[12] R^2s for the nonphysician models varied from 0.04 (Part B drugs) to 0.52 (inpatient care). The explanatory power of these regressions was strongly associated with the importance of the spending category to total Medicare spending.

TECHNICAL APPENDIX B
CONSTRUCTION OF STANDARDIZED COSTS

Background

This appendix describes the methods employed to generate "standardized costs." The goal is to construct a measure of total medical care use by Medicare beneficiaries. The Medicare program uses a complex system of administered prices that are designed primarily to reflect the cost of local inputs, but are also manipulated to achieve other social goals. Our methods build upon and adapt those used by the Centers for Medicare and Medicaid Services in their development of resource use reports; their methods, in turn, build upon methods developed by MedPAC (2003). Separate sets of procedures were developed for Medicare payment systems that exist for 16 classes of providers.

A key distinction between our measure of "standardized costs" and measures of Medicare payments is that we measure total payments to providers for Medicare-covered services rendered to Medicare beneficiaries, including payments out of the Medicare trust funds, patient cost-sharing, and payments by other insurers. For instance, in the context of physician services, we base standardized costs on the total allowed charge for a given service, rather than on the Medicare payment.

Types of Adjustments Made

1. *Adjustments for the year in which the service was provided.* Costs are based on Medicare payment rates in effect in 2006. Because annual standardized costs for 2006 decedents will likely include services rendered in 2005, the costs for services rendered in 2005 are adjusted to 2006 payment levels in line with annual updates for the type of service.
2. *Adjustments for the geographic location in which the service was provided.* For nearly all types of services, Medicare adjusts payment levels to reflect local geographic variations in the price of labor, real estate, and other inputs into the production of medical services. In some cases, there are special rules that provide extra payment for rural providers and those who practice in designated provider-shortage areas. Finally, some Part B services are priced by carriers. In constructing standardized prices we eliminate all of these geography-based payment differences so that, for instance, a given service provided in New York City will receive the same standardized cost as one provided in rural Kansas, where wages and other input prices are generally lower.
3. *Adjustments associated with different payment systems within a given class of providers.* In some instances, Medicare payment policy identifies certain classes of providers for whom payment systems differ from the norm. For example, while most short-term acute-care hospitals are paid prospectively on a DRG basis, rural critical access hospitals (CAHs) are paid retrospectively on a cost basis. Moreover, Maryland hospitals are paid on the basis of that state's all-payer hospital rate-setting system, rather than under regular DRG rules. Our standardized cost assigns a common cost to specific services regardless of whether or not the provider falls into a special class.
4. *Adjustments for provider-specific differences in payment designed to achieve other social goals.* Some providers are eligible to receive certain add-ons to their Medicare payments by virtue of their case mix, function, or costs. Examples are the extra disproportionate share hospital (DSH) or graduate medical education (GME) payments that are made to some hospitals. Under our procedures, for each specific type of hospitalization (e.g., DRG), these extra payments are averaged across all Medicare patients, regardless of the hospital that provided the care.

Overview of Specific Procedures

1. *Physician services (except anesthesia).* For services with RVU assignments, the number of RVUs for each service (differentiating between provision in facility or nonfacility settings, as recorded in claims) was multiplied by the national conversion rate. Modifier codes that affect payment (but not those associated with Health Professional Shortage Areas, or HPSAs) and, where relevant, number of units, were incorporated into standardized costs. This procedure eliminates geographic adjustments. For carrier-priced services that do not have RVU assignments, national average payments per Healthcare Common Procedure Coding System (HCPCS) codes were assigned.
2. *Anesthesiology services.* Standardized costs were based on national average allowed charges by HCPCS code. This approach was adopted largely because of complex rules regarding supervision of certified registered nurse anesthetists by anesthesiologists, for which information in claims files was incomplete.
3. *Part B drugs.* Payments for Part B drugs were calculated as average national per-unit payment made any time in 2006 by HCPCS code, multiplied by the number of units.
4. *Clinical laboratory services.* Standardized costs were calculated as the National Limitation Amount (NLA) associated with each clinical lab HCPCS code. This calculation eliminated geographic variations across carriers. Nationally, nearly all clinical lab services are paid at NLA levels.
5. *Ambulance services*. The assigned average allowed charge by ambulance HCPCS code adjusts for payment differences among payment areas, rural add-on payments, and geographic differences in the average distance traveled. Ambulance services provided in 2005 were standardized to 2006 levels, at which time the prospective payment system (PPS) phase-in process was completed.
6. *Community-based ambulatory surgical centers.* Based on HCPCS code and location of service, services were assigned the 2006 national Ambulatory Payment Category (APC) conversion factor multiplied by the APC relative weight, with adjustments for modifiers.
7. *Hospital short-term acute-care inpatient services.* Standardized costs were based on national average payment per DRG relative weight, with adjustments for transfers. No differentiation was made for CAHs or Maryland hospitals, hospitals receiving DSH or GME payments, or hospitals qualifying for bad-debt adjustments.
8. *Long-term care hospitals.* Standardized costs were based on the 2006 long-term care national base rate multiplied by the LTC-DRG relative weight.
9. *Inpatient rehabilitation facilities (IRFs).* The standardized cost was based on the average national payment per case mix group (CMG). Because the payment system changed between 2005 and 2006, services in 2005 were based on average national payment per 2005 CMG and then adjusted upward based on the 2006 market basket update. This procedure eliminates rural IRF add-ons as well as any extra payments associated with DSH and GME.
10. *Inpatient psychiatric facilities.* The standardized cost was calculated by assigning the average national per-diem payment for each psychiatric DRG, multiplied by the length of stay. Using regression analysis, we then made adjustments to the variable per-diem rates for length of time since admission. No adjustment was made for rural facilities or for facilities with an associated ER. Payment adjustments for comorbidities were made, consistent with Medicare rules.
11. *Skilled nursing facilities.* We assigned the average national per-diem payment per resource use group (RUG) score multiplied by the length of stay. The RUGs changed between 2005 and 2006. Services rendered in 2005 used the same procedures, but

based on 2005 RUGs. The 2005 standardized costs were then adjusted to reflect 2006 values using the market basket update. Standardized costs eliminated the differential payment levels for urban and rural SNFs, as well as swing beds in CAHs.

12. *Home health agencies.* We assigned 2006 national average cost per home health resource group (HHRG) for claims based on HHRGs. When the number of visits in the episode was less than five, standardized costs were based on the sum of nationally set (before geographic adjustments) per-visit amounts associated with the type of visit listed in the claim, consistent with payment rules.

13. *Hospital outpatient services paid under the outpatient prospective payment system (OPPS).* Services paid under OPPS were assigned the relevant APC value (conversion value times the APC relative weight). Payment discounts for multiple procedures were provided. No hold-harmless payment adjustments were made for cancer, children's, or small rural hospitals, and no special adjustments were made for CAHs, Indian Health Service facilities, or facilities in Maryland.

14. *Hospital outpatient services not covered by OPPS.* Standardized costs were based on the average national payment per HCPCS code, with adjustments made for number of units and modifiers where applicable. No differentiation was made between equivalent services from hospitals and from freestanding facilities, as contained in the outpatient claims files.

15. *Hospice services.* Because of incomplete data, we regressed the average per-diem rate on the combination of revenue center codes in order to generate predicted per-diem values that were multiplied by the length of stay.

16. *Durable medical equipment.* Standardized costs were assigned as the average national payment by HCPCS code-modifier combination. Modifiers accounted for new versus used equipment and for rented versus purchased. Standardized costs accounted for the number of units, where relevant.