

Supplementary Appendix

This appendix has been provided by the authors to give readers additional information about their work.

“Geographic Variation in Fee-for-Service Medicare Beneficiaries' Medical Costs Is Largely Explained by Disease Burden”

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Appendix A

Construction of Standardized Costs

Background

This appendix describes the methods employed to generate “standardized costs”. The goal is to construct a measure 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, which, 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 Medicare payments is that we measure total payments to providers for Medicare covered services rendered to Medicare beneficiaries, including both payments out of the Medicare trust funds, patient cost sharing, as well as 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 the Medicare payment.

Types of adjustments made

- 1. Adjustments for 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 cost for services received in 2005 are adjusted to 2006 payment levels based on 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 input prices such as labor, real estate costs, and other inputs to 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, for Part B services, some

services are priced by Carriers. In constructing standardized prices we eliminate all of these geographic-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 less expensive.

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 there are different payment systems than the norm. For example, while most short-term 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 based on 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. In some cases, certain providers are eligible to receive add-ons to their Medicare payments by virtue of their casemix, function, or costs. Examples are the extra disproportionate share hospital (DSH) or graduate medical education (GME) payments that are paid to some hospitals. Under our procedures, for each specific hospital service, these extra payments are averaged out across all Medicare patients, regardless of the hospital that provided the care.

Overview of specific procedures:

1. Physician Services (except anesthesia): For services with RVUs 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 HPSAs, etc.) 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 mean payments per HCPCS codes were assigned.

2. **Anesthesiology services:** Standardized costs were based on national mean allowed charges by HCPCS code. This approach was used in large part because of complex rules regarding supervision of CRNAs by anesthesiologists, for which incomplete information was contained in claims files.

3. **Part B Drugs:** 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 Limit Allowance (NLA) associated with each clinical lab HCPCS code. This eliminated geographic variations across carriers. Nationally, nearly all clinical lab services are paid at NLA levels.

5. **Ambulance services:** Assigned average allowed charge by ambulance HCPCS code, which adjusts for both payment differences across payment areas, rural add-on payments, and geographic differences in the average distances traveled. Ambulance services provided in 2005 were standardized to 2006 levels, at which time the 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 APC conversion factor times the APC relative weight, with adjustments for modifiers.

7. **Hospital short-term acute inpatient services.** Standardized costs were based on national average payment per DRG relative weight, with adjustments for transfers. No differentiation is made for CAHs or Maryland hospitals, whether the hospital received 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 times the LTC-DRG relative weight.

9. **Inpatient rehabilitation facilities (IRF).** The standardized cost was based on the mean national payment per CMG (case mix group). Because the payment system changed between 2005 and 2006, services in 2005 were based on mean 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 mean national per diem payment for each psychiatric DRG, multiplied by the length of stay. Using regression analysis, we then make adjustments for the variable per diem rates by time since admission. No adjustment was made for rural facilities or whether the facility had an ER associated with it. Payment adjustments for comorbidities were made, consistent with Medicare rules.

11. **Skilled nursing facilities.** We assigned the mean national per diem payment per RUG (Resource Use Group) score times the length of stay. The RUGs changed between 2005 and 2006. Services rendered in 2005 used the same procedures, but based on 2005 RUGs. 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 HHRG (home health resource group) 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 (i.e. before geographic adjustments) per visit amounts associated with the type of visits 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 made. 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 mean national payment per HCPCS code, with adjustments made for number of units and

modifiers where applicable. No differentiation is made between hospital based and free-standing facilities contained in the outpatient claims files for equivalent services.

15. **Hospice services.** Due to 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 account for new vs. used equipment and whether the equipment was rented or purchased. Standardized costs account for the number of units, where relevant.

Appendix Table 1. Explanatory variables and sample means for models that include additional beneficiary, physician, and market controls.

(data sources shown in notes) N=1,563,523.

Explanatory variable	Sample mean
Beneficiary Health (HCC variables)	
5 year age categories (65-69 to 95+) interacted by gender (13 variables; females 65-69=Ref. Grp.) ^a	--
Indicator for dual Medicaid/Medicare eligibility ^a	0.132
Interaction term between dual eligible indicator and female sex ^a	0.097
Indicator for originally qualified for Medicare due to disability ^a	0.076
HCC condition indicators (see Table 2 in paper and Appendix Table 2 for full list) ^a	--
Other Beneficiary Characteristics	
Indicator that beneficiary moved between 2005 and 2006 ^a	0.011
Indicator that beneficiary used services in multiple census divisions during year ^a	0.213
Imputed family income, based on beneficiary demographic characteristics, CTS site, and Census zip code characteristics (in \$1000) ^{a,b}	39.32
Race/ethnicity^a	
White (ref)	0.892
Black	0.076
Other	0.031
Medical home physician and practice characteristics. (For variables whose source is the CTS Physician Survey, values are set to zero if usual source of care (USOC) physician attributed to the beneficiary is not a CTS respondent. Means reported are for beneficiaries attributed to CTS respondent as their USOC physicians)	
Physician specialty^c	
Primary care (ref)	0.533
Medical specialist	0.316
Surgical specialist	0.151
Indicator that usual source of care was attributed to a CTS physician survey respondent ^a	0.129
Indicator that physician is board certified in primary specialty ^c	0.874
Indicator that physician takes into account patient out-of-pocket costs in treatment decisions ^c	0.903
Number of years of practice ^c	19.19
Indicator of foreign medical graduated ^c	0.199
Indicators of strength of practice financial incentives to provide more services to patients (based on practice ownership, compensation incentives, and base compensation method and how these are associated with reported incentives to increase services to patients)^c	
Weak (ref)	0.066

Appendix Table 1 (continued)

Explanatory variable	Sample mean
Moderate	0.393
Strong	0.541
Practice size/type^c	
Solo/2 physician (ref.)	0.394
Group, 3-9 physicians	0.217
Group, 10-39 physicians	0.088
Group, 40+ physicians	0.074
Group/staff model HMO	0.011
Medical School/university	0.037
Hospital	0.121
Other	0.057
Percent practice revenue from Medicaid ^c	11.42
Percent practice revenue from Medicare ^c	41.70
Percent practice revenue from capitated contracts ^c	9.220
Pct. of hospitalized patients for which a hospitalist is used ^c	26.23
Physician reports inadequate time with patients during office visits a major problem affecting quality of care ^c	0.190
Market Supply Variables (measured at county level)^d	
Total number of physicians per 1,000 pop ^e	2.25
Number of beds in hospital with major medical school affiliation per 1000 pop. ^{e,f}	1.14
Number of beds in hospital without major medical school affiliation per 1000 pop. ^{e,f}	3.47
Number of Skilled Nursing Home beds per 1000 elderly pop. ^{e,f}	37.17
Number of Home Health Agency employees per 1000 elderly pop. ^{e,f}	5.63
Number of Hospice employees per 1000 elderly pop. ^{e,f}	0.832
Market Structure Variables (measured at county level except as indicated)	
Percent of physicians in county who are medical specialists ^e	0.316
Percent of physicians in county who are surgical specialists ^e	0.151
Percent of HHA capacity in for-profit entities ^f	0.495
Percent of Hospital capacity in for-profit entities ^f	0.186
Percent of SNF capacity in for-profit entities ^f	0.710
Medical home physicians' perception of the competitive situation in their market ^d	
Not at all competitive (ref)	0.386
Somewhat competitive	0.482
Very Competitive	0.132

Appendix Table 1 (continued)

Explanatory variable	Sample mean
Physician reports lack of timely reports from other providers a major problem affecting quality of care ^d	0.126
Site-level concentration of hospital beds (0-1 Herfindahl index), 2005 ^g	0.133
Medicare advantage penetration rate, 2005 ^e	13.05
Average risk-adjusted Herfindahl concentration index of E&M visits among physicians in county (0-1 scale where 1 indicates all care provided by single physician) ^a	0.521
Medicare fee difference ^h	-8.58

^aSource: Medicare claims

^bSource: 2003 CTS Household Survey

^cSource: 2004-05 CTS Physician Survey

^dAdditionally, we include three 0-1 control variables indicating no physicians, hospitals home health agencies, or SNFs in the county, as well as three variables indicating low-population county (<30,000) interacted with SNF, HHA, and Hospice supply dummies, to account for the fact that providers in these markets likely serve multiple counties.

^eSource: 2008 Area Resource File (using data from 2005)

^fSource: 2005 Provider of Services File

^gSource: 2005 American Hospital Association Survey

^hSource: Constructed from various sources, see Hadley, et.al. 2010 for details.(1)

References

1. Hadley J, Reschovsky J, Corey C, Zuckerman S. Medicare fees and the volume of physicians' services. *Inquiry*;46(4):372-90.

Appendix Table 2. Variables Included In Three Casemix Adjustment Approaches

	Age/Sex/ Race only	Modified HCC	Full HCC
Age/sex interactions (Female 65-69=ref)			
Female 70-74	X	X	X
Female 75-79	X	X	X
Female 80-84	X	X	X
Female 85-89	X	X	X
Female 90-94	X	X	X
Female 95+	X	X	X
Male 65-69	X	X	X
Male 70-74	X	X	X
Male 75-79	X	X	X
Male 80-84	X	X	X
Male 85-89	X	X	X
Male 90-94	X	X	X
Male 95+	X	X	X
HCC condition variables			
Extensive Third-Degree Burns		X	X
Hip Fracture/Dislocation		X	X
Major Head Injury		X	X
Severe Head Injury		X	X
Traumatic Amputation		X	X
Acute Myocardial Infarction		X	X
Aspiration and Specified Bacterial Pneumonias		X	X
Bone/Joint/Muscle Infections/Necrosis		X	X
Cerebral Hemorrhage		X	X
Intestinal Obstruction/Perforation		X	X
Ischemic or Unspecified Stroke		X	X
Opportunistic Infections		X	X
Pneumococcal Pneumonia, Emphysema, Lung Abscess		X	X
Septicemia/Shock		X	X
Severe Hematological Disorders		X	X
Unstable Angina and Other Acute Ischemic Heart Disease		X	X
Vascular Disease with Complications		X	X
Amputation Status, Lower Limb/Amputation Complications		X	X
Breast, Prostate, Colorectal and Other Cancers and Tumors		X	X

Appendix Table 2, Continued

	Age/Sex/ Race only	Modified HCC	Full HCC
Dialysis Status		X	X
Lung, Upper Digestive Tract, and Other Severe Cancers		X	X
Lymphatic, Head and Neck, Brain, and Other Major Cancers		X	X
Metastatic Cancer and Acute Leukemia		X	X
Spinal Cord Disorders/Injuries		X	X
Cerebral Palsy and Other Paralytic Syndromes		X	X
Chronic Obstructive Pulmonary Disease		X	X
Chronic Ulcer of Skin, Except Decubitus		X	X
Cirrhosis of Liver		X	X
Congestive Heart Failure		X	X
Cystic Fibrosis		X	X
Decubitus Ulcer of Skin		X	X
Diabetes with Acute Complications			X
Diabetes with Neurologic or Other Specified Manifestation			X
Diabetes with Ophthalmologic or Unspecified Manifestation			X
Diabetes with Renal or Peripheral Circulatory Manifestation			X
Diabetes without Complication			X
Combined Diabetes categories		X	
Disorders of Immunity		X	X
End-Stage Liver Disease		X	X
Hemiplegia/Hemiparesis		X	X
HIV/AIDS		X	X
Inflammatory Bowel Disease		X	X
Major Organ Transplant Status		X	X
Multiple Sclerosis		X	X
Muscular Dystrophy		X	X
Paraplegia		X	X
Parkinson's and Huntington's Diseases		X	X
Quadriplegia, Other Extensive Paralysis		X	X
Rheumatoid Arthritis and Inflammatory Connective Tissue Disease		X	X
Schizophrenia		X	X
Seizure Disorders and Convulsions		X	X
Specified Heart Arrhythmias		X	X

Appendix Table 2, Continued

	Age/Sex/ Race only	Modified HCC	Full HCC
Artificial Openings for Feeding or Elimination			X
Cardio-Respiratory Failure and Shock			X
Coma, Brain Compression/Anoxic Damage			X
Major Complications of Medical Care and Trauma			X
Protein-Calorie Malnutrition			X
Respirator Dependence/Tracheostomy Status			X
Respiratory Arrest			X
Angina Pectoris/Old Myocardial Infarction			X
Chronic Hepatitis			X
Drug/Alcohol Dependence			X
Nephritis			X
Polyneuropathy			X
Proliferative Diabetic Retinopathy and Vitreous Hemorrhage			X
Drug/Alcohol Psychosis			X
Major Depressive, Bipolar, and Paranoid Disorders			X
Pancreatic Disease			X
Renal Failure			X
Vascular Disease			X
Vertebral Fractures without Spinal Cord Injury			X
Condition Interaction Terms			
Diabetes/Congestive Heart Failure (but no Renal Failure)		X	X
Diabetes/Cerebrovascular disease		X	X
Congestive Heart Failure/Chronic Obstructive Pulmonary Disease		X	X
COPD/Cerebrovascular disease/Coronary Artery Disease		X	X
Renal Failure/Congestive Heart Failure (but no Diabetes)			X
Renal Failure/Congestive Heart Failure/Diabetes			X
Other HCC variables			
Dual Eligible for Medicaid and Medicare		X	X
Originally eligible due to disability		X	X
Dual Eligible and female		X	X
Patient race (White=ref.)^a			
Black	X	X	X
Other	X	X	X

^a Patient race is not technically part of the HCC model, but is included in all regressions under the category of "other beneficiary characteristics."

Appendix Table 3. Comparison of Prospective and Concurrent HCC model Regression Results^a

	Prospective HCC		Concurrent HCC	
	Coefficient	P-value	Coefficient	P-value
Intercept	3,243	0.000	1,684	0.000
Female 70-74	649	0.000	32	0.396
Female 75-79	1,417	0.000	-52	0.309
Female 80-84	2,341	0.000	-455	0.000
Female 85-89	3,341	0.000	-476	0.000
Female 90-94	4,326	0.000	-704	0.000
Female 95+	4,568	0.000	-519	0.066
Male 65-69	284	0.000	-228	0.000
Male 70-74	998	0.000	-360	0.000
Male 75-79	1,921	0.000	-507	0.000
Male 80-84	2,775	0.000	-1,049	0.000
Male 85-89	3,940	0.000	-1,481	0.000
Male 90-94	4,979	0.000	-1,753	0.000
Male 95+	6,724	0.000	-1,208	0.022
Dual Eligible	1,444	0.001	-362	0.369
Dual Eligible and Female interaction	200	0.246	485	0.001
Originally eligible due to disability	1,866	0.000	-470	0.000
HIV/AIDS	5,664	0.171	6,631	0.253
Septicemia/Shock	4,779	0.000	12,905	0.000
Opportunistic Infections	2,704	0.000	10,839	0.000
Metastatic Cancer and Acute Leukemia	19,706	0.000	21,150	0.000
Lung, Upper Digestive Tract, and Other Severe Cancers	8,425	0.000	7,462	0.000
Lymphatic, Head and Neck, Brain, and Other Major Cancers	6,687	0.000	6,428	0.000
Breast, Prostate, Colorectal and Other Cancers and Tumors	1,630	0.000	2,512	0.000
Diabetes with Renal or Peripheral Circulatory Manifestation	3,617	0.000	1,457	0.000

Appendix Table 3. Comparison of Prospective and Concurrent HCC model Regression Results^a (Con't.)

	Prospective HCC		Concurrent HCC	
	Coefficient	P-value	Coefficient	P-value
Diabetes with Neurologic or Other Specified Manifestation	2,937	0.000	1,700	0.000
Diabetes with Acute Complications	1,612	0.002	-375	0.485
Diabetes with Ophthalmologic or Unspecified Manifestation	1,995	0.000	664	0.000
Diabetes without Complication	750	0.000	270	0.000
Protein-Calorie Malnutrition	4,287	0.000	11,634	0.000
End-Stage Liver Disease	5,734	0.000	5,074	0.000
Cirrhosis of Liver Chronic Hepatitis Intestinal	3,849	0.000	1,214	0.000
Chronic Hepatitis	988	0.127	911	0.006
Intestinal Obstruction/Perforation	2,589	0.000	9,506	0.000
Pancreatic Disease	2,291	0.000	4,672	0.000
Inflammatory Bowel Disease	1,751	0.000	2,792	0.000
Bone/Joint/Muscle Infections/Necrosis	3,294	0.000	8,035	0.000
Rheumatoid Arthritis and Inflammatory Connective Tissue Disease	2,678	0.000	2,125	0.000
Severe Hematological Disorders	7,881	0.000	11,108	0.000
Disorders of Immunity	3,447	0.000	10,244	0.000
Drug/Alcohol Psychosis	3,068	0.000	9,258	0.000
Drug/Alcohol Dependence	2,969	0.000	3,673	0.000
Schizophrenia	4,467	0.000	4,716	0.000
Major Depressive, Bipolar, and Paranoid Disorders	3,343	0.000	4,901	0.000
Quadriplegia, Other Extensive Paralysis	8,019	0.000	10,601	0.000
Paraplegia	6,707	0.000	10,299	0.000
Spinal Cord Disorders/Injuries	4,597	0.000	6,861	0.000
Muscular Dystrophy	2,082	0.090	2,532	0.054
Polyneuropathy	2,535	0.000	3,179	0.000
Multiple Sclerosis	3,508	0.000	2,609	0.000

Appendix Table 3. Comparison of Prospective and Concurrent HCC model Regression Results^a (Con't.)

	Prospective HCC		Concurrent HCC	
	Coefficient	P-value	Coefficient	P-value
Parkinsons and Huntingtons Diseases	4,945	0.000	3,116	0.000
Seizure Disorders and Convulsions	2,872	0.000	3,210	0.000
Coma, Brain Compression/Anoxic Damage	3,373	0.000	6,230	0.000
Respirator Dependence/Tracheostomy Status	7,650	0.000	48,072	0.000
Respiratory Arrest Cardio-Respiratory Failure and Shock	8,197	0.000	10,401	0.000
Cardio-Respiratory Failure and Shock	3,702	0.000	7,695	0.000
Congestive Heart Failure	3,168	0.000	1,912	0.000
Acute Myocardial Infarction	1,800	0.000	13,339	0.000
Unstable Angina and Other Acute Ischemic Heart Disease	1,503	0.000	7,574	0.000
Angina Pectoris/Old Myocardial Infarction	1,592	0.000	3,218	0.000
Specified Heart Arrhythmias	2,101	0.000	3,008	0.000
Cerebral Hemorrhage	1,165	0.006	8,413	0.000
Ischemic or Unspecified Stroke	2,310	0.000	3,008	0.000
Hemiplegia/Hemiparesis	2,953	0.000	7,976	0.000
Cerebral Palsy and Other Paralytic Syndromes	1,970	0.001	3,397	0.000
Vascular Disease with Complications	4,424	0.000	8,540	0.000
Vascular Disease	2,572	0.000	2,589	0.000
Cystic Fibrosis	1,421	0.080	1,606	0.058
Chronic Obstructive Pulmonary Disease	3,106	0.000	1,823	0.000
Aspiration and Specified Bacterial Pneumonias	4,324	0.000	9,070	0.000
Pneumococcal Pneumonia, Emphysema, Lung Abscess	1,841	0.000	5,652	0.000
Proliferative Diabetic Retinopathy and Vitreous Hemorrhage	2,057	0.000	792	0.000
Dialysis Status	7,427	0.000	16,683	0.000
Renal Failure	2,445	0.000	2,312	0.000
Nephritis	1,862	0.000	1,347	0.000
Decubitus Ulcer of Skin	5,301	0.000	10,350	0.000

Appendix Table 3. Comparison of Prospective and Concurrent HCC model Regression Results^a (Con't.)

	Prospective HCC		Concurrent HCC	
	Coefficient	P-value	Coefficient	P-value
Chronic Ulcer of Skin, Except Decubitus	3,615	0.000	1,486	0.000
Extensive Third-Degree Burns	-1,648	0.323	27,807	0.000
Severe Head Injury	-658	0.616	7,283	0.000
Major Head Injury	1,938	0.000	6,068	0.000
Vertebral Fractures without Spinal Cord Injury	3,065	0.000	4,917	0.000
Hip Fracture/Dislocation	2,506	0.000	13,676	0.000
Traumatic Amputation	5,472	0.000	14,257	0.000
Major Complications of Medical Care and Trauma	2,007	0.000	13,317	0.000
Major Organ Transplant Status	6,322	0.000	12,342	0.000
Artificial Openings for Feeding or Elimination	6,286	0.000	11,218	0.000
Amputation Status, Lower Limb/Amputation Complications	4,288	0.000	6,529	0.000
Diabetes/Congestive Heart Failure (No Diabetes)	1,015	0.000	789	0.000
Diabetes/Cerebrovascular disease	651	0.005	733	0.000
Congestive Heart Failure/Chronic Obstructive Pulmonary Disease	1,637	0.000	3,364	0.000
COPD/Cerebrovascular disease/Coronary Artery Disease	1,051	0.120	3,920	0.000
Renal Failure/Congestive Heart Failure (No diabetes)	553	0.105	3,188	0.000
Renal Failure/Congestive Heart Failure/Diabetes	2,508	0.000	6,450	0.000
Number of observations	1,512,521		1,563,523	
R squared	0.133		0.584	

^a Dependent variable for both equations are 12 month standardized costs. The prospective model uses prior year diagnostic information to construct condition indicator variables, while the concurrent model uses diagnoses from the current year. As a result, the sample size is smaller in the prospective model as two years rather than one year of diagnostic information is required for sample inclusion. Variable means are very similar between the prospective and concurrent model samples.

Appendix Table 4. Unadjusted and adjusted site means with site rankings (1=least costly; 60=most costly) under alternative casemix adjustment approaches

CTS site	Full sample										Decedents only							
	Unadjusted std. costs		Age-sex-race only		Concurrent HCC		Prospective HCC		Modified HCC		Unadjusted std. costs		Age-sex-race only		Concurrent HCC		Modified HCC	
	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank
NE Indiana	5,632	1	5,924	1	8,293	8	7,180	2	8,241	10	28,060	4	29,069	3	38,959	26	39,086	28
E North Car	6,246	2	6,463	3	9,143	34	7,931	9	8,708	17	32,408	12	29,718	6	37,843	18	36,420	12
Santa Rosa	6,346	3	6,035	2	7,490	2	6,935	1	7,378	2	29,050	9	30,938	12	34,331	4	32,947	3
Dothan	6,436	4	6,710	7	9,457	45	7,884	8	9,079	30	30,714	10	30,762	11	45,224	55	43,551	53
NW Washington	6,490	5	6,613	4	8,647	16	7,851	7	8,310	12	28,641	5	29,799	8	38,011	20	35,684	10
Killeen	6,497	6	7,113	11	8,403	11	7,994	11	8,341	13	31,804	11	30,673	10	36,746	10	35,506	9
N Utah	6,581	7	6,817	8	9,281	41	8,307	17	9,272	40	26,760	1	27,691	1	42,185	48	40,214	37
NE Illinois	6,764	8	6,703	6	9,116	31	8,127	12	8,726	18	27,996	3	30,338	9	37,545	16	34,949	8
Syracuse	6,769	9	6,686	5	8,352	10	7,587	5	8,254	11	28,817	7	29,778	7	34,315	3	34,264	5
Modesto	6,832	10	7,098	10	8,276	6	7,475	4	7,970	5	28,918	8	29,311	5	34,173	2	32,333	1
Greenville	6,959	11	7,309	14	9,054	29	8,293	16	8,933	22	36,409	23	35,391	22	39,626	35	38,735	25
Wilmington	7,089	12	7,493	16	9,511	48	8,711	19	9,157	33	32,461	13	31,466	14	40,354	39	37,800	18
Augusta	7,174	13	7,225	12	8,725	20	8,158	13	8,749	20	33,797	17	31,112	13	36,946	13	36,864	13
E Maine	7,232	14	7,228	13	8,576	14	7,686	6	8,154	8	27,320	2	28,834	2	36,915	12	34,845	7
Minneapolis	7,350	15	7,593	18	9,480	47	9,059	25	9,728	47	34,562	20	34,993	20	39,392	30	39,407	29
W-Cen Alabama	7,395	16	6,947	9	9,927	52	8,330	18	9,267	39	38,857	29	37,327	27	45,701	56	44,632	55
San Francisco	7,528	17	7,370	15	8,209	5	7,945	10	7,907	3	32,980	14	34,258	17	35,614	6	34,253	4
Portland	7,644	18	7,495	17	8,642	15	8,180	14	8,665	16	28,733	6	29,305	4	37,179	15	36,402	11
Rochester	8,246	19	7,760	19	7,185	1	7,421	3	7,151	1	33,452	16	34,334	18	32,378	1	32,781	2
Greensboro	8,250	20	8,233	21	9,153	35	9,024	24	9,056	27	37,889	27	37,231	26	39,596	33	38,741	26
Worcester	8,265	21	8,078	20	8,653	17	8,287	15	8,954	24	38,030	28	39,017	29	38,199	22	38,906	27
Bridgeport	8,371	22	8,428	22	8,884	25	8,745	20	8,728	19	43,246	39	44,558	40	40,090	36	39,993	35
Terre Haute	8,425	23	8,515	23	9,074	30	9,019	23	9,051	26	35,372	22	35,977	24	39,215	28	37,906	19
Lansing	8,481	24	8,629	25	9,400	44	9,319	30	9,316	42	34,663	21	35,053	21	38,247	23	36,870	14

Appendix Table 4. Unadjusted and adjusted site means with site rankings (1=least costly; 60=most costly) under alternative casemix adjustment approaches

CTS site	Full sample										Decedents only							
	Unadjusted std. costs		Age-sex-race only		Concurrent HCC		Prospective HCC		Modified HCC		Unadjusted std. costs		Age-sex-race only		Concurrent HCC		Modified HCC	
	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank
Huntington	8,605	25	8,781	27	9,044	28	8,922	22	9,156	32	37,230	26	37,995	28	40,966	44	40,919	41
Knoxville	8,643	26	8,775	26	8,827	23	9,248	28	9,161	35	34,193	18	34,596	19	36,164	7	38,459	23
N Georgia	8,643	27	8,991	30	9,124	33	9,310	29	9,159	34	34,488	19	33,508	16	38,734	25	38,388	21
Washington DC	8,665	28	8,606	24	8,705	18	9,152	27	8,815	21	40,315	32	39,695	33	36,849	11	37,395	17
Seattle	8,851	29	8,982	29	9,154	36	9,457	32	9,075	29	36,886	25	36,846	25	39,189	27	38,558	24
Milwaukee	8,913	30	8,885	28	9,272	40	9,461	33	9,520	45	39,004	30	39,339	30	39,394	31	39,762	31
Atlanta	9,110	31	9,258	32	9,308	42	9,788	37	9,478	44	40,539	34	39,471	32	40,617	41	41,225	44
Detroit	9,137	32	9,202	31	8,556	12	9,099	26	8,414	14	46,285	49	44,628	41	36,470	8	37,058	16
San Antonio	9,324	33	9,531	35	9,461	46	9,824	38	9,812	48	45,362	43	45,513	46	41,247	46	42,988	50
Phoenix	9,455	34	9,711	36	9,683	50	9,904	43	9,977	52	42,793	36	42,753	37	43,472	54	43,291	52
Newark	9,555	35	9,299	33	8,283	7	8,852	21	8,164	9	47,880	51	47,612	53	37,548	17	38,285	20
Orange County	9,621	36	9,955	42	9,168	38	9,649	35	9,138	31	45,621	44	46,100	48	40,785	42	41,699	46
Columbus	9,671	37	9,796	38	8,825	22	9,866	41	9,211	36	45,771	45	44,740	42	39,623	34	40,962	42
Baltimore	9,697	38	9,520	34	9,118	32	9,860	40	9,478	43	48,130	53	47,142	51	40,193	37	41,571	45
Denver	9,715	39	9,790	37	8,978	27	10,093	47	9,670	46	42,749	35	42,033	34	38,020	21	39,762	32
Riverside	9,772	40	9,932	41	8,834	24	9,492	34	8,654	15	43,503	40	42,590	35	40,476	40	39,818	33
Las Vegas	9,809	41	10,258	45	8,711	19	9,882	42	9,064	28	45,084	42	42,804	38	38,631	24	41,219	43
Cen Arkansas	9,823	42	9,820	39	10,001	53	9,997	44	9,856	50	36,621	24	35,924	23	41,009	45	40,049	36
Little Rock	10,105	43	9,930	40	10,343	58	10,215	49	10,213	56	33,399	15	33,153	15	42,267	49	42,159	47
Indianapolis	10,136	44	10,138	43	8,934	26	9,770	36	9,266	38	39,383	31	39,339	31	39,438	32	39,971	34
Tulsa	10,425	45	10,533	49	10,844	59	11,523	58	10,814	58	40,423	33	42,661	36	48,757	59	48,752	59
Chicago	10,572	46	10,419	47	10,195	57	10,851	52	10,200	55	45,880	47	45,677	47	42,558	52	43,130	51
Shreveport	10,614	47	10,521	48	10,141	56	11,098	57	10,956	59	48,062	52	47,072	50	43,087	53	48,566	58
Cleveland	10,616	48	10,249	44	8,810	21	9,851	39	8,952	23	46,429	50	47,219	52	40,796	43	40,827	40

Appendix Table 4. Unadjusted and adjusted site means with site rankings (1=least costly; 60=most costly) under alternative casemix adjustment approaches

CTS site	Full sample										Decedents only							
	Unadjusted std. costs		Age-sex-race only		Concurrent HCC		Prospective HCC		Modified HCC		Unadjusted std. costs		Age-sex-race only		Concurrent HCC		Modified HCC	
	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank	Mean Cost	Rank
Nassau	10,684	49	10,582	50	8,319	9	9,442	31	8,035	7	42,939	37	44,058	39	35,343	5	34,319	6
W Palm Beach	10,945	50	10,700	51	10,139	55	10,420	51	10,100	54	48,636	55	49,650	56	46,131	58	46,164	56
Los Angeles	10,980	51	10,983	52	9,219	39	10,060	45	9,257	37	55,312	57	55,798	59	42,281	51	44,387	54
Pittsburgh	11,188	52	10,351	46	9,157	37	10,341	50	9,312	41	42,974	38	45,049	43	40,308	38	40,529	38
Houston	11,349	53	11,589	55	10,086	54	11,873	59	10,454	57	55,567	59	53,402	57	45,872	57	47,366	57
Middlesex	11,432	54	11,186	54	8,031	3	10,069	46	7,942	4	48,887	56	49,277	55	37,074	14	36,890	15
Philadelphia	11,663	55	11,142	53	8,561	13	10,152	48	9,000	25	44,887	41	45,138	44	36,723	9	39,408	30
Tampa	11,835	56	11,737	56	9,725	51	11,078	56	9,835	49	48,279	54	48,230	54	42,269	50	42,791	49
St. Louis	11,976	57	11,877	57	9,356	43	10,990	54	9,873	51	45,804	46	45,248	45	39,387	29	40,703	39
Boston	12,137	58	11,892	58	9,599	49	11,076	55	9,999	53	45,963	48	46,492	49	41,563	47	42,568	48
New York City	13,294	59	12,965	59	8,118	4	10,977	53	7,971	6	55,431	58	54,965	58	37,926	19	38,431	22
Miami	15,098	60	15,142	60	12,700	60	13,305	60	13,260	60	62,589	60	63,376	60	49,471	60	51,564	60