Appendix A: Summary of Literature

This Appendix provides summaries of selected empirical studies that focus on the variation in healthcare spending, costs, and prices. The table below summarizes the explanatory variables used in each study. In addition, we discuss the literature that explores hospital quality.

Studies Focused on Medicare Spending

- Cutler and Sheiner (1999) identify large regional variations in Medicare spending across 212 hospital referral regions.[1] The authors note that these differences may or may not reflect inefficiency. In order to examine the source of regional differences, they conduct a series of regression analyses that measure the extent to which regional differences in Medicare spending can be explained by differences in illness, demographic differences that affect the demand for medical care, or differences in the supply of medical care. They find that variables related to illness explain 66% of the variability in Medicare spending. Demographic factors and variables that reflect medical supply further increase the explanatory power of the model to between 75 and 80%.[2]

- Researchers associated with the Dartmouth Atlas Project have reported in several studies a wide regional variation in Medicare spending.[3] The studies have either focused on price-adjusted Medicare spending by region or samples of patients presumed to be similarly ill across regions, with few adjustments for patients' demographic characteristics and health status. According to the Dartmouth researchers, some of the regional variation is due to differences in prices paid for similar services, and some is due to differences in illness, but large differences remain in terms of the volume of healthcare services received by patients in different regions. These differences in volume are shown in the more frequent use of hospital or physician services, diagnostic tests, and other procedures in some regions. They also conclude that integrated delivery systems offer great promise for improving quality and lowering costs. It remains unclear, however,

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[1] Cutler, David M., and Louise Sheiner, "The Geography of Medicare," *American Economic Association Papers and Proceedings*, Vol. 89, No. 2 (1999) ("Cutler and Sheiner, 1999"). Hospital referral regions are created by grouping zip codes into geographic units where a preponderance of hospital admissions occur.

[2] Some demographic factors (share of the population that is black, Hispanic, female, poor, or rich) increase the explanatory power of the model to approximately 70%. It should be noted, however, that the data used in this study already adjusts spending by age, race, sex and differences in Medicare payment rates by region. This reduces the apparent explanatory power of the demographic variables. In terms of medical supply, areas with large shares of for-profit hospitals and specialists appear to have higher spending, although the authors note that these variables are potentially endogenous (for example, high medical spending among sick populations may contribute to increase the supply of specialists but may not be caused by it).

[3] *See* Fisher, Elliott S., Julie P. Bynum, and Jonathan S. Skinner, "Slowing the Growth in Health Care Costs – Lessons from Regional Variation" *The New England Journal of Medicine*, Perspective (February 2009); "The Policy Implications of Variations in Medicare Spending Growth," The Dartmouth Atlas of Health Care (2009). *See* also Fisher, Elliott S., David E. Wennberg, Therese A. Stukel, Daniel J. Gotlieb, F.L. Lucas, and Etoile L. Pinder, "Implications of Regional Variations in Medicare Spending - Part I," *Annals of Internal Medicine*, Vol. 138, No. 4 (2003) ("Fisher et al., 2003"); and Fisher, Elliott S., David E. Wennberg, Therese A. Stukel, and Daniel J. Gottlieb, "Variations in The Longitudinal Efficiency of Academic Medical Centers," *Health Affairs* (2004) ("Fisher et al., 2004").

whether the observed differences in utilization respond to unobservable patient characteristics—as reflected in the demographic and health status variables used in other studies, graduate medical education and other Medicare payments, provider and/or payor characteristics (*e.g.*, supplemental coverage), or inefficiency.

- In a more recent study, Zuckerman et al. (2010) analyzed regional Medicare spending per beneficiary.[4] The study finds that the observed geographic differences in spending could be explained in large part by differences in patients' demographic characteristics and health status. Demographic characteristics reduced the magnitude of the unexplained differences by about 50% (measured as the difference between the first and fifth quintiles of the distribution). Variables reflecting health status of the population further reduced the unexplained differences to 33%.[5] Zuckerman et. al (2010) conclude that previous findings may exaggerate the importance of regional differences in Medicare spending if these differences are in part due to unmeasured patient characteristics.[6]

- Reschovsky et al. (2011) conducted a beneficiary-level analysis with additional explanatory variables to capture demand factors, such as patient characteristics and health status, and supply factors, such as the number of hospital beds, physicians and the availability of other healthcare resources.[7] Consistent with Zuckerman el at. (2010), this study finds that the large majority of Medicare service use can be explained by health status and patient demographics, with supply factors being insignificant or weakly related to service use.

- The Medicare Payment Advisory Commission ("MedPAC") analyzed regional differences in Medicare spending and Medicare service use.[8] MedPAC's analysis adjusts raw Medicare spending per region to obtain a measure of Medicare "use" of services (*i.e.*, a measure of the "quantity" of services delivered). To do this, MedPAC first adjusts Medicare spending for differences in Medicare payment rates (*e.g.*, regional wages and

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[4] As in Cutler and Sheiner (1999) the data are adjusted by Medicare standardized prices but could not be adjusted to remove Medicare payments for DSH and teaching hospitals. *See* Zuckerman, Stephen, Timothy Waidmann, Robert Berenson, and Jack Hadley, "Clarifying Sources of Geographic Differences in Medicare Spending," *The New England Journal of Medicine,* Special Article (2010) ("Zuckerman et al., 2010").

[5] Other variables reflecting income and the supply of healthcare resources did not add significant explanatory power to the model.

[6] In their study, Zuckerman et al. (2010) show that the results from simple models that only incorporate some baseline health characteristics and demographic variables are similar to earlier results obtained by Sutherland et al. (2009) and Dartmouth researchers. *See* Sutherland, Jason M., Elliott S. Fisher, and Jonathan S. Skinner, "Getting Past Denial—The High Cost of Health Care in the United States," *The New England Journal of Medicine,* Perspective (September 2009); and Fisher et al., 2003.

[7] Reschovsky, James D., Jack Hadley, Cynthia B. Saiontz-Martinez, and Ellyn R. Boukus, "Following the Money: Factors Associated with the Cost of Treating High-Cost Medicare Beneficiaries," *Health Services Research* (article online in advance of print - February 2011). This study uses standardized cost as a measure of service use. This measure includes the full reimbursement from Medicare, other insurers and patient payments, eliminates geographic payment differences that account for input price variation, and adjusts for other Medicare payments such as DSH and graduate medical education.

[8] "Regional Variation in Medicare Service Use," Medicare Payment Advisory Commission, Report to the Congress (January 2011).

special payments to teaching, DSH, and rural hospitals) and then adjusts spending levels for differences in beneficiaries' health status, demographics, and other factors. After these adjustments, variation in spending across regions drops from 55% to 30% (measured as the difference between the 90th and 10th percentile of the distribution). MedPAC finds that this variation in service use is still substantial. Nonetheless, about 46% of Medicare beneficiaries live in areas that have a service use within 5% of the national average and approximately 85% live in areas with a service use within 15% of the national average.[9] This variation in service use does not imply waste or inappropriate hospital practices. For example, although this study takes into account Medicare adjustments such as GME/IME and DSH, it is generally understood that teaching hospitals will use more services (*e.g.*, more scans), not only more personnel. This may not be fully captured by the IME adjustment, but still recognized through higher Medicare spending. The study also notes that differences in service use could result from other factors that affect beneficiaries' care-seeking tendencies, such as the availability of supplemental insurance, ease of access, and others. Finally, MedPAC notes that although growth in service use also varies by region, it is not positively correlated with the level of service use. In fact, MedPAC finds a slightly negative correlation between service use and service growth.

- The Congressional Budget Office (CBO) also provides a review of the literature on regional differences in Medicare spending.[10] It concludes that prices of healthcare services and the population's health status are important in explaining geographic variation. According to the CBO review, other demographic characteristics and patients' treatment preferences appear to explain a small amount of the geographic variation and a substantial portion of the variation remains unexplained.

Studies Focused on Non-Medicare Patients

- Koenig et al. (2003) analyzed all-payor hospital inpatient costs using the Medicare Cost Reports.[11] The authors estimate an average inpatient cost per discharge for approximately 3,500 U.S. hospitals. Their model includes several of the explanatory variables used in this Report. It includes case mix, the Medicare wage index, urban/rural indicator variables, the shares of Medicare and Medicaid hospital days, special care days, and Medicare outlier payments. In addition, the model includes explanatory variables that distinguish among three types of mission-related costs for teaching hospitals: (i) graduate medical education, (ii) biomedical research, and (iii) the maintenance of standby capacity for complex and highly specialized cases.[12] The results show that academic medical

[9] Looking at the extremes values of the distribution of service use, MedPAC finds that the area with the greatest service use (Miami, FL) has nearly twice the level of service use as the region with the lowest service use (LaCrosse, WI). MedPAC raises concerns that these differences could stem from overuse and possibly fraud and abuse by some providers.

[10] "Geographic Variation in Health Care Spending," Congressional Budget Office (February 2008), ("CBO Report, 2008"). Although this study was published in 2008, it should be noted that it used Medicare data from 2004 and before, and most of the literature reviewed in the study is from before 2004.

[11] Koenig et al., 2003.

[12] As it is done in other studies and this Report, the authors use the number of hospital interns and residents per bed as a measure of the hospital's teaching intensity. In order to obtain measures of the

centers and other teaching hospitals do more research and have more standby capacity than nonteaching hospitals. In addition, teaching hospitals tend to have higher case mix and labor costs. For academic medical centers, variables related to case mix and regional costs account for 26% of the total inpatient cost and the combined mission-related activities account for an additional 28% of the total inpatient costs. They also find that the maintenance of standby capacity represents the largest mission-related cost for teaching hospitals.

- While not including regression analyses, a report from Milliman Inc. calculates average costs and prices for California hospitals.[13] Cost estimates are based on operating costs (for all payors) and average prices are estimated from allowed charges for commercial inpatient discharges. The report takes into account geographic differences in costs through Medicare's inpatient adjustment factors and adjusts for case mix by making use of APR-DRG/SOI benchmarks (All Patient Refined Diagnosis Related Group/Severity of Illness). The results are not adjusted for charity care and teaching intensity, which are shown separately in the report. Milliman notes that the indices obtained do not take into account whether hospitals with greater than average charity care, Medi-Cal, or Medicare patients obtain contributions to their costs from commercial insurers. In addition, the report does not attempt to adjust for demographic factors, health status, or any other measure of severity within APR-DRG. Given these limitations, the report focuses on presenting calculated indices to compare and understand inpatient hospital costs and prices in California. It does not highlight any high-cost hospitals and does not provide policy recommendations.[14]
- Wu (2009) analyzed managed-care per-diem payments to hospitals in Massachusetts.[15] The main data for this study were obtained from a public employer's claims dataset. The model used to explain hospital payments included standard demographic variables, DRG-level effects, and hospital characteristics (*e.g.*, major teaching hospitals, ownership type, open-heart surgery facilities, utilization, etc.) The author also included certain health plan characteristics such as size and a measure of the ability to channel patients. The results of this study show that patient characteristics and hospital characteristics explain only very

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hospital's research mission, they use the amount of funding from the National Institutes of Health (NIH), whether the hospital has a general clinical research center, and whether the hospital has a positron emission tomography (PET) scanner. To measure standby capacity, they rely on the number of specialty care beds, the availability of sophisticated clinical services, and the number of solid organ transplants.

[13] "Cost Efficiency at Hospital Facilities in California: a Report Based on Publicly Available Data," Milliman Inc. (October 2007). The California Office of Statewide Health Planning and Development (OSHPD) requires each hospital to submit financial results on a quarterly basis. Milliman Inc. used 2005 data from these files.

[14] In another study, Milliman Inc. identified 16 U.S. cities that had low per-capita inpatient costs for both Medicare and commercial payors, as well as positive hospital margins. However, Milliman Inc. found that these cities had little in common with respect to factors such as hospital market concentration, payor market concentration, wage index, ratio of primary care to specialty care, and the intensity of services provided. *See* Milliman Inc., 2010.

[15] Wu, Vivian Y., "Managed Care's Price Bargaining with Hospitals," *Journal of Health Economics*, Vol. 28 (2009).

limited payment variation. The study suggests that large payors and payors with a better ability to channel patients seem to be able to obtain greater discounts from hospitals.

Studies Focused on Quality of Care

We reviewed studies that explore whether regions and hospitals with high spending are associated with higher quality of care. The analysis of quality is particularly limited by the absence of well defined measures of quality. In addition, a methodological limitation to the analysis arises from the potential *selection bias* in the choice of hospitals. Selection bias occurs when severely ill patients disproportionately choose high quality hospitals.[16] As a result, health outcomes such as mortality rates cannot be compared without taking into account the differences in the severity of illness of the population served.

Several researchers have tried to overcome these data and methodological limitations, with mixed results. Some studies found that quality of care for Medicare enrollees was not better, and was sometimes worse, in high-spending regions.[17] However, studies on cost efficiency suggest that low-cost providers tend to have lower quality and that high-cost providers tend to receive sicker patients.[18] Other studies found positive health outcomes from intensive treatment, for example, at high-volume university hospitals, and report large differences in survival rates.[19]

A number of authors have questioned the validity of some of the quality measures used in these studies.[20] For example, simple measures based on medications received during initial hospitalization cannot capture the full aspects of hospital quality. Hospitals differ in many dimensions and proper measures of qualities that apply, for example, to community hospitals, may not be relevant for tertiary facilities. Hospitals may also differ in their cost structures

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[16] More broadly, patients choose treatments and providers according to their severity of illness, co-morbidity, and other patient characteristics and preferences that may be unobservable to the researcher.

[17] Dartmouth researchers analyzed Medicare spending by region focusing on samples of patients presumed to be similarly ill or by focusing on end-of-life spending. *See* Fisher et al., 2003, and Fisher et al., 2004.

[18] *See* Jha, Ashish K., E. John Orav, Allen Dobson, Robert A. Book, and Arnold M. Epstein, "Measuring Efficiency: The Association of Hospital Costs and Quality of Care," *Health Affairs*, Vol. 28, No. 3 (2009); and Mutter, Ryan L., Michael D. Rosko, and Herbert S. Wong, "Measuring Hospital Inefficiency: The Effects of Controlling for Quality and Patient Burden of Illness," *Health Services Research*, Vol. 43, No. 6 (2008).

[19] *See*, *e.g.*, Gutierrez, Juan C., Noor Kassira, Rabih M. Salloum, Dido Franceschi, and Leonidas G. Koniaris, "Surgery for Rectal Cancer Performed at Teaching Hospitals Improves Survival and Preserves Continence," *Journal of Gastrointestinal Surgery*, Vol. 11, No. (2007); and Verhoef, Christian, Rens van de Weyer, Michael Schaapveld, Esther Bastiaannet, and John Th. M. Plukker, "Better Survival in Patients with Esophageal Cancer After Surgical Treatment in University Hospitals: A Plea for Performance by Surgical Oncologists," *Annals of Surgical Oncology*, Vol. 14, No. 5 (2007).

[20] Shahian et al. (2007) find that cardiac surgery report cards used to assess risk-adjusted mortality and surgery volume tend to be problematic because of case misclassification and lack of standardization. *See* Shahian, David M., Treacy Silverstein, Ann F. Lovett, Robert E. Wolf and Sharon-Lise T. Normand, "Comparison of Clinical and Administrative Data Sources for Hospital Coronary Artery Bypass Graft Surgery Report Cards," *Journal of the American Heart Association*, Vol. 115, No. 12 (2007). The authors also highlight other limitations from the use of risk-adjusted outcomes from report cards. *See* Shahian, David M. and Sharon-Lise T. Normand, "Comparison of "Risk-Adjusted" Hospital Outcomes," *Journal of the American Heart Association*, Vol. 117, No. 15 (2008).

according to their primary missions. Furthermore, hospitals may just concentrate on those activities that are more commonly measured.[21]

In addition, data on Medicare spending may be misleading because Medicare payments are disproportionately high in states that have a large social burden, poorer quality, and low healthcare spending overall.[22] But if one considers total health spending, states with more health spending per capita tend to have better-quality care.

Some researchers have developed more sophisticated statistical tools to incorporate the fact that patients who select different hospitals (or treatments) are likely to have different health characteristics, some of which are unobservable to the researcher. These studies use patients' distances to alternative hospitals as independent predictors of how intensively the patient will be treated. The central assumption in this method is that patients close to hospitals with high volume and capability to perform certain procedures are more likely to get the treatment, independently from their health status. The researcher can then compare outcomes such as mortality rates for patients that appear to be identical in their health status and demographics, but some get more intensive treatment because they live closer to a hospital that offers the treatment. This method is also based on the observation that patients tend to choose hospitals that are closer to where they live. Hence, after controlling for all the demographic characteristics of the population, this method would predict that hospital A is of higher quality than hospital B if patients residing near hospital A have lower mortality than patients residing near hospital B.

In an earlier study that used this methodology, McClellan et al. (1994) shows positive outcomes from the incremental use of more invasive procedures on Medicare patients.[23] Using a similar methodology, Geweke et al. (2002) find that the smallest and largest hospitals provide the highest quality, and patients with high severity of illness are disproportionately admitted to high quality hospitals.[24]

Gowrisankaran and Town (1999) highlight that these econometric methods yield significantly different results from the standard methods, even after controlling for demographic information

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[21] Dranove et al. (2003) show findings that suggest that healthcare report cards give doctors and hospitals incentives to "game" the system and decline to treat more difficult, severely ill patients. *See* Dranove, David, Daniel Kessler, Mark McClellan, and Mark Satterthwaite, "Is More Information Better? The Effects of 'Report Cards' on Health Care Providers," *Journal of Political Economy*, 2003, Vol. 111, No. 3 (2003).

[22] *See* Cooper, Richard A., "States With More Health Care Spending Have Better-Quality Health Care: Lessons About Medicare," *Health Affairs*, Vol. 28, No. 1 (2009).

[23] *See* McClellan, Mark, Barbara J. McNeil, and Joseph P. Newhouse, "Does More Intensive Treatment of Acute Myocardial Infarction in the Elderly Reduce Mortality? Analysis Using Instrumental Variables," *The Journal of the American Medical Association*, Vol. 272, No. 11 (1994).

[24] Geweke, John, Gautam Gowrisankaran, and Robert J. Town, "Bayesian Inference for Hospital Quality in a Selection Model," Econometrica, Vol. 71, No. 4 (2003). Gowrisankaran et al. (2006) use a similar methodology to assess whether increased hospital volume lower mortality. *See* Gowrisankaran, Gautam, Vivian Ho, and Robert J. Town, "Causality, Learning and Forgetting in Surgery," *working paper* (January 2006).

and co-morbidities.[25] This confirms that failure to properly adjust for severity of illness is likely to lead to substantial mismeasurement of hospital quality.

[25] *See* Gowrisankaran, Gautam and Robert J. Town. "Estimating the Quality of Care in Hospitals Using Instrumental Variables," *Journal of Health Economics,* Vol. 18 (1999).

Selected Literature on Spending and Price Differences

Study	Dependent Variable	Explanatory Variables Considered					
		Regional costs	Case Mix	Demographics	Health Status	Provider Characteristics/Supply of Resources	Payor Characteristics
Cutler et al. (1999)	Per-capita Medicare spending	Costs outside the medical sector		Race, sex; Income and education.	Shares of smokers, obese, hypertensive, and sedentary; Measures of illness based on rates of hospitalization for hip fracture, heart attacks, strokes, gastrointestinal bleeding, and surgery for lung or colon cancer; Age-adjusted mortality rates; Timing and causes of death.	For-profit and government owned; Supply of beds and physicians; Proximity to medical schools; Specialization rate; Medical residents.	Non-elderly population on managed care; Uninsured population.
Koenig et al. (2003)	All-payor inpatient cost	Medicare wage index and urban/rural variable	CMI; Special care, nursery, and swing-bed days.		Medicare outlier payments	Interns and residents per bed; Level of NIH funding, general clinical research center, and (PET) scanner; Specialty care beds, sophisticated clinical services, solid organ transplants, AIDS/HIV programs, psychiatric emergency care; SPECT scanner, and trauma level I.	
Milliman Inc. (2007)	Commercial inpatient hospital payments	Medicare inpatient adjustment factors	APR-DRG/SOI adjustment			Identifier for major teaching hospitals (based on residents per bed and IME amounts)	
CBO Review of Studies (2008)	Per-capita Medicare spending	Prices of health care services; Special hospital payments.		Age, sex, race; Income and education; Urbanization; Individual preferences; Dual beneficiary.	Mortality and illness rates; Health status; Smoking and health risk behaviors; Obesity, air pollution.	Physicians per capita; % of PCP; Supply of medical providers.	Managed care enrollment; Medicaid eligibility.
Wu (2009)	Per-diem payment from managed care plans for adult non-elderly population		DRG dummies	Age, sex; Income.		Major teaching hospitals; Open-heart surgery facilities; Cardiac catheterization lab/angioplasty facilities; Hospital size, ownership type; Excess capacity.	Plan size; Ability to channel patients.
Dartmouth Atlas Project*	Per-capita Medicare spending by region; End-of-life expenditure.	Standardized Medicare prices	CMI	Age, sex, race, income, education; Urban/rural residence; Employment; Marital status; Supplementary insurance.	Self-reported health; Incident illness (myocardial infarction, hip fracture, colorectal cancer); Comorbid conditions (previous revascularization or MI, congestive heart failure, diabetes, history of angina, peripheral vascular disease, smoker, COPD, other); Functional status, mortality.	Hospital beds and physicians; Teaching hospitals; Medical specialists.	
Zuckerman et al. (2010)	Per-capita Medicare spending	Standardized Medicare prices		Age, sex, race; Urban/rural residence; Income; Supplementary insurance.	Self-reported health status: smoking, body-mass index; Previous diagnosis of diabetes, hypertension, myocardial infarction, coronary heart disease, another heart problem, stroke, or any nonskin cancer; Changes in health status: person died in year, or new diagnosis in listed conditions; Proxy respondent.	Beds and physicians per 1000 elderly persons; % of PCP; Teaching hospital; Medical residents per bed.	
MedPAC (2011)	Per-capita Medicare spending	Medicare wage index; Practice cost indexes.	CMS HCC risk scores	Age and sex	Health status (CMS HCC risk score); disability; institutional status; dual eligibility (enrollment to Part A and B).	Rural; GME, IME, DSH, CAH, and outlier payments.	
Reschovsky et al. (2011)	Medicare service use	Medicare wage index; Medicare relative fee variable.	Hierarchical Coexisting Conditions (HCC) risk-adjustment model variables	Age, sex, race; Imputed income; Dual beneficiary.	Patient qualified as disabled; Changes in patient residence or services in multiple census divisions; Patient long-term institutionalized, or died during following year.	Physician characteristics: race, gender, years in practice, board certified or international graduate. Clinical specialty, inadequate time in office; timely communication and financial incentives; Market characteristics: physicians, hospital beds, and skilled nursing facility beds per resident, percentage of specialists and teaching hospitals beds, home agency and hospice employment, for-profit entities, and rural markets; Care fragmentation and hospital concentration.	Share of revenue from Medicare, Medicaid, Medicare Advantage and capitation.

Sources: Cutler, David M., and Louise Sheiner, "The Geography of Medicare," *American Economic Association Papers and Proceedings*, Vol. 89, No. 2 (1999); Koenig, Lane, Allen Dobson, Silver Ho, Jonathan M. Siegel, David Blumenthal, and Joel S. Weissman, "Estimating the Mission Related Costs of Teaching Hospitals," *Health Affairs*, Vol. 22, No. 6 (2003); "Cost Efficiency at Hospital Facilities in California: a Report Based on Publicly Available Data," Milliman Inc. (October 2007); "Geographic Variation in Health Care Spending," Congressional Budget Office (February 2008); Wu, Vivian Y., "Managed Care's Price Bargaining with Hospitals," *Journal of Health Economics*, Vol. 28 (2009); Zuckerman, Stephen, Timothy Waidmann, Robert Berenson, and Jack Hadley, "Clarifying sources of Geographic Differences in Medicare Spending," *The New England Journal of Medicine*, Special Article (2010); "Regional Variation in Medicare Service Use," Medicare Payment Advisory Commission, Report to the Congress (January 2011); Reschovsky, James D., Jack Hadley, Cynthia B. Saiontz-Martinez, and Ellyn R. Boukus, "Following the Money: Factors Associated with the Cost of Treating High-Cost Medicare Beneficiaries," *Health Services Research* (article online in advance of print - February 2011).

* Dartmouth Atlas Project includes the following studies: Fisher, Elliott S., Julie P. Bynum, and Jonathan S. Skinner, "Slowing the Growth in Health Care Costs – Lessons from Regional Variation" *The New England Journal of Medicine*, Perspective (February 2009); "The Policy Implications of Variations in Medicare Spending Growth," The Dartmouth Atlas of Health Care (2009); Fisher, Elliott S., David E. Wennberg, Therese A. Stukel, Daniel J. Gotlieb, F.L. Lucas, and Etoile L. Pinder, "Implications of Regional Variations in Medicare Spending - Part I" *Annals of Internal Medicine*, Vol. 138, No. 4 (2003); and Fisher, Elliott S., David E. Wennberg, Therese A. Stukel, and Daniel J. Gottlieb, "Variations in The Longitudinal Efficiency of Academic Medical Centers," *Health Affairs* (2004).