Inpatient Care Intensity And Patients' Ratings Of Their Hospital Experiences

What could explain the fact that Americans with chronic illnesses who receive less hospital care report better hospital experiences?

by John E. Wennberg, Kristen Bronner, Jonathan S. Skinner, Elliott S. Fisher, and David C. Goodman

ABSTRACT: The intensity of hospital care provided to chronically ill Medicare patients varies greatly among regions, independent of illness. We examined the associations among hospital care intensity, the technical quality of hospital care, and patients' ratings of their hospital experiences. Greater inpatient care intensity was associated with lower quality scores and lower patient ratings; lower quality scores were associated with lower patient ratings. The common thread linking greater care intensity with lower quality and less favorable patient experiences may be poorly coordinated care. [*Health Affairs* 28, no. 1 (2009): 103–112; 10.1377/hlthaff.28.1.103]

The intensity of acute care hospital use by the chronically ill, measured by days spent in the hospital and inpatient physician visits, varies more than twofold among states and regions.[1] Previous research has shown that Medicare spending is inversely associated with technical quality measures among states and Hospital Referral Regions (HRRs) defined by the *Dartmouth Atlas* project.[2] There is also evidence that per capita use of acute care hospitals may be associated with patients' ratings of their inpatient experiences. In California, patients using hospitals in regions with greater care intensity such as Los Angeles tended to give lower ratings to their hospitals than those using hospitals in regions with more conservative care patterns such as Sacramento.[3]

John Wennberg (john.e.wennberg@dartmouth.edu) is the Peggy Y. Thomson Chair in the Evaluative Clinical Sciences and founder and director emeritus of the Dartmouth Institute for Health Policy and Clinical Practice in Lebanon, New Hampshire. Kristen Bronner is managing editor of the Dartmouth Atlas of Health Care, *produced at the Dartmouth Institute. Jonathan Skinner is the John Sloan Dickey Third-Century Professor in Economics at Dartmouth College in Hanover, New Hampshire. Elliott Fisher is director of the Center for Health Policy Research at the Dartmouth Institute, a professor of community and family medicine at Dartmouth Medical School, and a senior associate in the Veterans Affairs (VA) Outcomes Group in White River Junction, Vermont. David Goodman is a professor of pediatrics and of community and family medicine at Dartmouth Medical School and associate director of the Center for Health Policy Research.*

DOI 10.1377/hlthaff.28.1.103

Recent developments make it possible to study these relationships more closely. On 28 March 2008 the Centers for Medicare and Medicaid Services (CMS) posted on its Hospital Compare Web site the first results of a national survey of the patient experience: the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS).[4] By linking the results of HCAHPS and measures of technical process quality, also available on the CMS Web site, with data from the *Dartmouth Atlas of Health Care*, we have been able to test two related hypotheses raised by previous studies. The first is that patients living in regions with more-aggressive patterns of inpatient care tend to rate their inpatient experiences less favorably. The second is that patients' ratings of their hospitals and objective measures of technical quality are positively correlated. In this paper we first describe the variations in hospital care intensity and the distribution of patients' rating scores of hospitals located in the 306 HRRs, thus providing a national test of our first hypothesis. We then test our second hypothesis by comparing patients' experiences with measures of objective process quality, again at the HRR level.

Methods And Approaches

■ **Survey questions.** The HCAHPS survey asked a sample of patients recently discharged from a participating hospital eighteen questions about key aspects of their hospitalizations.[5] Based on these questions, the CMS posted ten measures of patient experience on its Hospital Compare Web site: how well nurses communicated; how well doctors communicated; how responsive the hospital staff was to patients' needs; how well staff helped patients manage pain; whether they provided pertinent information on postdischarge care; whether staff explained medications to patients before administering them; whether rooms were clean; whether rooms were quiet at night; whether the patient would recommend the hospital to family and friends; and how they rated the hospital on a scale of 0 to 10.

■ **Rating methods.** This study focuses primarily on the last question: the global rating patients gave to their hospital experience (but which, as we show, is highly correlated to the other HCAHPS measures). Hospitals were evaluated by the CMS according to the percentage of discharged patients who gave the hospital a "high" rating (a score of 9 or 10); a "medium" rating (a score of 7 or 8); or a "low" rating (6 or lower). The percentage of patients who gave their hospital a high rating ranged from 12 percent to 94 percent; the percentage giving a medium rating, from 5 percent to 54 percent; and the percentage giving a low rating, from 0 percent to 75 percent. For this study, we aggregated the rating scores of individual hospitals to provide weighted average estimates for the hospitals located in each region, with the weight reflecting each hospital's total discharges for 2006.

■ **Sample of patients and hospitals.** The survey was administered forty-eight hours to six weeks after discharge to a random sample of patients across medical conditions. The 28 March CMS release was for a random sample of patients hospitalized between October 2006 and June 2007 in 2,517 U.S. hospitals, who had agreed

to participate in the survey. The sample included 2,473 acute general hospitals, or 53.9 percent of the 4,584 acute general hospitals listed as active in 2006 by the American Hospital Association (AHA). According to AHA data, reporting hospitals accounted for 74.4 percent of discharges to U.S. acute general hospitals in 2006. Although the CMS does not post the number of patients interviewed at each hospital, it does report the distribution according to three groups: the results are based on fewer than 100 interviews in only 78 reporting hospitals (3.2 percent); in 531 (21.5 percent), the results are based on 100–299 patient surveys; and in 1,864 (75.4 percent), they are based on a sample of 300 patients or more.

■ **Technical quality measures.** The hospitals' technical quality measures were also taken from data posted on Hospital Compare for 2005. Three summary scores were calculated: one for five measures of the management of acute myocardial infarction (AMI); a second for two congestive heart failure (CHF) measures; and a third for three pneumonia measures. In addition, we calculated a composite score, which is the weighted average of the three condition-specific summary scores, where the weights depend on the number of responses for each category.[6]

■ **Measures of hospital care intensity.** Acute hospital care intensity measures are for chronically ill Medicare patients with one or more of nine chronic illnesses, using the methodology of follow-back from death, reported previously.[7] We used a summary measure of inpatient care intensity, which reflects the regional propensity to rely on the acute care hospital in managing chronic illness over the last two years of life: the hospital care intensity (HCI) index. The HCI index reflects both the amount of time spent in the hospital and the intensity of physician intervention during hospitalization. It is based on two variables: the number of days spent in the hospital and the number of inpatient physician visits patients experienced. For each variable, the ratio to the national average was calculated, and the index was calculated as the simple average of the two ratios. Because the HCI index relies on national weights assigned to HRR-level utilization measures, it avoids potential bias in comparing per capita Medicare spending rates in high- and low-cost regions (for example, New York City versus Enid, Oklahoma), where Medicare diagnosis-related groups (DRGs) and physician reimbursement rates may vary.

Other measures of intensity include per capita Medicare spending, physician labor and bed input, and terminal care intensity among regions. As reported previously, full-time-equivalent (FTE) labor inputs are measured over patients' last two years of life for all physicians, medical specialists, and primary care physicians (PCPs).[8] The mix between PCPs and medical specialists is evaluated as the ratio of FTE inputs of PCPs to specialists. Terminal care measures include patient days spent in the hospital during the last six months of life; inpatient visits during the last six months of life; and the percentage of deaths occurring during a hospitalization that included admission to an intensive care unit (ICU).

■ **Data source and methods.** Data for regions are for a 20 percent sample of patients who were residents of a given geographic area at the date of death and include

all patients who had one or more of the nine chronic illnesses, whether or not they were hospitalized. (The diagnoses for nonhospitalized patients were identified using the 20 percent sample of physician claims.)

All measures are adjusted for age, sex, race, and the types and number of chronic illnesses patients had. The *Dartmouth Atlas* data used here are for deaths occurring in 2001–2005 and are posted on the *Dartmouth Atlas* Web site.[9] The relationships among measures of technical process quality, HCAHPS patient reports, care intensity, and measures of labor input were examined using product-moment correlation analysis. Analyses were conducted at the state, region, and hospital-specific levels of aggregation. The direction of the associations was consistent for each level of aggregation. The results reported below are for HRRs.

Study Results

■ **Variation in hospital care intensity.** We found a fourfold variation in the HCI index among the 306 HRRs (Exhibit 1). Residents of the Newark region were at the top of the scale, with an HCI index about 90 percent greater than the national average; Chicago was 45 percent above and Pittsburgh was 25 percent above the national average; Cleveland was at the national average; Denver was 25 percent below and Salt Lake City was 49 percent below the national average. Exhibit 1 shows the location on the conservative-aggressive spectrum of care for selected, mostly larger urban regions across the United States. For example, Los Angeles, Miami, and Manhattan ranked near the top, with an HCI index that was greater than Chicago's; Minneapolis, Sacramento, Rochester, Minnesota (the region dominated by the Mayo Clinic), Seattle, and Portland ranked below Denver. Only eight of the 306 HRRs ranked lower than Salt Lake City on the HCI index. During their last two years of life, residents living in Newark and Los Angeles spent, on average, 33.1 and 28.0 days in the hospital, respectively, and averaged 75.9 and 76.9 inpatient physician visits; those in Portland and Salt Lake City averaged 12.2 and 11.6 days in the hospital and had 16.3 and 15.4 visits, respectively.

■ **Correlation of care intensity with patients' ratings.** Exhibit 2 confirms our hypothesis that patients living in regions with more aggressive patterns of inpatient care tend to rate their inpatient experiences less favorably. It looks at practice patterns in regions that rank in the highest, median, and lowest quintiles on the HCI score. Each group contains about 20 percent of the U.S. population. Among the regions with high HCI scores, per capita spending in the last two years of life was 59 percent higher than for similar patients living in regions with low HCI scores and 34 percent higher than the median quintile. Resource inputs were strikingly greater in the highest quintile, with physician labor input 78 percent higher (and that of medical specialists, 135 percent higher) than the lowest quintile, with similar results for acute care hospital beds. Terminal care in high-HCI regions was much more aggressive, with twice as many beneficiaries seeing ten or more physicians and 63 percent more experiencing death in association with an intensive care episode.

EXHIBIT 1
Distribution Of The Hospital Care Intensity (HCI) Index Among Selected Hospital Referral Regions (HRRs)

HCI range/HRR	HCI score	Hospital days	Inpatient visits
1.40 to 1.92			
Newark, NJ	1.92	33.1	75.9
Los Angeles, CA	1.80	28.0	76.9
Miami, FL	1.78	29.0	73.4
Manhattan, NY	1.69	34.9	56.6
Chicago, IL	1.45	26.3	55.2
New Orleans, LA	1.44	23.1	60.3
Philadelphia, PA	1.40	24.8	54.4
1.20 to 1.39			
Houston, TX	1.38	21.9	58.3
Fort Lauderdale, FL	1.35	22.0	55.7
Las Vegas, NV	1.35	21.1	57.1
Memphis, TN	1.32	23.8	50.3
Detroit, MI	1.28	23.1	49.0
Pittsburgh, PA	1.25	22.4	48.0
Tampa, FL	1.24	20.2	51.1
1.00 to 1.19			
Jackson, MS	1.16	24.5	37.6
San Antonio, TX	1.09	20.5	40.2
Washington, DC	1.07	21.1	37.6
Kansas City, MO	1.05	19.5	39.2
Dallas, TX	1.04	19.5	38.2
St. Louis, MO	1.01	20.5	34.7
Cleveland, OH	1.00	19.3	35.7
0.80 to 0.99			
Boston, MA	0.99	20.0	34.0
San Francisco, CA	0.96	18.7	34.5
Nashville, TN	0.95	20.4	30.4
Atlanta, GA	0.92	18.5	31.9
Milwaukee, WI	0.91	18.3	31.4
Columbus, OH	0.84	17.3	28.5
Phoenix, AZ	0.80	15.1	29.7
0.48 to 0.79			
Denver, CO	0.74	14.6	26.3
Minneapolis, MN	0.71	15.3	23.0
Sacramento, CA	0.71	15.1	22.9
Rochester, MN	0.64	14.9	18.6
Seattle, WA	0.64	13.7	20.2
Portland, OR	0.54	12.2	16.3
Salt Lake City, UT	0.51	11.6	15.4

SOURCE: Authors' analysis of Medicare data.
NOTES: Association between HCI index and patients' experiences of inpatient care. Hospital days and visits are per beneficiary in the last two years of life.

Exhibit 2 also displays patients' hospital ratings, aggregated up to the HRR level. A pattern emerges: patients living in regions with higher per capita Medicare spending and greater amounts of physician labor and hospital beds, and

EXHIBIT 2
Practice Patterns In Managing Chronic Illness During The Last Two Years Of Life And Patients' Ratings Of Hospital Experiences In Regions By Quintile Rank On The Hospital Care Intensity (HCI) Index

	HCI quintile			
	Lowest	**Median**	**Highest**	**(Ratio H/L)**
HCI index score	0.67	0.96	1.46	(2.17)
Resource inputs during the last two years of life				
Medicare spending per decedent	$38,296	$45,385	$60,798	(1.59)
Physician labor inputs per 1,000 decedents				
All physicians	16.6	20.5	29.5	(1.78)
Medical specialists (MS)	5.6	7.8	13.1	(2.35)
Primary care (PC) physicians	7.4	8.6	11.5	(1.55)
Ratio PC/MS	1.34	1.10	0.88	(0.66)
Hospital bed inputs per 1,000 decedents	40.0	53.4	70.8	(1.77)
Terminal care				
Percent seeing 10 or more MDs during last six months of life	20.2%	30.0%	43.7%	(2.16)
Percent of deaths with intensive care unit admission	14.3	18.9	23.2	(1.63)
Percent enrolled in hospice during last six months of life	30.1	31.7	30.2	(1.00)
Patients' evaluations of hospital experiences (percent of patients who gave negative rating)				
Patients who gave a rating of 6 or lower	9.3%	10.8%	13.9%	(1.49)
Patients probably or definitely would not recommend the hospital	4.7	5.9	8.2	(1.74)
Doctors sometimes or never communicated well	4.6	5.1	6.6	(1.42)
Nurses sometimes or never communicated well	5.2	6.4	8.9	(1.72)
Pain was sometimes or never well controlled	7.0	8.3	10.4	(1.48)
Patients sometimes or never received help as soon as they wanted	10.9	13.9	18.3	(1.68)
Staff sometimes or never explained medicines before giving them to patients	22.1	24.7	28.4	(1.29)
Room was sometimes or never clean	10.3	12.7	13.8	(1.34)
Sometimes or never quiet at night	15.0	15.4	19.1	(1.28)
Staff did not give patients information about what to do during recovery at home	18.5	20.9	25.0	(1.35)

SOURCE: Authors' analysis of Medicare data.
NOTES: Association between low global rating by patients of hospital experiences and technical quality scores.

where patients with chronic illnesses were treated more aggressively, were more likely than those in regions with less care to give their hospitals a low rating. The tendency is seen even in regions that used more PCPs. However, in regions where primary care tended to dominate—as measured by the ratio of PCPs to medical specialists—patients were less inclined to give their hospitals a negative rating.

■ **Correlations between HCI index and HCAHPS ratings.** We also looked at the correlations between the HCI index and HCAHPS ratings among the 306 HRRs. The proportion of patients giving their hospital a low global rating of 6 or less on the 0–10 scale ranged from 3.8 percent to 29.8 percent of the sample of patients. The correlation coefficient between the proportion of patients reporting a negative rating and the HCI index was 0.51 ($p < 0.001$). The percentage of patients reporting a negative experience was positively correlated with HCI in all categories of the HCAHPS

survey listed in Exhibit 2, with correlation coefficients significant at $p < 0.001$.

■ **Relationship of patients' ratings to technical quality measures.** We also found evidence to support our second hypothesis: that patients' ratings of their hospitals and objective measures of technical quality are correlated. Among regions, hospitals with lower overall ratings by their patients also tended to have lower quality measures. The correlation coefficient among the 306 regions between the percentage of patients giving their hospitals a negative global rating and the CMS "Compare" composite quality score was −0.40 ($p < 0.001$). Considering each of the disease categories separately, the correlation between patients' ratings of their hospital and summary quality measures was −0.37 ($p < 0.001$) for heart attack patients; −0.41 ($p < 0.001$) for pneumonia patients; and −0.15 ($p = 0.007$) for CHF patients. The association between the composite quality score and the HCI index on global ratings of hospitals was tested in a multiple regression that showed independent effects of each variable on the likelihood of a negative global rating.[10]

Discussion

Patients hospitalized in regions with greater inpatient care intensity tend to rate their hospitals unfavorably and are more dissatisfied with their hospital experiences for tangible reasons—dirty rooms, noisy nighttime, poor pain control, and shortfalls in communication with doctors and nurses. These phenomena, when interpreted in the light of research showing that illness- and severity-adjusted mortality is higher in regions with greater use of acute care hospitals, are consistent with the view that patterns of practice in regions with greater use of acute care hospitals by the chronically ill exhibit considerable inefficiency, in the sense of using more resources to achieve no better, or even worse, outcomes.[11]

What could explain the fact that Americans with chronic illnesses who receive less hospital care report better personal experiences while in the hospital? Most of the HCAHPS evaluations are concerned with the coordination of care and communication with patients. But the profile of practice patterns in Exhibit 2 suggests that the reason for poor communication and care coordination is not simply that there are not enough physicians. Quite the opposite: regions with conservative use of inpatient care and happier patients use less physician labor in managing chronic illnesses as measured by FTE labor input, a standardized measure of the quantity of physician resources used in managing cohorts of patients. This is true for PCPs as well as medical specialists.

One variable associated with lower intensity and greater patient satisfaction is the mix between primary care and medical specialists. Regions where primary care dominates tend to be more conservative in the use of acute care hospitals. This suggests that the interactions (communication and care coordination) between PCPs and medical specialists in markets where primary care dominates may be an important factor in promoting conservative care. The number of physicians involved in caring for a patient may matter in influencing the patient's expe-

rience. If having too many physicians leads to disorganized care and duplication of services, this may provide an explanation not only for the poorer performance on technical quality measures, but also for the association between the percentage of patients seeing ten or more physicians and a negative hospital rating.[12] Indeed, a survey of physicians found that those in higher-spending regions were more likely than those in regions with less care to report that both the continuity of care with their patients and the quality of communication among physicians were inadequate to support high-quality care.[13]

The way medical practice is organized may also matter: health care in many of the regions ranked in the lowest quintile on the HCI index is dominated by large group practices or organized hospital systems. Minneapolis, Sacramento, Seattle, Portland, and Salt Lake City, which rank in the lowest quintile on the HCI index, are examples of such HRRs. Well-established large group practices are also prevalent in other regions with low HCI scores, including the Mayo Clinic (Rochester, Minnesota, and LaCrosse, Wisconsin), the Geisinger Clinic (Danville, Pennsylvania), the Billings Clinic (Billings, Montana), the Marshfield Clinic (Marshfield, Wisconsin), the Duluth Clinic (Duluth, Minnesota), Scott and White Clinic (Temple, Texas), the Dartmouth-Hitchcock Clinic (Lebanon, New Hampshire), the University of Iowa Clinic (Iowa City) and the University of Wisconsin Clinics and Dean Stoughton Clinic (Madison). With a few exceptions (for example, Henry Ford in Detroit and the Ochsner Clinic in New Orleans), large group practices are notably absent in regions with higher HCI scores.

Our study uncovered an intriguing relationship between the CMS measures for inpatient technical process quality (ITQ) and the CMS measures reporting patients' experiences with inpatient care. But why should these two dimensions of care quality be correlated, since events that go into the hospital's ITQ score are generally unobservable by patients? The correlation between ITQ and HCAHPS suggests an overlapping causal pathway, which we suspect is the general idea of "care coordination," a dimension along which patient satisfaction and performance on ITQ measures may be aligned.[14] The relationships between these two dimensions of quality deserve further investigation.

■ **Study limitations.** Several limitations need to be discussed. The first concerns possible bias because of nonreporting hospitals. The 28 March CMS release of the HCAHPS survey included data on 2,473 acute general hospitals, which accounted for 74.4 percent of discharges to U.S. acute general hospitals; three HRRs had no reporting hospitals. We tested the effect of reporting bias by studying the association between HCI index and HCAHPS results on subgroups of regions with high reporting percentages (90 percent or more of hospitals in the region: N = 90) and low reporting (less than 90 percent: N = 217); results were essentially the same.

A related concern is nonresponse bias; for some hospitals, fewer than 30 percent of patients responded to the HCAHPS survey. In theory, such biases could affect our results, because regions with the highest response rates also tended to

have the greatest levels of satisfaction with their hospitals. However, even when the HRRs were stratified according to the likelihood of response (40 percent, 35–39.9 percent, 30–34.9 percent, and ≤30 percent), the strong correlation between the HCI index and patient satisfaction was replicated with $p < 0.01$ for all categories except for the 30–34.9 percent category ($p = 0.086$).

Second, because the CMS does not report patient-level data for HCAHPS, we could not compute standard errors for rates. However, 96.8 percent of hospital estimates are based on a sample of 100 or more patients, and, when data are aggregated to the regional level, imprecision of estimates is not an important factor.

Third, it can be argued that the proper level of aggregation for our study is the hospital. For many hospitals, however, the 20 percent sample of physician claims is too small to develop statistically stable measures of utilization, given the relatively small number of decedents with chronic illnesses assigned to each hospital. As well, it can be problematic in some cases to assign decedents to a specific hospital. By contrast, there is much less ambiguity about assigning patients to the set of regional hospitals in the HRR. In addition, average intensity is measured precisely, given the very large sample sizes for HRRs.

Finally, one might object to the use of "look-back" measures of utilization for patients in the last six months of life.[15] The most important objection to such measures—that they inadequately reflect differences in disease severity—is addressed by adjusting for differences across regions in the prevalence of specific chronic diseases (these adjustments do not greatly affect the results). Furthermore, variation in care during the last six months of life is highly correlated with variation during previous periods in the progression of chronic illness; thus, the HCI index locates regions along a spectrum of reliance on acute hospitals in treating patients with progressing chronic illnesses, not just those in the terminal phase.

■ **Conclusion.** The percentage of patients who rate their hospitals poorly and give low scores on other measures of the patient experience is directly correlated with the overall intensity of inpatient experience, higher Medicare spending, greater resource use, and more end-of-life care. This should be interpreted in light of evidence that greater care intensity is associated with possibly worse outcomes. Our study suggests that efforts to encourage better coordination of care, rather than simply training more physicians or spending more money, holds the key to future health care reform.[16]

The authors gratefully acknowledge the support of the Robert Wood Johnson Foundation (Grant nos. 059491 and 056970), the National Institute on Aging (NIA) (Grant no. 2P01AG019783), and the Dartmouth Atlas *Collaborative. The authors thank Martha M. Smith for editorial assistance.*

NOTES

1. J.E. Wennberg et al., *Tracking the Care of Patients with Severe Chronic Illness: The Dartmouth Atlas of Health Care 2008* (Lebanon, N.H.: Dartmouth Institute for Health Policy and Clinical Practice, 2008).
2. K. Baicker and A. Chandra, "Medicare Spending, the Physician Workforce, and Beneficiaries' Quality of Care," *Health Affairs* 23 (2004): w184–w197 (published online 7 April 2004; 10.1377/hlthaff.w4.184).
3. J.E. Wennberg et al., "Evaluating the Efficiency of California Providers in Caring for Patients with Chronic Illnesses," *Health Affairs* 24 (2005): w526–w543 (published online 16 November 2005; 10.1377/hlthaff.w5.526); and L.C. Baker, E.S. Fisher, and J.E. Wennberg, "Variations in Hospital Resource Use for Medicare and Privately Insured Populations in California," *Health Affairs* 27, no. 2 (2008): w123–w134 (published online 12 February 2008; 10.1377/hlthaff.27.2.w123).
4. See U.S. Department of Health and Human Services, *Hospital Compare—A Quality Tool for Adults, Including People with Medicare*, http://www.hospitalcompare.hhs.gov (accessed 22 October 2008).
5. For the methodology, see ibid.
6. The five performance measures for AMI are the percentage of eligible patients receiving (1) aspirin at time of admission; (2) aspirin at time of discharge; (3) angiotensin-converting enzyme (ACE) inhibitor for left ventricular dysfunction; (4) beta-blocker at admission; and (5) beta-blocker at discharge. The two CHF measures are the percentage of patients with (1) assessment of left ventricular function, and (2) ACE inhibitor for left ventricular dysfunction. For pneumonia, the three measures are the percentage of patients with (1) oxygenation assessment; (2) pneumococcal vaccination; and (3) timing of initial antibiotic therapy. The summary scores are equally weight-averaged for the items in each category. Hospital-specific summary scores are given only for those hospitals for which four of the five AMI measures and all of the CHF and pneumonia measures were based on twenty-five or more patients. See A.K. Jha et al., "Care in U.S. Hospitals—The Hospital Quality Alliance Program," *New England Journal of Medicine* 353, no. 3 (2005): 265–274.
7. The conditions, which include malignant cancer/leukemia, CHF, chronic pulmonary disease, dementia, diabetes with end organ damage, peripheral vascular disease, chronic renal failure, severe chronic liver disease, and coronary artery disease, are based on L.I. Iezzoni et al., "Chronic Conditions and Risk of In-Hospital Death," *Health Services Research* 29, no. 4 (1994): 435–460. For the follow-back methodology, see Wennberg et al., "Evaluating the Efficiency of California Providers."
8. Wennberg et al., *Tracking the Care of Patients.*
9. See the *Dartmouth Atlas* Web site, http://www.dartmouthatlas.org.
10. The regression was run at the HRR level; the dependent variable (Y) was the percentage of patients reporting a low global rating (6 or less on 0–10 scale). The independent variables were the composite quality score and HCI index. With just quality in the regression, the results were as follows: $Y = 45 - 0.39 \times$ quality variable ($R^2 = 0.16$; $N = 302$; t-statistic in parenthesis for the coefficient on quality = 7.7). Including both quality and the HCI index yielded the following: $Y = 30 - 0.28 \times$ quality variable $+ 5.4 \times$ HCI index ($R^2 = 0.33$; t-statistics for quality and HCI = 5.8 and 8.8, respectively). Thus, the perception of hospital quality by patients is associated independently with both process quality and the HCI index.
11. E.S. Fisher et al., "The Implications of Regional Variations in Medicare Spending, Part 1: Utilization of Services and the Quality of Care," *Annals of Internal Medicine* 138, no. 4 (2003): 273–287; and E.S. Fisher et al., "The Implications of Regional Variations in Medicare Spending, Part 2: Health Outcomes and Satisfaction with Care," *Annals of Internal Medicine* 138, no. 4 (2003): 288–298.
12. See G.S. Becker and K.M. Murphy, "The Division of Labor, Coordination Costs, and Knowledge," *Quarterly Journal of Economics* 107, no. 4 (1992): 1137–1160.
13. B.E. Sirovich et al., "Regional Variations in Health Care Intensity and Physician Perceptions of Quality of Care," *Annals of Internal Medicine* 144, no. 9 (2006): 641–649.
14. For a review of the dimensions of care coordination, see T. Bodenheimer, "Coordinating Care—A Perilous Journey through the Health Care System," *New England Journal of Medicine* 358, no. 10 (2008): 1064–1071.
15. See P.B. Bach, D. Schrag, and C.B. Begg, "Resurrecting Treatment Histories of Dead Patients: A Study Design That Should Be Laid to Rest," *Journal of the American Medical Association* 292, no. 22 (2004): 2765–2770.
16. J.E. Wennberg et al., "Extending the P4P Agenda, Part 2: How Medicare Can Reduce Waste and Improve the Care of the Chronically Ill," *Health Affairs* 26, no. 6 (2007): 1575–1585; and E.S. Fisher et al., "Creating Accountable Care Organizations: The Extended Medical Staff," *Health Affairs* 26, no. 1 (2007): w44–w57 (published online 5 December 2006; 10.1377/hlthaff.26.1.w44).