

RESEARCH SYNTHESIS REPORT NO. 6  
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# Geographic variation in Medicare per capita spending: Should policy-makers be concerned?

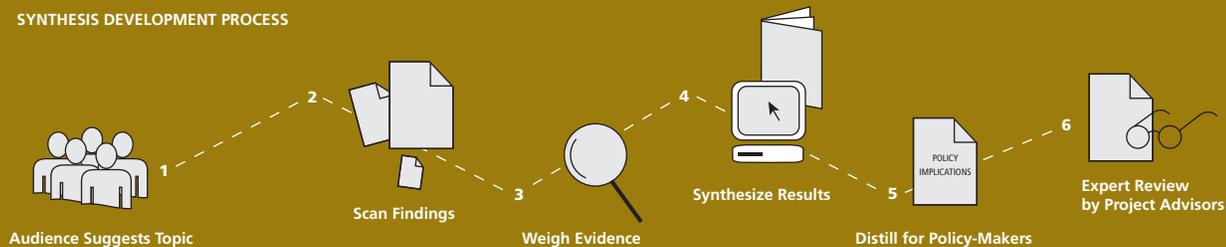
Also see companion Policy Brief available at [www.policysynthesis.org](http://www.policysynthesis.org)

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**THE SYNTHESIS PROJECT** (Synthesis) is an initiative of The Robert Wood Johnson Foundation to produce relevant, concise, and thought-provoking briefs and reports on today's important health policy issues. By synthesizing what is known, while weighing the strength of findings and exposing gaps in knowledge, Synthesis products give decision-makers reliable information and new insights to inform complex policy decisions. For more information about the Synthesis Project, visit the Synthesis Project's Web site at [www.policysynthesis.org](http://www.policysynthesis.org). For additional copies of Synthesis products, please go to the Project's Web site or send an e-mail request to [pubsrequest@rwjf.org](mailto:pubsrequest@rwjf.org).

### SYNTHESIS DEVELOPMENT PROCESS



# Introduction

In contrast to Medicare’s nationwide uniformity in eligibility and benefits, per capita Medicare spending varies geographically. Policy-makers are concerned about this variation as it leads to the sense that some “win”—receiving more services, higher revenues or better benefits—and some “lose,” and because it raises questions about the appropriateness and efficiency of the care received. This synthesis examines the research on geographic differences in Medicare per capita spending in order to help policy-makers understand the issue and consider whether and how they might respond.

The synthesis focuses on variation in Medicare spending for three reasons. First, there is a unique federal responsibility for the program. Second, Medicare beneficiaries account for a substantial share of national health care spending. Third, data are available on variation in spending for Medicare, while they are not for other populations. But although we focus on Medicare, many of the same issues are relevant to other programs and populations.<sup>1</sup>

## The synthesis examines recent research on four key policy-relevant questions:

1. Does Medicare spending vary geographically?
2. How much of the variation is due to differences in population mix and prices across areas?
3. What explains the geographic variation in spending that remains after adjusting for population and price differences?
4. Do people in higher spending areas receive better care (i.e., higher quality, better access)?

The synthesis focuses on findings from peer-reviewed medical and health services research studies published between 1999 and mid-2003, as well as related reports from agencies charged with advising Congress on these issues. We also include two older “classic” studies addressing the link between care and quality. All of the studies assign Medicare spending to the location where beneficiaries reside, not where care was received.<sup>2</sup> Such an adjustment is crucial because many people cross state or area borders to seek care (17).<sup>3,4</sup> Relevant research draws on national databases that include detailed information on use of services and spending by Medicare beneficiaries in the traditional (fee-for-service) program.

The studies examine components of geographic differences in spending (Figure 1), which include the characteristics of the population and their health care needs, the price of services that may vary across areas, and differences in the quantity and mix of services used, which are influenced by patients, providers and other factors. Some of these factors are more amenable to policy intervention than others.

# Introduction

Figure 1. Components of per capita Medicare spending and factors influencing them

Components of per capita spending	Factors influencing them	Comment
<b>Population characteristics and need.</b>	Age, sex, health and disability status.	These variables tend to be fixed and generally immutable.
<b>Price</b> (payment unit, rate, any explicit or implicit subsidy to achieve valued goals).	<p>Medicare-administered prices are a product of the specific methods used to calculate price for each service, the way adjustments are made across areas, the units of payment, techniques for updating payment annually and adjustments for health status and risk.</p> <p>Congress historically has modified payment to achieve valued national goals (e.g., financing of graduate medical education, funding for providers serving the poor, subsidies for providers in rural or underserved areas).</p>	<p>Policies in this area tend to be under the control of policy-makers but threats of decreased provider participation may constrain ability to change pricing policy. Provider responses to prices take into account prices paid by other insurers and the providers' dependence on Medicare.</p> <p>While authorized subsidies can be changed by legislation, there is strong interest in maintaining many of them.</p>
<b>Volume of services</b> (number, mix, setting of care, intensity, practice patterns).	<p>Supply (available services and capacity).</p> <p>Local standards of care and provider preferences.</p> <p>Provider education, professional training and norms for appropriateness.</p> <p>Financial incentives of payment policy that influence provider practices and care recommendations.</p> <p>Patient demand and propensity to use (reaction to advertising, individual preferences, norms and expectations).</p>	<p>Effective policy in this area is constrained by the limited consensus on what care is appropriate and the challenges in changing provider behavior to match practice norms. While Medicare policy can have some influence, broader social intervention may be needed.</p>

Source: Gold, 2004

Figure 2 lists the major studies included in the synthesis, the general approach taken by them and which of the research questions they target. For ease of presentation, we combine papers that relate to a single body of work published in different places. In general, studies use one of two primary approaches: descriptive analyses that employ methods for studying small area variation (some do this more rigorously than others) or multivariate analyses to adjust data for certain factors or identify significant sources of variation. Some of the studies on the relationship between variation and quality of care incorporate clinical assessment based on medical records review, in addition to claims data. In summarizing findings, we give more emphasis to the studies using the most rigorous analyses. See Appendix III for a more detailed summary of included studies.

# Introduction

Figure 2. Overview of relevant studies

Author/paper reference	Dominant approach	Time period for data	Aggregate spending variation	Variation adjusted for price and population	Other determinants of variation	Relationship between spending and quality
MedPAC 2003, 2002	Descriptive analysis	2000	✓	✓	✓	✓
Wennberg et al. 1999, 2002; Skinner et al. 2001	Descriptive analysis	1995–96	✓	✓	✓	✓
Fuchs et al. 2001, 2003	Multivariate analysis	1990		✓	✓	✓
Gage et al. 1999	Descriptive analysis	1995	✓		✓	✓
Cutler & Sheiner 1999	Multivariate analysis	1995		✓	✓	✓
Baker et al. 1999	Multivariate analysis	1990–94	✓		✓	
Fisher et al. 2003 1, 2	Clinical assessment	1993–95				✓
Chassin et al. 1987; Leape 1990	Clinical assessment	1981		✓		✓
Fisher et al. 2000	Multivariate analysis	1989–90			✓	
Silverman et al. 1999	Multivariate analysis	1989 1992 1995			✓	✓

Source: Gold, 2004

# Findings

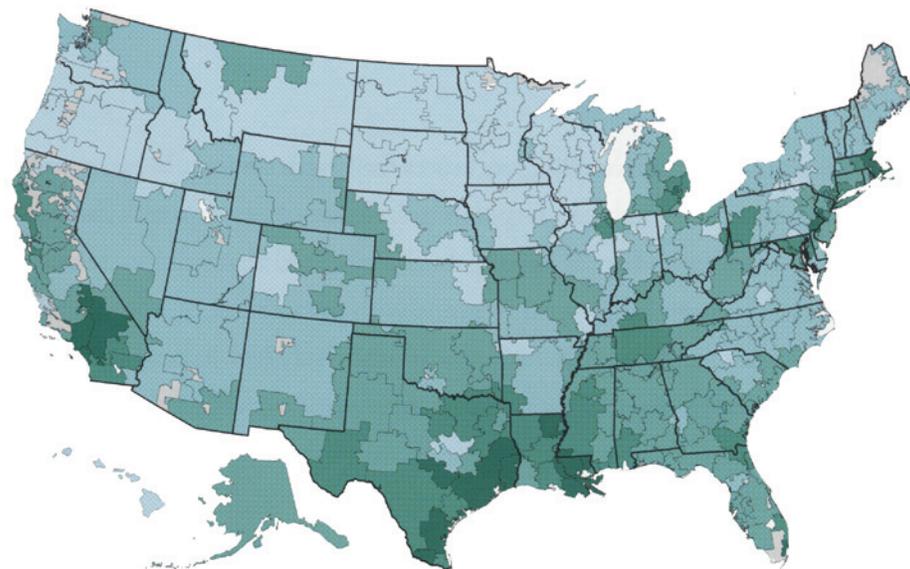
## Does Medicare spending vary geographically?

**Yes.** Research shows that Medicare per capita spending varies widely and persistently across geographic areas however they are defined (6, 14, 17, 20).

**Per capita Medicare expenditures vary almost three-fold between the highest and lowest spending areas.** Perhaps the best known study on this issue, by Wennberg et al. (20), found that the mean Medicare expenditure per capita in 1996 was \$4,993, but that spending ranged from a high of \$8,500 to a low of \$3,000 across hospital referral areas. These extremes reflect substantial variation across the nation. Of the 306 defined hospital referral regions across the country, for example, 56 had spending that was 25 percent or more below the national average and 19 had spending that was 30 percent or more above the national average. Only 104 of the 306 regions were within 10 percent of the average (Figure 3).

**Clear regional patterns exist in unadjusted Medicare spending;** Southern California, East Texas and Louisiana, the Boston area, and selected other East Coast markets, for example, had substantially higher spending levels than the Upper Midwest, Montana, and Oregon. Further, regions high in one type of spending such as inpatient hospital care tend to be high in others like physician and hospital outpatient services or home health, indicating that geographic variation has a consistency that cannot be explained solely by substitution of some services for others in different areas of the country.

Figure 3. Unadjusted Medicare spending per beneficiary, 1996



Ratio of rates of unadjusted reimbursements for noncapitated Medicare to the U.S. average by hospital referral region (1996)

1.30 to 1.73	(19)
1.10 to < 1.30	(43)
0.90 to < 1.10	(104)
0.75 to < 0.90	(84)
0.56 to < 0.75	(56)
Not populated	

Source: Dartmouth Atlas of Health Care, 1999

## Findings

### How much of the variation is due to differences in population mix and prices across areas?

**In general, studies find that less than half the variation in spending across areas is explained by population mix and differences in the price of individual services.** Differences in the amount and types of care used, rather than population characteristics and prices, are responsible for much of the variation in spending. Because research methods vary, estimates of how much price contributes to variations in spending differ. Studies agree, however, that substantial variation in spending occurs across areas, even when prices are held constant.

**Comparisons of spending across areas require adjustments for population characteristics and some types of price variation.** To generate appropriate comparisons among areas, researchers must adjust data for local differences that are not under the control of the delivery system, such as population characteristics including age, sex, health status and price differences that result from differences in wage levels across areas.

The need for health care varies with the characteristics of the population. Among children, for example, the average use of health services is high at birth but declines rapidly as children age. For adults, spending (other than for pregnancy) starts out relatively low and then begins to increase in middle age, and this acceleration continues. Among elderly beneficiaries, spending increases with age but varies substantially even for beneficiaries of the same age. To account for this phenomenon, analyses of geographic differences in spending typically adjust for differences in population characteristics. The most common adjustments are for age and sex, although some researchers go beyond this to adjust for measures of health status. In the most current version of the Dartmouth Atlas of Health Care (20), for example, adjustments are made for age, sex, race (where available) and an illness-based measure of health status. That measure is derived from an index that includes information on mortality and rates of coronary artery disease, stroke and selected other illnesses.

Price per unit of care also differs across areas and contributes to differences in spending per capita. Differences in price combine differences in the cost of “inputs” that are largely beyond the control of providers (e.g., local area wage rates, liability coverage) and other factors that affect pricing, such as differences in the supply of providers across areas, which influence their ability to select patients and set higher prices for services. While Medicare’s payment policy adjusts for differences in input prices across areas (17), and has increasingly encouraged uniform national pricing other than for such adjustments, some variation in pricing persists. Analysts disagree on whether or not such differences ought to be removed before comparisons are made. Removing them shifts the focus of the comparison from overall cost variation to variation in the use of services and mix of care received. Some studies focus primarily on those causes of variation, while others focus more broadly on all causes of spending variation.

In addition, some geographic variation in Medicare payments reflects specific policy objectives. Medicare makes higher payments to selected rural providers, for example, in order to promote access to care. The program also authorizes increased payments to particular providers such as disproportionate share or teaching hospitals to compensate them for the costs of providing care to the uninsured or graduate medical education. Because those price differentials are based on Medicare policy, many researchers adjust estimates of spending to eliminate their effects when making comparisons.

## Findings

**Comparing study results is difficult.** Researchers use different methods to make demographic and price adjustments (Figure 4). Wennberg and colleagues (20) adjust for variation in area cost of living as measured by price indices of labor and practice costs. The Medicare Payment Advisory Commission (MedPAC) (17) uses a similar approach but directly incorporates the input price adjusters used in setting Medicare payments. MedPAC also makes the most extensive adjustments for the way Medicare uses pricing policy to achieve other goals (e.g., graduate medical education). Fuchs et al. (12) use the opposite approach, beginning with data on service use and weighting it by standardized national prices to develop indices of variation that account for the mix of care received. Cutler and Sheiner (8), in contrast, use a multivariate model that generates regression-based estimates of the contribution of diverse variables to differences in spending.

**Most studies do not measure the independent contributions of population and price to variation.** Ideally, one would like to be able to separate out the contribution of population and price to variation in spending across areas, because the policy implications of the two are not the same. Unfortunately, published estimates often do not show how much each independently contributes. We therefore do not attempt to do so here.

*Figure 4. Understanding why estimates differ across studies*

Because the timeframes, measures and methods used in different studies are not consistent, specific estimates and findings differ across studies. For example, while both Gage et al. (14) and MedPAC (17) report variation in Medicare per capita spending at the state level, MedPAC weights its estimates by the size of the Medicare population in each state, whereas Gage et al. and most other researchers give each state or area the same weight in their analysis. Adjusting for population appears to lead to estimates that show less variation in spending across the country, though differences are still substantial. MedPAC estimates, for example, that 69 percent of the Medicare population is in states where per capita fee-for-service spending is within 15 percent (plus or minus) of the national average.

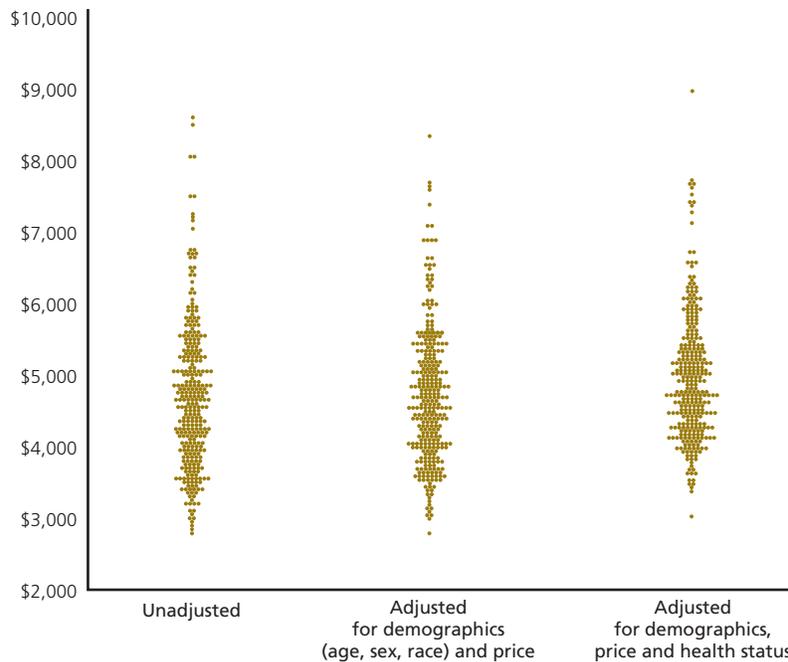
Another big difference is in the unit of analysis. While some studies examine state differences in spending, others look at variation in spending across smaller areas that subdivide states. The most common method for doing this has been to apply the definitions used by Wennberg and his team (20), who divide the country into more than 300 hospital referral regions. Large variations in use have been found in studies of both states and local areas. Because of the heterogeneity within states and the importance of the local market in health care, analyses using units smaller than states tend to be particularly valuable.

*Source: Gold, 2004*

**Population and price differences combined account for less than half the variation in spending across areas.** While some of the variation in per capita spending can be explained by differences in the population mix and prices across areas, substantial variation in spending remains after adjusting for these factors (8, 13, 17, 20). For example, Fuchs et al. (13) found that after controlling for demographics and health status,<sup>5</sup> median per capita Medicare spending for whites aged 65 to 84 was \$3,099 but there was almost a two-fold variation between the highest (\$4,368) and the lowest (\$2,316) area. Wennberg et al. (20) found that adjusting for age, sex, race and illness-based measures of health status—as well as for prices—reduced the variation in spending across hospital referral areas by only about 18 percent (Figure 5).

## Findings

Figure 5. Medicare spending variation\* before and after adjusting for population and price differences, 1996



\*Distribution of spending per beneficiary across hospital regions  
Source: Dartmouth Atlas of Health Care, 1999

The MedPAC analysis—which uses state data but incorporates more detailed price adjustments and a different but equally detailed approach to adjust for the population’s health—shows that about 40 percent of the variation in spending among states is attributable to differences in health status, underlying differences in the cost of providing units of care in different areas, and congressionally legislated special payments to hospitals that contribute to differences in expenditures across areas. (The latter adjustment accounts for much less of the reduced variation than do the first two.) As noted previously, MedPAC’s work weights states by their population, while the other analyses do not. In contrast, Cutler and Sheiner (8) find that health status and demographics account for about 66 percent of the variation in Medicare spending per capita, although their analysis probably overstates the amount of variation in health spending that is attributable to those factors.

### What explains the geographic variation in spending that remains after adjusting for population and price differences?

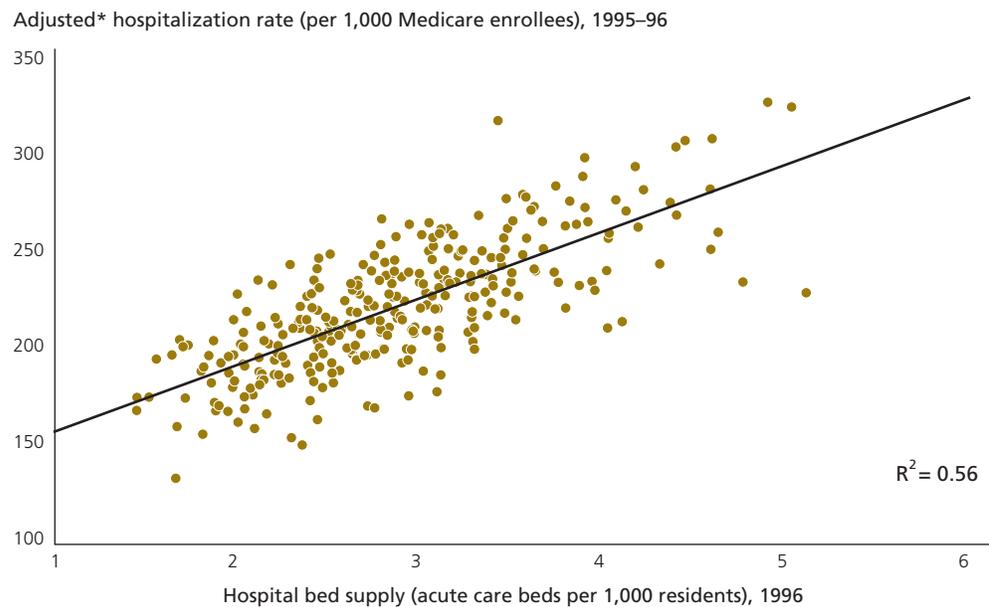
**More than half the variation in spending reflects differences in the use of services.** The variation in use is affected by the supply of services, provider training, local standards of care, provider preferences, Medicare payment policy, financial incentives and patient demand for services and propensity to use them. Yet, solid evidence on the relative contribution of each is lacking, in part because data on local markets and practices are difficult to obtain.

## Findings

**Most studies show a strong positive association between the supply of health care providers and use of services.** In the 1970s, Roemer and Shain first observed that the rate of hospitalization depends directly on the supply of hospital beds, leading to the conclusion that “a bed built is a bed filled” (an observation referred to as Roemer’s law).<sup>6</sup> Recent Medicare research has focused on the relationship between spending and the amount and type of health care resources in an area, finding a positive correlation between the two—although causality is often hard to prove (8, 9, 17, 20). To some extent, results may reflect differences in population mix and need that remain after adjustment, because health status is hard to measure and limited data exist. In addition, studies may overstate the relationship between health care supply and spending because many factors affecting supply and demand are interrelated and it is unclear whether supply generates demand or the reverse.

Wennberg et al. (20) documented that acute care hospital resources and the physician workforce vary dramatically across areas of the country. In 1996, for example, the supply of hospital beds in different areas ranged from 1.5 to 5.0 beds per thousand residents. That study found that variation in hospital beds was strongly associated with hospitalization rates for Medicare beneficiaries (Figure 6). Also, some areas had over 300 physicians per 100,000 people, while others had half as many or less. The mix of primary care and specialty care physicians also varied across areas.

Figure 6. Association between hospital bed supply and adjusted hospitalization rate, 1995–1996



\*Adjusted for sex, race and health status  
Source: Dartmouth Atlas of Health Care, 1999

Several multivariate analyses report similar findings. Fisher et al. (11) found that areas with more hospital beds per capita have higher hospitalization rates, particularly for medical conditions, and that these differences extend across income and race groups. MedPAC (17) and Cutler and Sheiner (8) also found a positive relationship between the supply of providers and spending, with the supply of specialist physicians and for-profit hospitals being the most important variables in their analysis. Silverman et al. (18) determined that spending is higher in areas with a higher share of for-profit hospitals.

## Findings

Cutler and Sheiner find that supply explains less of the variation in spending than do other authors. However, they control for demand factors that might also influence supply, thus potentially underestimating the contribution of supply to observed variation in spending.

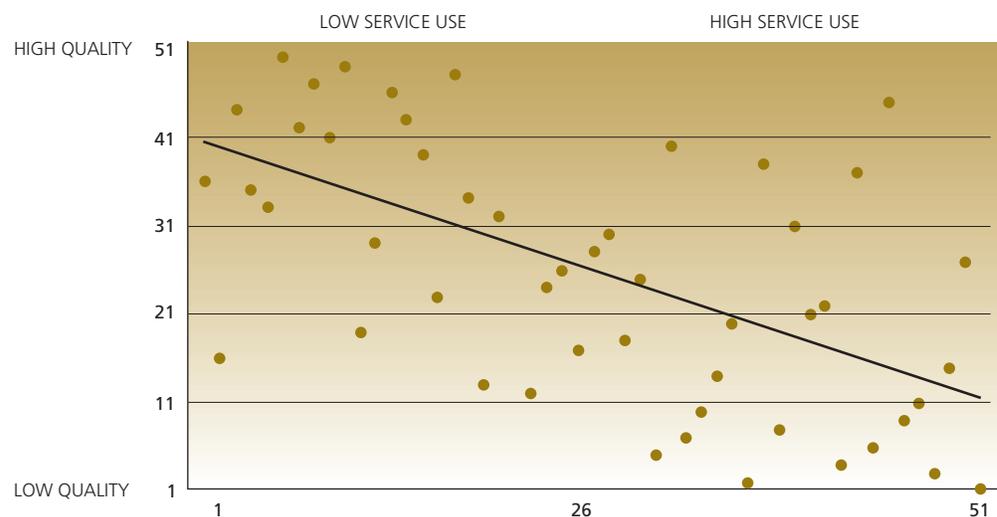
**Health care use also varies with other market characteristics.** Several studies have found lower spending in areas with high HMO penetration (6, 8).<sup>7</sup> Some researchers use extent of HMO penetration as a proxy for the level of competition in a market. Under that assumption, the finding that spending and HMO penetration are inversely related suggests that competition reduces demand for services and spending. But it could also mean that managed care develops in areas where provider and beneficiary attitudes and the forms of provider organization produce lower use rates.

### Do people in higher spending areas receive better care (i.e., higher quality, better access)?

**While limited, the existing research indicates that people in higher spending areas do not receive better care.** The evidence includes both general descriptive analyses examining the association between use and quality (17, 19, 20), as well as more clinically detailed studies examining the relationship between spending and the appropriateness of care received (7, 9, 10, 16).

**Per capita spending levels are not positively correlated with quality or outcome measures.** MedPAC (17) examined the association between higher per capita spending (adjusted for population and price) in states and quality of care—as measured by Jencks et al. using data on receipt of 24 preventive measures or treatments that are strongly related to improved outcomes. The study found that states with higher use did not rank more highly on quality and, if anything, ranked lower (Figure 7).

Figure 7. Rankings of states on adjusted service use and quality of care, 2000



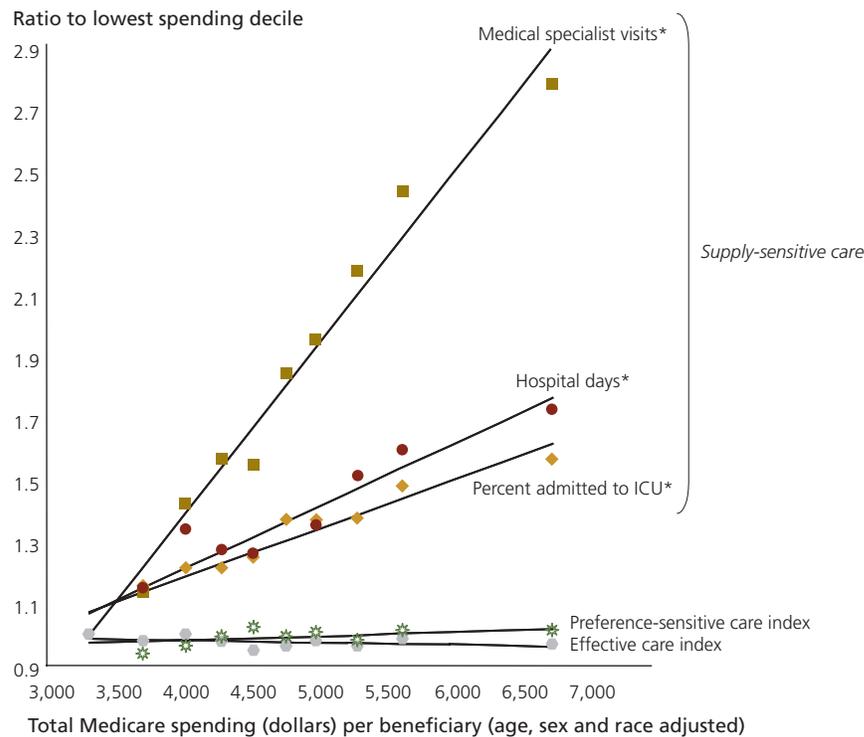
Note: The measures of both adjusted service use and quality are ordinal. For example, the state with the highest quality has a quality measure of 51 and the state with the second-highest quality has a measure of 50, and so on down to 1.

Source: MedPAC analysis of county-level fee-for-service expenditures and other data from CMS, and Jencks et al. 2003

## Findings

The most extensive descriptive analysis of the relationship between use of services and quality has been undertaken by Wennberg and colleagues (19, 20). The researchers used several indicators and approaches to assess the relationship between use and quality, typically finding little relationship between the two. They also distinguished between three kinds of services: effective services that all patients should receive;<sup>8</sup> preference-sensitive care for which patients and their clinicians must choose between at least two valid alternatives with differing risks and benefits;<sup>9</sup> and supply-sensitive services that are difficult to associate with particular needs and whose use tends to increase with the supply of providers relative to the population. They find that effective care services are about equally likely to be underused in both high- and low-spending areas, as are discretionary procedures that are preference-sensitive (Figure 8). High- and low-spending areas, however, differ greatly in the frequency of physician specialty visits and in use of intensive hospital care at the end of life—services that are more likely to be supply-sensitive. This means that while beneficiaries may have greater access to services, there is little evidence that the services they receive as a result are more appropriate or effective.

Figure 8. Use of effective care, preference-sensitive care, and supply-sensitive care among hospital referral regions (grouped by spending in dollars per beneficiary), 1996



\*Care provided per decedent in the last six months of life  
Source: Dartmouth Atlas of Health Care, 1999

**Inappropriate care is provided in both high- and low-spending areas.** In a classic early study using Medicare data for 1981, experts reviewed medical records to assess the rate and appropriateness of care in high-, medium- and low-use areas for three procedures: coronary angiography, carotid endarterectomy and upper gastrointestinal tract endoscopy. The researchers found no instances in which high use of procedures was associated with higher rates of appropriateness (7). Leape and colleagues (16) used similar methods to assess variation across areas within the same state, and found that wide variation in rates of appropriate procedures was not correlated with use levels.

## Findings

More recently, Fisher et al. (9, 10) examined the relationship between levels of spending and quality of care using data on spending for end-of-life care (which correlates with average total per capita spending in the area). The team categorized geographic regions into five groupings ordered from low- to high-spending. They then examined costs and outcomes of care for hip fractures, colorectal cancer, and acute myocardial infarction in each area. They found that people in high-spending regions received 60 percent more care for these three conditions but did not have better quality or outcomes of care (9). They also did not have lower mortality rates, better functional status or higher satisfaction (10).

In summary, research on the relationship between spending and measures of health care appropriateness or health outcomes is limited to some relatively strong studies focused on particular conditions and an accumulation of evidence from cruder descriptive studies. The results provide no evidence that areas spending more money have better quality or outcomes of care.

**The reasons that patterns of care and spending vary so greatly across the country are still highly uncertain.** The difficulty of explaining geographic differences in health care use is illustrated by recent work by Fuchs, McClellan and Skinner (13) seeking to explain Florida “exceptionalism.” This term is used to characterize the fact that per capita Medicare utilization in Florida appears to be 17 to 25 percent above the national average (depending upon the population adjustments used) while Florida mortality rates were 10 percent below the national average. Based on what is known from other studies, the authors rejected the conclusion that higher utilization results in lower mortality. Rather, they looked for characteristics of both providers and beneficiaries that might explain Florida’s outlier status on both measures. None of their hypothesized reasons for such variation (e.g., physician-induced demand, selective in-migration) could be empirically supported. The authors concluded that policy-makers should be cautious in attempting to address geographic variation in spending because many of the reasons for it are unclear and policy has the potential to introduce harm, as well as good.

## Implications for Policy-Makers

Research provides strong evidence of wide variation in Medicare spending across regions of the country regardless of how they are defined. Some, but by no means all, of this variation can be explained by population and price differences. A larger portion of the variation is due to differences in how care is used across areas, but much remains unknown about why practices differ so greatly across the country. Additionally, a positive association exists between the supply of health services and use of those services. Higher spending does not appear to lead to higher quality, more appropriate care, better outcomes or reduced mortality. Following are some of the issues policy-makers may want to consider in deciding whether and how to respond to these findings.

**Some causes of variation are more amenable to policy intervention than others.** As shown in Figure 1, population, price and use of health services influence Medicare spending in a variety of ways and some of these influences are easier to modify than others. For example, the fact that Medicare serves an increasingly aged population is beyond policy-makers' control, yet it drives growth in Medicare spending per capita and contributes to area variation because the mix of Medicare beneficiaries differs across locales. Analogously, while Congress has the ability to set Medicare prices, its ability to influence medical practice is more limited.

**Further refinements in administered pricing for fee-for-service Medicare are not likely to make spending much more uniform.** Current research shows that efforts to make pricing more uniform have the potential to lower the variation in Medicare spending across areas only to a limited degree because differences in the patterns of use across areas—and not pricing—explain most of the variation in spending.

**Although higher-spending areas do not generate better outcomes, there is no easy mechanism to translate lower payments to these areas into more effective or efficient care.** If obtaining more uniformity in spending across areas is a policy goal, changing current care patterns will be necessary. Achieving such changes is easier said than done and there are many factors policy-makers may want to consider in deciding whether or how to intervene.

- ***Cost savings from narrowing the variation in area payments are not guaranteed.*** Reducing payments to high-cost areas is an option that some people advocate, given the wide variation in spending. For example, Wennberg and Wennberg (5) estimate that if per capita spending in all regions were to reflect amounts spent by regions in the lowest decile of spending (adjusted for age, sex and race) Medicare would save \$40 billion—or almost 29 percent of current outlays. But research shows that providers in both high- and low-spending regions overuse, underuse and misuse care. Consequently, increasing appropriate use of services will raise some costs while reducing others. Although many analysts expect that the overall effect would be to lower the average spending, such an outcome is not guaranteed. Further, because evidence on the appropriateness of care is incomplete, determining an appropriate level of payment would be difficult.
- ***Tying payment strictly to the proven appropriateness of care might be controversial.*** Despite the growing interest in performance measurement and accountability in Medicare, agreed-upon standards of care are still under development and debate in many areas. Policy-makers may be uncomfortable with the perception that Medicare is determining a standard of care. If Medicare moved to a more competitive model based on private plans, it could theoretically avoid setting explicit standards of care by making capitation payments to the plans and letting them decide what care to provide. However, existing experience indicates that uniform payments on their own do not create sufficient incentives to change provider practice.

## Implications for Policy-Makers

- ***Whether Medicare alone can reduce variation in use of services across areas is uncertain.*** Agreed-upon standards for appropriate care are often lacking, and regulation of the supply of providers is a strategy more typical of state than federal practice—and that strategy is currently out of favor because of today’s focus on market competition. Modifying payments without making underlying changes in practice will probably shift the cost to beneficiaries, plans or providers without necessarily improving the efficiency or effectiveness of care.
- ***Positive action or incentives to raise the quality of care could ultimately reduce variation.*** Some policy experts believe that Medicare should focus less on area variation per se and more on making strategic changes that influence utilization in desirable ways (2). Programs could be established to improve and reward quality of care by developing standards and sharing performance data (1). Medicare could also support centers of excellence and disseminate information on appropriate practices (19). Payment systems could incorporate more rewards for providing appropriate and high-quality care. Efforts could focus on high-cost beneficiaries (e.g., disease management) rather than high-cost regions (geographic variation) (3). The Centers for Medicare and Medicaid Services (CMS) have a number of existing and planned demonstrations to address these issues.

**Geographic variation in Medicare spending will be a policy issue for the foreseeable future.** The Medicare Modernization Act of 2003 (MMA) is intended to encourage greater involvement of private plans in Medicare, with a more structured system of competition in which plans make bids based on their estimated costs, which are then factored into their Medicare payments. But geographic variation in spending is likely to persist under this model and might even become more visible as the bids will reflect variation in practice across the country. Further, under the MMA, the benchmark for assessing bids includes an estimate of average area fee-for-service costs in the traditional Medicare program, which will also reflect variation in spending across the country. As a result, premiums for private plans will continue to differ nationwide, as will the benefits available to beneficiaries.

**Geographic variation in spending is not unique to Medicare, and highlights the potential value of efforts to encourage evidence-based medicine.** The extensive and inexplicable variation in health care spending across the country underscores potential inefficiencies throughout the health care system. Despite a high rate of spending, we have no clear indications that most of the care received is appropriate; at the same time there is evidence that many highly effective services are underused.

Emerging evidence on variations in care and utilization has generated strong interest in developing and strengthening evidence-based medicine. But creating the required systems and infrastructure (including medical consensus on protocols and data systems that provide clinicians with appropriate information of the right type at the right time) is a major challenge. Policy-makers will want to consider what responsibility the federal government should have in supporting these efforts.

**Uneven spending also raises questions about how to structure other health policies, including the provision of tax credits, to promote insurance coverage.** While they could be set as a percentage of premiums, most proposals call for uniform tax credits. Because of geographic variation in per capita spending, however, these fixed dollar amounts will buy more or different health care in some areas of the country than in others.

## The Need for Additional Information

While some aspects of geographic variation are well researched, information is lacking in several important areas.

- ***Variation in spending for other populations.*** Because Medicare is a uniform national program with common databases, there has been much research on this population, but little on others. Remediating this will require the creation of uniform national data from decentralized and inconsistent data systems maintained by states, private purchasers and others.
- ***Effective strategies for changing practice patterns.*** Today's practice patterns represent the accumulated effects of tradition, dispersed delivery, training modes, patient expectations and a preference for high technology care, among other things. We need a better understanding of what distinguishes areas that perform better—providing a higher proportion of more appropriate care—from others that do less well. Also, we need more information about how to support evidence-based medicine at the local level. Very little is known about the “changeability” of market-specific practices.
- ***Very low-use areas.*** Though research finds little evidence of a correlation between the amount and appropriateness of care, these results are likely to generate skepticism from policy-makers concerned about access to quality care in low-use areas, including rural locations. Are outcomes really no worse in these areas than others? And if so, what does this mean? Does the lack of correlation between use and outcomes—if that is so—mean that policy-makers should be any less concerned about care in these areas? Better research that targets the dynamics underlying such findings could help policy-makers understand them.
- ***Research on the implications of area variation for structuring capitation payments, tax credits and other national policies.*** If history is any guide, Congress will continue to struggle with how best to set or assess the equity of Medicare capitation payments and how to structure any tax incentives to support coverage more broadly. More research on the implications of geographic variation and alternative ways to structure such policies would be useful.

## Endnotes

1. This synthesis focuses broadly on reasons for variation in spending. It is beyond the scope of the paper to review or evaluate pricing policies for individual Medicare services. (Readers seeking such analysis can refer to the annual reports to Congress issued by MedPAC.)
2. Data to support studies of variation in spending come from the claims that providers submit. Thus, when using such data to examine variation in spending across the country, the data must be adjusted to reflect the county where the beneficiary lives rather than where the provider is located. (The need for such an adjustment explains why it is not appropriate to divide estimates of aggregate state health spending by the population in each state to derive an estimate of per capita spending.) The national health accounts, from which state estimates derive, use provider data and are not adjusted for border crossing by people seeking care. Travel may be especially likely for specialized referral services. Border crossing also is very common in some complex markets—the New York metropolitan area, for example, involves providers in New York City and its suburbs as well as parts of New Jersey, Connecticut and possibly even Pennsylvania.
3. The numbers in parentheses refer to reference articles from Appendix I.
4. See also Glenn Hackbarth. *Adjusting Medicare Payments for Local Market Input Prices*. Statement before the Subcommittee on Health, Committee on Ways and Means, U.S. House of Representatives, July 23, 2002, and Medicare Payment Advisory Commission. *Observations on State-Level Variation in Medicare Spending*. March 13, 2002. Both are available at [www.medpac.gov](http://www.medpac.gov).
5. Because of the way these spending estimates are generated, the differences reflect variation in the mix and use of services across areas for beneficiaries with similar characteristics and health needs.
6. See A. R. Somers and H. R. Somers. *Health and Health Cost Policies in Perspective*. Germantown, MD: Aspen Systems Cooperation, 1977, p. 93.
7. How robust this relationship remains today after the managed care backlash is uncertain because the greatest growth has been in more loosely organized forms of managed care.
8. They focus on consensus care for heart attack victims and effective but often underused preventive services such as pneumonia vaccination, mammograms, colorectal cancer screening, diabetic eye exams, diabetic glucose screening and lipid testing.
9. Examples include decisions on cardiac bypass surgery and on surgery for back pain, where less invasive alternative treatment options exist.

# Appendix I References

## Overview Articles

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17. Medicare Payment Advisory Commission. Chapter 1: "Geographic Variation in Per Beneficiary Medicare Expenditures." *Report to Congress: Variation and Innovations in Medicare*, June 2003.
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## Appendix II Methodological Discussion

With a few exceptions, this review focuses on nationally based studies of geographic variation in spending and use for the Medicare population published since 1999. We focused on research completed in the past five years because the Medicare market has changed extensively since the mid-1990s. (However, the findings reported here are also consistent with the longitudinal body of research.) The only exceptions are two papers (by Chassin et al. and by Leape et al.) from a study that is now relatively old (1981) but addresses the relationship between quality and appropriateness of use. We focused on Medicare because that has been a major focus of congressional interest and because research is most extensive in this area.

All of the studies included here have been peer reviewed. Most are from refereed medical and health services research journals; the remainder comes from congressional agencies that incorporate substantial peer review in their work, or other research institutes, such as the National Bureau of Economic Research.

Appendix III summarizes the studies found that met the eligibility criteria we set, including the data sources they use, the time period and population, the geographic unit of analysis, the basic methods used by the study and the study's focus on one or more of the four Synthesis questions: (1) how much spending variation is there? (2) How much variation is there after adjusting for population and price? (3) What other factors explain variation? (4) Is spending variation associated with variation in quality?

The studies rely on Medicare research files (from claims data and other sources) for information on Medicare spending in different areas, supplemented by other data (such as HMO penetration or hospital supply) for the same areas. Studies on the first two research questions mostly rely on descriptive analysis of available Medicare data. Such descriptive analysis is also used in some of the studies addressing the relationship between spending and quality or the influence of selected variables in spending differences. Studies of the relationship between spending and quality—including those on the appropriateness of care—use more sophisticated statistical analysis to control for other variables and/or primary data collection to yield more precise measures and comparisons than can be generated from Medicare data alone.

Most studies use data for Medicare beneficiaries in the traditional fee-for-service program, as those data are widely available. Because the same data are used to set prices for Medicare's capitated managed care plans, the absence of data on Medicare HMO (or other private plan) enrollees is not a major issue.

Studies use a variety of geographic units of analysis, including states, counties or aggregations of counties (e.g., hospital service areas). There is no consensus on which unit should be used, although MedPAC (17) suggests that analysts should note the presence of extensive within-state spending variation. All the studies that we have included analyze spending based on residence of the beneficiary, not location of service. This adjustment—not readily made in earlier years but now broadly used—is important because provider supply varies across areas and beneficiaries may seek care outside their area of residence.

The timeframes examined by the studies vary, even among studies published over the same period. Differences in timeframe and unit of analysis mean that studies may show different absolute values for per capita spending and magnitudes of variation across studied areas. For this reason, we highlight the general findings rather than precise estimates of variation.

## Appendix III Summary of Studies Included in Synthesis

Study	Data source	Study period/population	Unit of analysis	Basic methodology	Research findings related to synthesis questions:			
					How much spending variation is there?	How much variation is there after adjusting for population and price?	What other factors explain variation?	Is variation in spending associated with variation in quality of care?
Baker et al. 1999	Medicare Part A/B claims data by county on expenditures linked with data on Medicare enrollment. Total system HMO market share data (Medicare and non-Medicare) from GHAA (trade association) developed by author for earlier study.	1990–1994	802 market areas nationwide identified by aggregations of counties thought to reflect hospital service areas (NCHS analysis by Makuc 1991).	Multivariate analysis of role of HMO market share on Medicare spending per capita for fee-for-service beneficiaries (adjusted to reflect 1994 Medicare fee schedule throughout period).	Descriptive statistics on 1990 and 1994 Part A and Part B expenditures per beneficiary (mean, 10 <sup>th</sup> , 50 <sup>th</sup> and 90 <sup>th</sup> percentile). Mean average charge 1990–1994 shown.	N/A	Multivariate analysis to assess contribution of HMO market share to per capita Medicare FFS spending controlling for Medicare 65+ age and sex distribution, per capita income, hospital bed and physician supply and year.	N/A
Chassin et al. 1987	Medicare physician data from carriers in eight states to calculate procedure rates; primary chart review by clinicians of information on appropriateness of selected procedures in specified low-, average- and high-use sites.	1981  Medicare beneficiaries with one of three specified procedures: coronary angiography, carotid endarterectomy, and upper gastrointestinal tract endoscopy. Three sites were used per procedure across a total of five sites in all.	For each procedure, three sites were selected. One had high use, one had low use, and the third varied across procedures.	The literature was reviewed to identify procedure-specific explicit criteria for appropriateness. Expert physicians rated clinical information on appropriateness for the procedure. Results analyzed by procedure and site according to whether procedure was appropriate, equivocal, or inappropriate.	N/A	N/A	N/A	Statistical analysis of differences in appropriateness by procedure and site (type).
Cutler and Sheiner 1999	Data from the 1998 Dartmouth Atlas of Health Care.	Data as presented in the 1998 Dartmouth Atlas of Health Care.	Hospital referral regions (n=212).	Multivariate analysis of Medicare spending per beneficiary adjusted for age, sex, race and price of services.	N/A	Estimates expense variation controlling for population and price.	Comparison of variation unadjusted and adjusted for illness, demographics, insurance supply and resources. Includes regression-based analysis using demographic and supply variables.	N/A

## Appendix III Summary of Studies Included in Synthesis

Study	Data source	Study period/population	Unit of analysis	Basic methodology	Research findings related to synthesis questions:			
					How much spending variation is there?	How much variation is there after adjusting for population and price?	What other factors explain variation?	Is variation in spending associated with variation in quality of care?
Fisher et al. 2003 1, 2	Data on myocardial infarction (MI) from the Cooperative Cardiovascular project. Hip and cancer data from medical charts. Medicare Beneficiary Survey (MCBS) data from the access-to-care component. Various other sources.	Medicare FFS patients with Parts A and B ages 65–99 and hospitalized between 1993–1995 for hip fracture, colorectal cancer and acute MI, and a representative sample drawn from MCBS 1992–95.	Hospital referral region of residence (n=206).	Divide hospital referral areas into quintiles based on an index of regional differences in practice at the end of life. The measure is of spending adjusted for age, sex and race. Compare quintile 1 to 5.	N/A	N/A	N/A	Compare variation across quintiles in content of care (major surgery, EMS, procedures, minor procedures, hospital utilization, end-of-life care), quality measures and access to care measures for acute MI and MCBS sample measures of prevention and access.  Regression-predicted mortality risk for each cohort linked to level of spending in HRR (hospital referral region).  Compared adjusted scores for change in functional status and for satisfaction across quintiles.
Fisher et al. 2000	20 percent sample of Medicare beneficiaries in denominator file merged with hospital claims file (MedPAC) and Census data.	Medicare FFS beneficiaries eligible for Part A and 65+ in 1989 or 1990.	Hospital referral regions (n=313).	Measures of hospital use and in-hospital mortality from MedPAC regressed against population characteristics (mostly imputed from the census) and hospital supply (AHA).	N/A	N/A	Regression-based analysis of influence of population characteristics on bed supply and of the association between bed supply and mortality rates.	N/A
Fuchs, McClellan and Skinner 2001; Fuchs 2003	Unspecified Medicare national data files showing mortality and service use by billing code and location of beneficiary residence, 1990 U.S. Census.	1990 White Medicare beneficiaries ages 65–84.	313 non-overlapping areas that span the nation, including 224 MSAs with populations exceeding 100,000 (areas based on Dartmouth team's hospital referral regions).	Per capita utilization index developed by weighting service used by Medicare's national reimbursement rate for that service divided by the number of Medicare beneficiaries in each county. Utilization and mortality indices are standardized by age and sex. Descriptive and multivariate analysis of determinants of use and mortality rate differences across areas.	N/A	Variation in utilization and mortality indices for areas grouped by region and population size. Multivariate analysis of determinants of the same.	Analysis of variation taking mortality and various socio-economic and other variables into account.  Selective hypothesis tests of explanations for Florida exceptionalism.	N/A

## Appendix III Summary of Studies Included in Synthesis

Study	Data source	Study period/population	Unit of analysis	Basic methodology	Research findings related to synthesis questions:			
					How much spending variation is there?	How much variation is there after adjusting for population and price?	What other factors explain variation?	Is variation in spending associated with variation in quality of care?
Gage et al. 1999	1995 Medicare claims and denominator files for the 5 percent beneficiary sample for most sources.	1995	States.	Descriptive analysis of unadjusted averages and rank for each state on various measures.	Aggregate and FFS per capita Medicare payments and beneficiary copayments by state (measures for selected types of services and expenditures also shown for selected states.) Per capita FFS cost sharing shown for top 10 states.	N/A	Descriptive analysis of Medicare population, aged, dual eligibles and percent HMOs (1998) by state. These distributions are used to discuss why spending and use may differ by state despite Medicare's uniform benefit and how policy changes could affect diverse states.	N/A
Leape et al. 1990	Same as in Chassin above but focused on 23 counties in one large populous state.	1981 Stratified sample of Medicare beneficiaries with angiography, endoscopy or endarterectomy.	County-based procedure rates; appropriateness of procedure by type and area characteristics.	Appropriateness determined the same as in Chassin. Multivariate analysis of appropriateness of procedure by use rate.	N/A	Age and sex standardized use rate for the three specified procedures by county.	N/A	Relationship between rate of procedure use and fraction of inappropriate use.
MedPAC 2003, 2000	Medicare FFS expenditures by beneficiary residence.*	2000	State and county (analysis weights units by Medicare enrollment).	Descriptive analysis comparing states (and for some measures, counties) on outcome measures normalized to 1. Analysis uses data weighted for Medicare enrollment by area in terms of the percentage difference from the average beneficiary.	Aggregate Part A/B spending per capita by state.	Aggregate Part A/B spending adjusted crudely for input prices with and without health status, Part A/B participation and special payments to hospitals. Calculated for states and counties.	Regression-based analysis of county-based adjusted spending (weighted by beneficiaries) controlling for demographics, hospital bed supply and HMO penetration.	Scattergram comparing state rank on adjusted expenditures (termed use) and on quality (Jencks et al. 2003).

## Appendix III Summary of Studies Included in Synthesis

Study	Data source	Study period/population	Unit of analysis	Basic methodology	Research findings related to synthesis questions:			
					How much spending variation is there?	How much variation is there after adjusting for population and price?	What other factors explain variation?	Is variation in spending associated with variation in quality of care?
Silverman et al. 1999	Medicare Part A/B continuous history data on spending and beneficiary characteristics, AHA data on hospital ownership.	1989, 1992, 1995, Medicare FFS beneficiaries 65+ only, eligible for Part A.	3421 nonoverlapping hospital service areas for 50 states as defined in the 1996 Dartmouth Atlas of Health Care. (Excludes areas with missing data.)	Multivariate analysis of per capita costs adjusted for selected input prices, age, sex and race. Hospital profit status— for-profit (208), not-for-profit (2860) or mixed (always or transitions)—defined across all three years.	N/A	Uses price-adjusted data but does not present analysis of them except as it relates to the assessment of the contribution of hospital profit status.	Multivariate analysis to assess contribution of hospital profit status on adjusted per capita costs in the area controlling for census region, percent urban, percent beds in chain hospitals, Medicare mortality rates, Medicare HMO penetration, physicians per capita and number of beds.	N/A
Wennberg et al. 1999, 2002.	Various Medicare files, provider organization data on resources, and other files.	Mostly 1995 and 1996.	Hospital service areas (n=3,436) and hospital referral regions (n=306) created by the Dartmouth team.	Descriptive analysis with mapping.	Various measures of variation for unadjusted Medicare reimbursements for FFS beneficiaries by hospital referral region in 1996.	Age, sex, race, illness and price-adjusted reimbursements by type for noncapitated Medicare beneficiaries in hospital referral regions 1996.	Analysis of geographic variations in: (1) hospital and physician resources; (2) patient need, practice style and hospital capacity; (3) quality of ambulatory care; (4) surgical care for common conditions; (5) care in the last six months of life; and (6) overall quality across regions (overuse, misuse, underuse, etc).	Inferred from the wide variations in area resources and use of specific services that are not correlated with spending levels. Particularly targeted analyses include:  Comparison of variation in age, sex, race and illness-adjusted discharge rate to predicted discharge rate.  Scatterplot comparing age, sex, price and illness adjusted Medicare spending in 1996 against quality of preventive care and payments in the last six months of life.

Source: Gold, 2004

\*Many beneficiaries cross borders to seek care. The adjustment for beneficiary residence is essential if the intent is to measure the amount of expense per beneficiary versus the location of providers.

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