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A Report of the Dartmouth Atlas Project

A New Series of Medicare Expenditure Measures by Hospital Referral Region: 2003-2008

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Executive Summary

In this report we present newly developed measures of Medicare expenditures at the hospital referral region level for 2003 to 2008. These estimates reflect a larger sample of Medicare beneficiaries than our past estimates: 20% of the fee-for-service population instead of a 5% sample as in the previous data series. These rates rely on the actual Medicare claims files rather than the Continuous Medicare History Sample, the original 5% sample used for Atlas reimbursement data, which has been discontinued by the Centers for Medicare and Medicaid Services (CMS).

The new data series also extends a study by Gottlieb et al. (2010)[i] that adjusted Medicare spending measures for differences across regions in how much CMS pays health care providers for each procedure, treatment or physician visit. In part, this process adjusts for the fact that New York City is more expensive than Fargo, North Dakota. Equally important is that we also removed differences in reimbursement rates generated by Medicare-specific provisions for higher payments to hospitals with medical and surgical residency training programs, and for the disproportionate share hospital (DSH) payments designed to compensate hospitals that serve a high percentage of low-income patients.[ii]

Introduction

Dartmouth Atlas data have been used for many years to compare utilization and expenditures across hospital referral regions (HRRs). While utilization measures—such as hospital days, physician visits and surgery rates—are straightforward to compare across HRRs, Medicare expenditures are more complicated. Traditionally, the Dartmouth Atlas and other researchers have relied on the summarized claims for a 5% sample of Medicare beneficiaries provided in the Continuous Medicare History Sample (CMHS). More recently, the availability of all comprehensive claims files and the greater number of patients represented in a 20% sample (specifically, the 20% of patients included in the CMS Physician/Supplier Part B file) have made it feasible to calculate per capita spending directly from the claims data, with more statistical precision in smaller HRRs. Furthermore, the CMHS has been discontinued. For this reason, we recreated the data series for 2003 to 2007 and created new data for 2008 using the 20% sample; these per capita spending rates are posted on our web site (www.dartmouthatlas.org). In this report, we compare the newly calculated and older HRR-level measures for 2007, the most recent overlapping year. Reassuringly, the results are very similar, but there are noticeable differences in several HRRs; this may reflect the sometimes poorly understood aggregation programs developed decades ago by CMS to create the CMHS data set.

More importantly, the level of detail in the 20% claims files allows us to follow up on the Gottlieb et al. (2010) study,[i] which reported 2006 price-adjusted Medicare spending per capita. In this report, we update estimates of price-adjusted expenditures for the years 2003 to 2008. Our price-adjustment method adjusts for more than the cost of living; as noted above, it also removes additional payments by Medicare to medical centers for resident training and the disproportionate share hospital (DSH) program.

Methods

The intuition behind the price adjustment approach is straightforward. Medicare reimburses health care providers for hospital admissions based on diagnostic-related groups (DRGs). CMS assigns a given DRG "weight" based on the estimated amount of resources necessary to provide a service; for example a stent for a major cardiovascular event had a weight of 2.3 in 2007, while a bypass surgery had a weight of 6.1. For 2007, the national average reimbursement rate for DRGs was $5,301 per DRG weight, although the actual payment per DRG varied considerably across HRRs. To adjust for the regional variations in reimbursement rates, we assigned a standardized price to each DRG, regardless of how much Medicare actually paid per DRG. The standardized price ended up being slightly higher than $5,301 per DRG in 2007 because of all the supplemental payments Medicare pays for graduate education, DSH payments and so forth.[1] Our standardized DRG price was determined so as to ensure that total price-adjusted dollar reimbursements in the U.S. in each year were equal to total unadjusted—that is, actual—reimbursements.[2] Note that in 2008, CMS began the transition to a new system (MS-DRG) with a larger number of DRG categories, so the specific codes have changed somewhat since then.

A similar approach was used for physician payments, which are typically billed on the basis of relative value units (RVUs). Once again, the age, sex and race-adjusted RVUs were added up across individual patients—and hence across HRRs—and then priced uniformly using a single national RVU reimbursement "price" for every HRR in the country.

Outpatient facility expenditures are trickier to price because there is no common "quantity" measure such as DRGs or RVUs, and the reimbursement rates are often adjusted by CMS using the wage index. Thus for outpatient facility expenditures, we "reverse engineered" expenditures using the local wage index, thereby deflating high outpatient spending in San Francisco and inflating outpatient spending in rural Iowa. Other, smaller expenditure categories, such as nursing home stays, were adjusted using a common price per day. For more details, see both the Gottlieb et al. (2010) study[i] and its technical appendix.[iii]

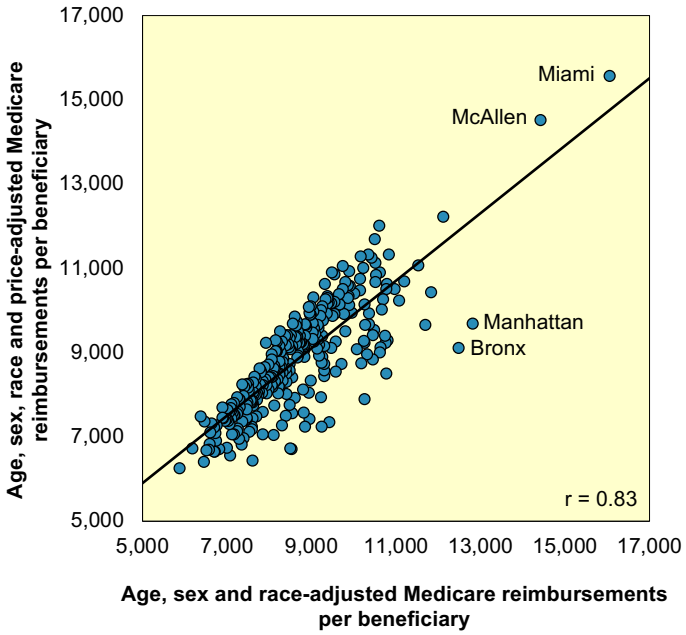
[1] Outlier payments are included as well for inpatient spending measures, although these are adjusted by the wage index to account for cost-of-living differences across regions.

[2] There is a slight further difference from the price-adjusted measures in the Gottlieb et al. (2010) *Health Affairs* paper, which normalized standardized prices so that total Medicare expenditures—for the over-65 and under-65 population—were equal to the price-adjusted expenditures. In this calculation, we normalize only for the over-65 population. Thus the 2006 data reported on our web site will differ slightly from the 2006 data reported originally in Gottlieb et al.

Regional Variation in Price-Adjusted Expenditures

Figure 1 shows the association between Medicare expenditures per beneficiary adjusted for age, sex and race only, and for age, sex, race and price by HRR in 2008. There is a close correlation between the two series, although, as might be expected, urban regions tended to exhibit lower spending rates after price adjustment, while rural regions exhibited higher spending. As the figure demonstrates, price adjustment did not affect the two highest-spending HRRs, Miami and McAllen, Texas. But other HRRs moved around somewhat in the rankings; for example San Francisco became a much lower-cost HRR. Map 1 shows regional price-adjusted spending across the U.S. in 2008. Expenditures ranged from less than $7,000 per beneficiary in eighteen HRRs—including Rapid City, South Dakota ($6,264), Honolulu ($6,653), San Mateo County, California ($6,723) and Portland, Oregon ($6,971)—to more than $12,000 per beneficiary in Miami ($15,571), McAllen ($14,529), Harlingen, Texas ($12,231) and Monroe, Louisiana ($12,027). The coefficient of variation (the standard deviation divided by the mean) was 0.148 when price-adjusted spending was considered, not much below the coefficient of variation without price adjustment (0.156).

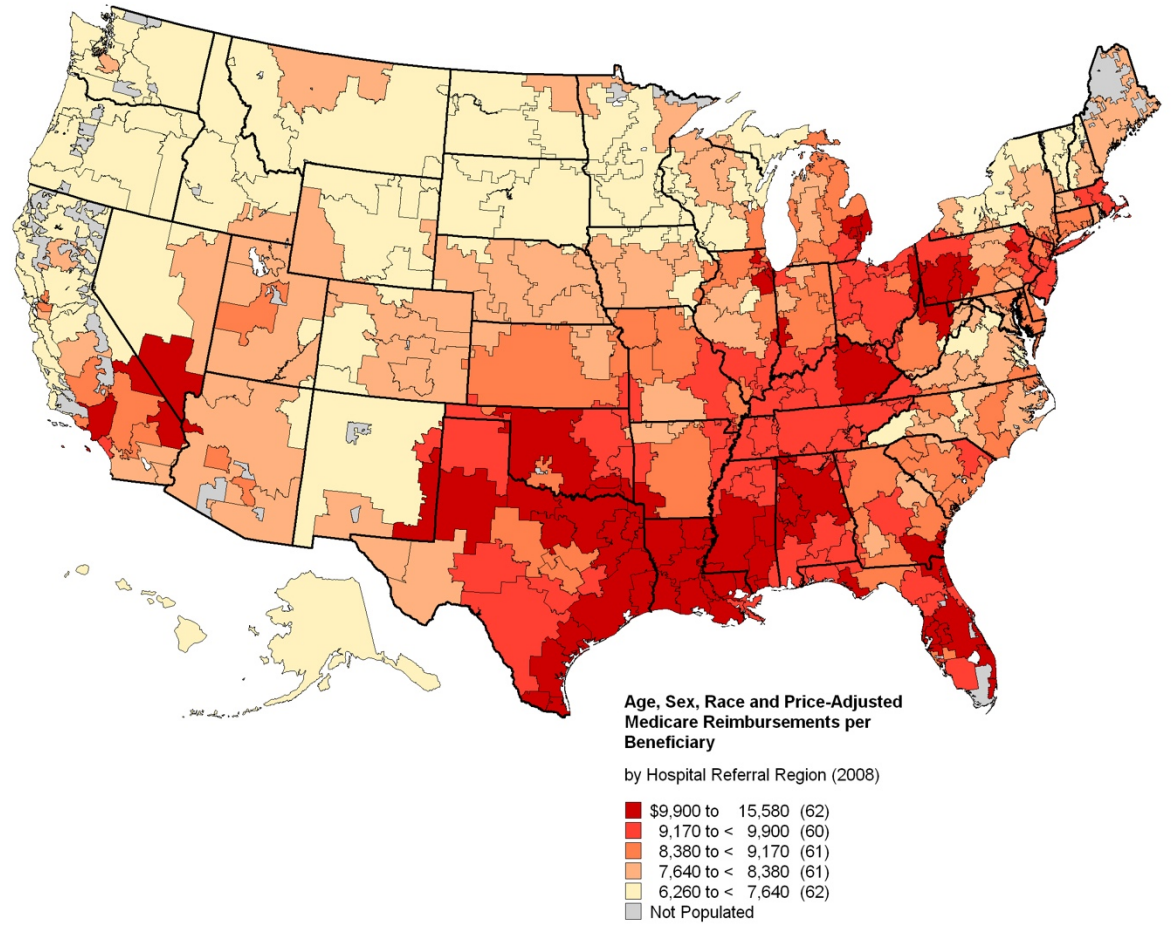
Figure 1. Correlation between age, sex and race-adjusted only and age, sex, race and price-adjusted Medicare reimbursements per beneficiary among hospital referral regions (2008)

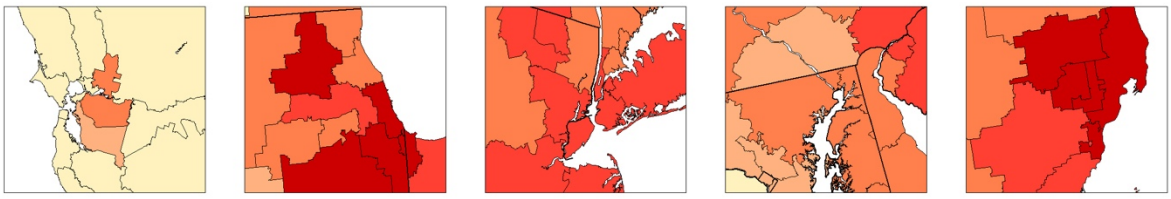


The figure shows the rates of Medicare spending per beneficiary adjusted for age, sex and race only (horizontal axis) and adjusted for age, sex, race and price (vertical axis). There was a strong correlation (r = 0.83) between non-price-adjusted and price-adjusted reimbursement rates, although price adjustment caused some HRRs, including Manhattan and the Bronx, to change position in the rankings.

The largest impact of price adjustment was seen in the New York metropolitan region (Manhattan and the Bronx), where spending rates did drop considerably. While these price-adjusted rates were still above the national average, they were no longer outliers. In part, the downward adjustment for spending in New York is a consequence of higher cost-of-living expenses there. But New York's Medicare reimbursement adjustment was also greater than San Francisco's, for example, which had a similar cost-of-living adjustment. The difference arises because New York hospitals train as many as one sixth of medical and surgical residents in the U.S.; the larger the number of residents being trained, the more Medicare pays hospitals per DRG, a policy that some have questioned as being overly generous.[iv]

Map 1. Price-adjusted Medicare expenditures per beneficiary by hospital referral region (2008)





The measures presented here reflect the DRGs billed to Medicare, but not actual inputs such as physician visits and hospital days. This latter measure of intensity is captured by the Hospital Care Intensity (HCI) index, available on the Dartmouth Atlas web site for chronically ill patients in their last two years of life.[v] The HCI index is a weighted average of hospital days and inpatient physician visits, and thus is impervious to price differences across HRRs; it is based entirely on utilization. In general, this measure corresponds closely to our price-adjusted Medicare expenditure measure, with New York City an exception. For Manhattan, the HCI index was very high—65% above average and among the highest HRRs in the country in 2007—while the price-adjusted spending rate was just 7% above the national average. The difference in these two measures—price-adjusted spending and the HCI index—can be reconciled easily; patients with a given DRG spend more time in the hospital and are visited by more physicians in New York. Thus, while New Yorkers are not much more likely to be admitted to the hospital than average, once they are admitted, they end up spending more days in the hospital and are visited by more physicians. The larger message is that the "intensity" of health care can be measured using different approaches, including both price-adjusted spending and utilization. Most of the time they yield the same answer, but in the more interesting cases, such as New York City, they do not.

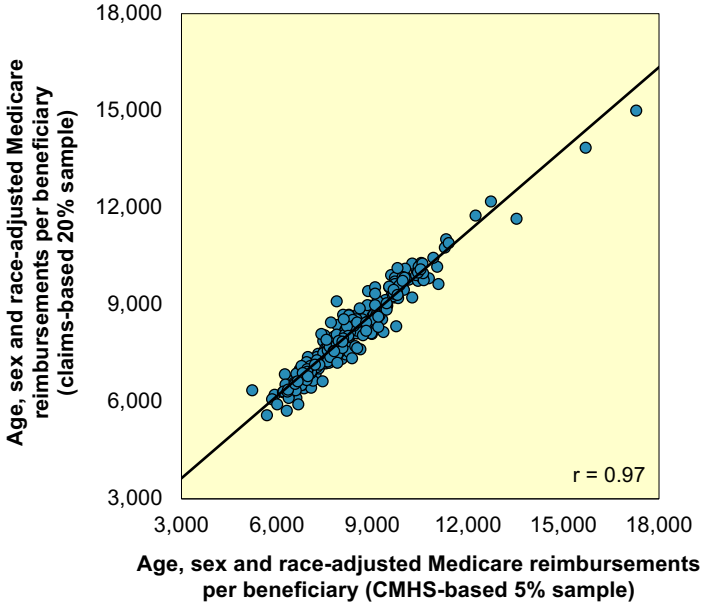
A Comparison of the CMHS 5% Sample with the 20% Claims Data

This section is primarily of interest to researchers using the earlier Atlas data. We compared the per capita spending rates generated from the 2007 CMHS-based 5% sample with those calculated from the 2007 claims-based 20% sample. The correlation coefficient between the two HRR-level measures was reassuringly high (r = 0.97) (Figure 2). As well, growth rates in Medicare spending between 1997 and 2007 are very closely associated, whether one uses the 2007 CMHS data or the claims-based 20% sample (r = 0.99).[3] In other words, one can still "chain" the older and newer data for the purpose of constructing long-term growth rates. That said, a few HRRs showed some change under the 20% sample compared to the earlier 5% sample; estimated per capita expenditures increased more than $1,000 per beneficiary in Johnstown, Pennsylvania ($7,876 in the CMHS-based sample versus $9,107 in the claims-based sample) and Salem, Oregon ($5,221 versus $6,371).[4] Miami remained the highest-spending region in the country in both samples, but its per capita spending rate decreased more than $2,000 per beneficiary in the claims-based sample ($17,274 versus $15,015). Per capita spending rates also showed a decrease in McAllen ($15,695 versus $13,860) and Harlingen, Texas ($13,531 versus $11,669). Spending estimates per capita were at least slightly lower in the claims-based sample for 216 of the 306 HRRs.

[3] The annual nominal growth rates were calculated by taking the natural log of spending in 2007 minus the natural log of spending in 1997 and dividing by 10.

[4] Reassuringly, the new CMS data posted on the Institute of Medicine web site[vi] is more consistent with our newer 20% sample than with the older 5% sample. While the CMS data reports spending for 2008 rather than 2007 (and does not adjust for age, sex and race), Johnstown, Pennsylvania is ranked 68th in HRR-level spending (out of 306 HRRs) in the CMS data, and 79th in our 2008 data – a very close correspondence.

Figure 2. Correlation between CMHS-based 5% sample and claims-based 20% sample rates of Medicare spending per beneficiary among hospital referral regions (2007)



The figure shows the rates of Medicare spending per beneficiary in 2007 adjusted for age, sex and race using the CMHS-based 5% sample (horizontal axis) and the claims-based 20% sample (vertical axis). There was a strong correlation (r = 0.97) between the two measures, ensuring the validity of long-term longitudinal studies using data derived from both samples.

What About Illness Adjustment?

One of the questions raised about geographic variations in spending is the degree to which remaining variation could be explained by differences in the underlying health status of beneficiaries in different HRRs. Others—including CMS and the Medicare Payment Advisory Commission (MedPAC)—have adjusted not only for prices, but also for illness. These estimates have been posted on web site of the Institute of Medicine (IOM)-sponsored committee studying geographic variations.[vi]

The CMS estimates posted on the IOM web site attempt to adjust for illness differences across HRRs using what are known as Hierarchical Condition Categories (HCCs), specific disease categories that are coded using the Medicare billing information. The problem with this approach, however, is the well-known "reverse causation" problem; HRRs with intensive use of physician visits and hospital admissions routinely code more diagnoses of disease (since nearly any physician visit is coded with at least one disease). In one study,[vii] otherwise similar Medicare beneficiaries who moved to higher-intensity HRRs ended up with additional diagnoses, so much so that their HCC codes would predict 19% higher spending per patient than for their counterparts who moved to low-intensity HRRs.[5] Thus there are biases in using HCC-based adjustments that tend to artificially diminish

[5] Mortality rates were similar for both groups even after their move.

true geographic variation in both spending and risk-adjusted mortality.[viii] This can be seen most readily in McAllen, Texas, one of the most expensive HRRs in the country and the one deemed to be the sickest in the country based on the HCC adjustment. Yet the 2007 age, sex and race-adjusted mortality rate for McAllen in the Medicare population (4.28 per 100 beneficiaries) was well below the national average (4.82) and even below the mortality rate in Provo, Utah (4.67).[6]

That said, clearly some regions are less healthy than others. Thus our estimates are likely to overstate spending in unhealthy regions and understate spending in healthy regions. We are currently developing new measures based on cohorts of Medicare beneficiaries who have had a hip fracture or heart attack in order to compare, for example, how hip fracture patients are treated in Minneapolis compared to those in New York.[7]

There are presumably other reasons why HRRs may differ with regard to spending. Some factors, such as income, do not appear to have any impact on spending, as shown in one recent study.[ix] Nonetheless, we view these price, age, sex and race-adjusted measures of Medicare expenditures as a first step in developing more accurate time-series measures of geographic variation in health care expenditures.

Conclusion

This Atlas report follows and expands upon the publication by Gottlieb et al. (2010)[i] that presented new measures of price-adjusted Medicare reimbursements. Price adjustment reduces the magnitude of overall variation and alters the ranking among HRRs somewhat; for example, New York City is no longer an outlier. But the magnitude of variation does not decrease much, because, while previously average-cost HRRs such as San Francisco become considerably less expensive, other HRRs with previously modest inpatient costs, such as Elyria, Ohio, become more expensive after adjustment for the lower prices there. Even after price adjustment, there remains a remarkable gap between price-adjusted Medicare reimbursements per beneficiary in HRRs such as Miami and Grand Junction, Colorado.

[6] Mortality rates are available at https://atlasdata.dartmouth.edu/downloads/general#mortality. The argument that greater spending in high-cost regions would have driven down mortality rates by the magnitude observed is highly unlikely, as the mortality effects of spending greater amounts on health care are at best modest in magnitude.

[7] Another approach to risk adjustment defines a retrospective cohort of chronically ill people within two years of their death by region and hospital.[x] This approach adjusts for differences across regions in the prevalence of chronic illness and the presence of multiple illnesses. On the other hand, a bias that could be introduced is that more intensive hospitals might rescue more of their patients from death, so these patients might not appear in the end-of-life cohort. This in turn would tend to make these intensive hospitals look *less* expensive, since the costly rescues are not included in the end-of-life cohorts.

References

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