How Will Provider-Focused Payment Reform Impact Geographic Variation in Medicare Spending?

David Auerbach, PhD, MS; Ateev Mehrotra, MD, MPH; Peter Hussey, PhD; Peter J. Huckfeldt, PhD; Abby Alpert, PhD; Christopher Lau, PhD; and Victoria Shier, MA

ABSTRACT

Objectives: The Institute of Medicine has recently argued against a value index as a mechanism to address geographic variation in spending and instead promoted payment reform targeted at individual providers. It is unknown whether such provider-focused payment reform reduces geographic variation in spending.

Study Design: We estimated the potential impact of 3 Medicare provider-focused payment policies—pay-for-performance, bundled payment, and accountable care organizations—on geographic variation in Medicare spending across Hospital Referral Regions (HRRs). We compared geographic variation in spending, measured using the coefficient of variation (CV) across HRRs, between the baseline case and a simulation of each of the 3 policies.

Methods: Policy simulation based on 2008 national Medicare data combined with other publicly available data.

Results: Compared with the baseline (CV, 0.171), neither pay-for-performance nor accountable care organizations would change geographic variation in spending (CV, 0.171), while bundled payment would modestly reduce geographic variation (CV, 0.165).

Conclusions: In our models, the bundled payment for inpatient and post acute care services in Medicare would modestly reduce geographic variation in spending, but neither accountable care organizations nor pay-for-performance appear to have an impact.

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Medicare spending per fee-for-service (FFS) beneficiary in 2008 varied widely across the 306 Hospital Referral Regions (HRRs) of the United States: it ranged from $6000 in Rapid City, South Dakota, to more than $18,000 in Miami, Florida. Some of this geographic variation is driven by differing health status and other demographic differences among residents of these regions.[1] However, research has also suggested that a large component of this geographic variation is due to differences in medical practice that do not appear to be associated with better healthcare quality or outcomes.[2-4] These concerns have raised interest in policies aimed toward reducing geographic variation in spending.

As part of the debate over the Affordable Care Act, Congress considered implementing a "value index," which would directly address this variation by reducing the rates Medicare pays providers in high-cost regions.[5] However, the Institute of Medicine (IOM) has argued against such policies, deeming them an overly blunt instrument.[6] Varying payment rates in this way would not account for the substantial differences within regions in provider efficiency, and thus, could penalize low-cost providers in high-cost regions.

Instead, the IOM favors policies that aim to reduce inefficiency at the provider level. Indeed, if inefficiency is more prevalent in high-cost areas, then policies that reduce inefficiency might also reduce geographic variation in spending as a beneficial accompanying effect. To assess the effects of such policies, the IOM asked us to model the impact of provider-focused interventions on geographic variation in spending.

In this article, we estimate the impact of 3 provider-focused policies on geographic variation in Medicare spending: 1) bundled payment, 2) pay-for-performance (P4P), and 3) accountable care organizations (ACOs). We chose these 3 policies as prominent, realistic interventions that are currently being implemented or piloted in Medicare, as well as in the private sector. Generally, these policies aim to improve upon

the incentive inherent in FFS payment to increase volume of care without necessarily improving outcomes.

For each policy, we generated a number of scenarios representing realistic but robust implementations of the policy and then estimated geographic variation in Medicare spending under each scenario. To ensure that the scenarios would be realistic, we based their design on policies that Medicare has already implemented (either as pilots or full programs). To ensure that they are robust (ie, illustrative of the potential impacts of a large-scale program), we modified the existing programs in many key ways. For example, instead of a voluntary bundled payment program, as is currently being piloted in Medicare, we modeled a mandatory program. We provide an overview of the policies and scenarios below with additional details in the eAppendix (available at **www.ajmc.com**).

Take-Away Points

Medicare spending per fee-for-service beneficiary in 2008 varied from $6000 in Rapid City, South Dakota, to more than $18,000 in Miami, Florida. While some policy makers favor directly reducing payments in high-cost areas, the Institute of Medicine favors policies focused on provider inefficiency. We investigated whether several such policies would have the virtue of also reducing variation in spending. If inefficiency is concentrated in high-cost areas, then this may be the case.

- Robust pay-for-performance and rapid diffusion of accountable care organizations would have minimal impact on such variation.
- Bundling inpatient and post acute care costs would modestly reduce such variation.

How the 3 Policies Theoretically Could Decrease Geographic Variation

In this section, we explain potential mechanisms by which these policies could reduce geographic variation in spending. Under a P4P program, providers such as hospitals, medical groups, and nursing homes receive higher payments if they attain a high level of performance on quality measures, or improve their performance on quality measures (some related recent policies also reward performance on cost measures, but we did not include such scenarios). For P4P to decrease geographic variation in spending, there must be a cost-quality relationship. If high-quality providers are clustered in regions with lower spending, then the P4P program would shift money from high-cost areas to low-cost areas, thereby reducing geographic variation in spending.

"Bundled payment" is a payment method in which providers receive a single payment for so-called bundles of healthcare services related to a patient's medical condition or a medical procedure. For bundled payment to decrease geographic variation in Medicare spending, there would need to be a national payment rate for each bundle and high-cost providers of bundles clustered geographically.

ACOs were initiated in Medicare as part of the Affordable Care Act. Organizations assume responsibility for the total costs of care for a designated population of Medicare beneficiaries, and if Medicare payments for assigned beneficiaries fall below a target, Medicare pays the provider organizations a fraction of the difference as bonus payments (if quality standards are met), and thus both Medicare and the organization benefit financially. In some models, provider organizations may also lose money if Medicare payments for assigned beneficiaries exceed the target. If ACOs do save money for Medicare on net and are clustered in higher-cost areas—and/or if ACOs save more in high-cost areas than low-cost areas—then geographic variation in spending could be reduced.

METHODS

To evaluate whether the 3 policies would decrease geographic variation in Medicare spending, we compared 2008 Medicare spending for each HRR under the baseline case with scenarios in which the policy was implemented. We compared the degree of geographic variation in the baseline case with that under the policies. Given space limitations, we provide an overview of our work and only 1 scenario per policy. The online eAppendix includes a detailed description of methods and data as well as results of other scenarios (sensitivity analyses) for each policy.

We compared all scenarios with unadjusted total Medicare spending for FFS full-year Part A and Part B enrollees 65 years or older in 2008, as reported by the IOM.[7] The underlying data derives from the CMS Chronic Conditions Warehouse,[8] which contains all Medicare claims for FFS beneficiaries. Methods, key assumptions, and data unique to each of our policy scenarios are described below. We present each policy independently, though we recognize potential policy interaction with simultaneous implementation.

Pay-for-Performance

We analyzed the impact of Medicare P4P programs targeting hospitals, nursing homes, and home health agencies (we report the effects of all programs combined). We based scenarios on existing or pilot Medicare P4P initiatives—specifically, the Hospital Value-Based Purchasing Program, the Nursing Home Quality-Based Purchasing Demonstration, and the Home Health Pay-for-Performance Demonstration.

Reflecting the design of existing and prior P4P programs, we measured each provider's performance on quality measures in terms of both achievement and improvement based on publicly available quality scores, with the latter based on changes in scores over 2 years. Using the 2008 total Medicare spending baseline, we estimated the effects of transferring 15% of total provider payments to an incentive pool. We then allocated pool funds to providers based on a linear exchange curve method in which the provider with the worst performance received no incentive payments, and providers received larger incentive payments with increased performance. Compared with the nursing home and home health Medicare programs currently being implemented, our scenarios were larger in scope (a national program vs regional pilots) and devoted a much larger amount of money to incentive payments.

Bundled Payment

We estimated the effects of a hypothetical mandatory Medicare bundled payment program. The main features of the hypothetical program were fashioned after the original design of the Medicare Bundled Payment for Care Improvement Initiative, a voluntary bundled payment program currently being implemented by CMS. (Note: CMS has recently been changing some elements of the design.) Consistent with the Medicare initiative, defined bundles of care include all Medicare Part A and Part B services provided to hospitalized beneficiaries from admission through 30 days post discharge. We created bundles for 10 high-volume, high-cost conditions as defined by 27 Medicare Severity – Diagnosis-Related Groups (MS-DRGs): acute myocardial infarction, congestive heart failure, chronic obstructive pulmonary disease, gastrointestinal bleed, hip fracture, kidney/urinary tract infection, lower extremity joint replacement, pneumonia, septicemia, and stroke. Together, the services included in bundles for these 27 MS-DRGs accounted for 15% of total Medicare Part A and Part B spending in 2008. We set a national base payment rate for each bundle that was adjusted for area-level input prices, similar to the Medicare Inpatient Prospective Payment System. The base payment rate for each bundle was set such that national spending on the bundled services remained unchanged from the baseline (revenue-neutral). In our policy scenario, all providers meeting a minimum volume threshold of 10 bundles per year would receive the bundled payment; providers below the volume threshold would continue to receive payments under status quo policies.

Accountable Care Organizations

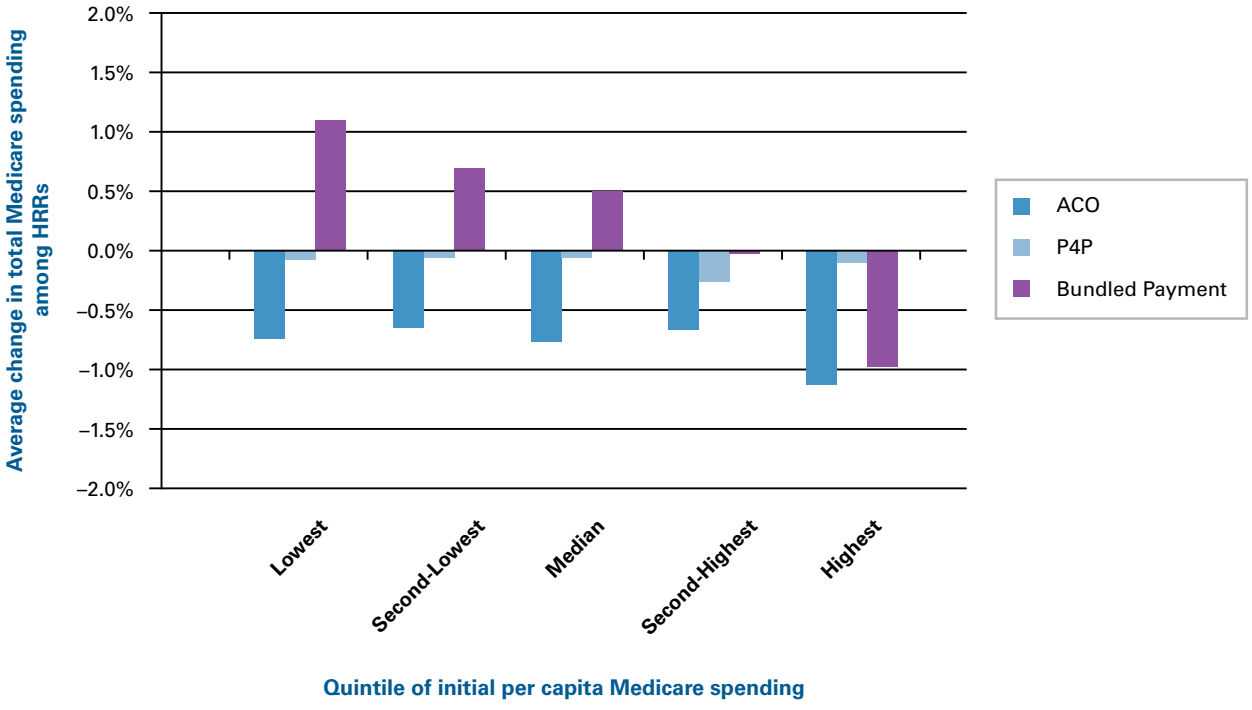
We estimated the impact of ACOs on geographic variation in Medicare spending by estimating current ACO enrollees' locations and assuming a reduction in spending for each enrollee. We identified beneficiaries associated with 148 ACOs participating in Medicare programs as of the end of 2012, plus 77 private sector ACOs that currently participate in various initiatives or pilots. We included private sector ACOs as "proxies" for where future Medicare ACOs might form, allowing us to model a more robust ACO program. In order to define which areas are affected by ACO enrollment, we assigned Medicare beneficiaries in these ACOs to an HRR using data directly from Medicare (when we had such data available). For other ACOs, we assigned beneficiaries to HRRs based on where the primary care physicians in the ACO were located, or if lacking that information, based on the location of associated hospitals or the ACO headquarters. Together, we estimated that the ACOs in our policy scenario would serve roughly 10% of Medicare FFS beneficiaries (7% in Medicare ACOs, 3% in private-sector ACOs). We employed an estimate of per beneficiary savings to Medicare of 3% to 5% depending on the type of ACO—rates somewhat higher than those implied by the literature.[9,10] We also assumed proportionally larger spending reductions for ACOs in areas with higher risk-adjusted spending, since these ACOs have potentially greater opportunity for improvement. We made these assumptions in keeping with the objective of simulating the potential impacts on geographic variation of robust versions of the policies in question.

RESULTS

Impact of 3 Policies on Geographic Variation in Spending

The effect of each policy on geographic variation in Medicare spending is illustrated in Figure 1, which separates the 306 HRRs in the United States into quintiles in their initial level of spending (lowest-spending HRRs are to the left) and displays the average change in spending in each quintile, under the 3 policies. Under P4P (the first cluster of columns), it is apparent that the effects on spending are very small and do not show a strong geographic pattern of impacts by spending quintile. The coefficient of variation (CV) of Medicare spending remains at 0.171 both in the baseline and under the policy scenario. Similar patterns emerge when each P4P program is analyzed separately: inpatient, home health, and nursing home (results in eAppendix). The ACO scenario reduces spending in all HRRs, but with a relatively weak geo-

Figure 1. Average Change in Medicare Spending Under Each Policy by Quintile of Initial Medicare Spending



ACO indicates accountable care organization; HRR, Hospital Referral Region; P4P, pay-for-performance.
The lowest quintile represents the 20% of HRRs with the lowest per capita spending in the baseline (no policy intervention). The highest quintile represents the 20% of HRRs with the highest per capita spending in the baseline (no policy intervention).

graphic pattern. Despite the relatively larger reduction in higher-cost HRRs, the CV under this policy is also unaffected and remains at 0.171. Under the bundled payment scenario, there is a clearer pattern of spending increases in the lower quintiles and spending reductions in the higher quintiles, leading to a reduction in the CV of geographic variation in total Medicare spending from 0.171 to 0.165. The reduction would be just over $400 (or 2.3%) in the highest cost HRR: Miami. In analyses focusing on only the portion of Medicare spending contained within the bundles, the CV under the bundled payment policy is 0.131 compared with a baseline of 0.158.

We conducted a number of sensitivity analyses in which we altered key parameters concerning how the policies were implemented (see eAppendix for results). In 1 alteration, we modeled a version of P4P in which incentive payments were allocated "tournament style" (only the top providers received any payments), and in another, we assumed that ACOs proliferated more widely to include 20% of Medicare FFS beneficiaries. Our results were not sensitive to these alternative scenarios. In alternative scenarios using price-standardized Medicare payment rates (eg, omitting disproportionate share hospital, indirect medical education, and area wage and price adjustments), the reduction in geographic variation was slightly smaller, while alterations removing the volume threshold in the bundled payment program resulted in a slightly larger reduction in variation.

What is Driving the Impact (or lack thereof) of the 3 Policies on Geographic Variation in Medicare Spending?

All 3 of the policies examined would have substantial effects on Medicare payments to individual providers, reallocating payments from low-performing to high-performing providers (the definition of good performance differs among the 3 policies). For example, under bundled payment in the case of acute myocardial infarction, the 5% of providers benefiting the most would receive more than a 20% increase in payments, while the 5% faring the worst would face more than a 15% reduction. Under P4P, 5% of home health providers would receive at least a 15% increase in payments and 5% would face more than an 11% reduction.

Nevertheless, we estimated that 2 of the policies (P4P and ACOs) would have no effect on geographic variation in

Table 1. Correlation Between the Performance on Select Quality Measures Used in the Inpatient P4P Program and Inpatient Spending per Beneficiary, by HRR

Selected Quality Measures Used in Hospital P4P Program	Correlation Coefficient
Heart failure patients with discharge instructions	0.16
Surgery patients with recommended venous thromboembolism prophylaxis ordered	0.07
Pneumonia patients with appropriate initial antibiotic selection	0.06
Surgery patients with prophylactic antibiotic received prior to surgery incision	0.04
Pneumonia patients with blood cultures in emergency department	0.00
Cardiac surgery patients with controlled 6 AM postoperative blood glucose	–0.01
Surgery patients with appropriate prophylactic antibiotic selection	–0.10
Surgery patients with prophylactic antibiotics discontinued appropriately	–0.10
Heart attack patients with PCI within 90 minutes of hospital arrival	–0.13
Heart attack patients with fibrinolytic received within 30 minutes of hospital arrival	–0.17

HRR indicates Hospital Referral Region; P4P, pay-for-performance; PCI, percutaneous cardiac intervention.
HRRs are the unit of analysis for this correlation. Performance on quality measures is a payment-weighted average of all providers within the HRR.

spending, and that the third (bundled payment) would have a modest effect, with the reason varying across the 3 policies.

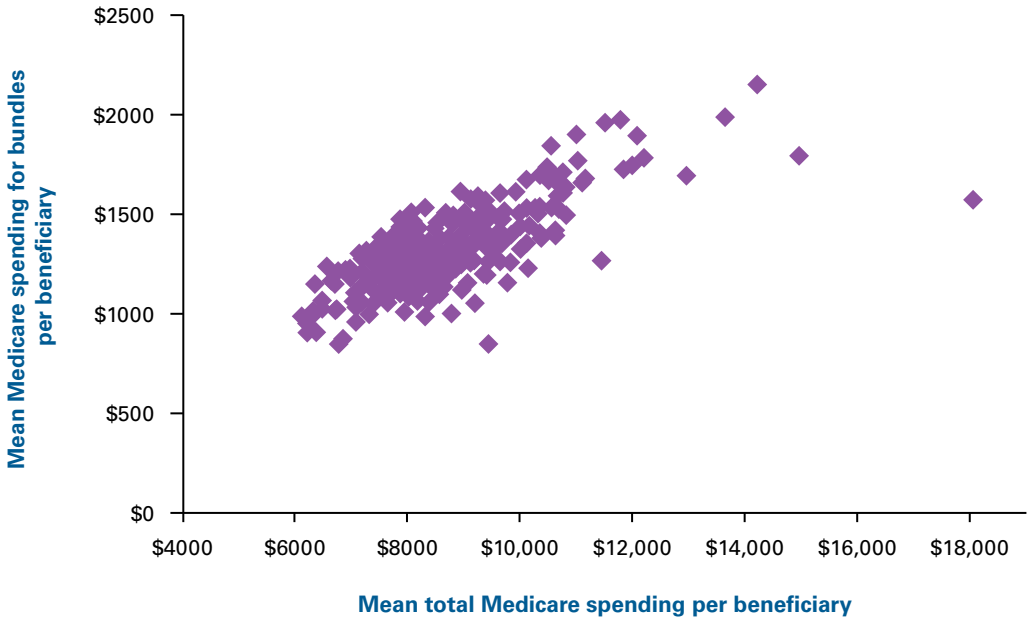
The lack of effect of P4P on geographic variation is due to the low correlation between quality and spending in a given area. For example, Table 1 shows little systematic correlation between performance on select inpatient quality measures and inpatient Medicare spending at the HRR level. There is also no consistent relationship between quality and spending for the nursing home and home health quality measures (data not shown).

The bundled payment scenario does exhibit a modest impact on geographic variation in Medicare spending—partly because we assume that Medicare will pay a national base rate (although with geographic adjustments for input price) for bundles of services. This policy would essentially "flatten out" variation in payments per bundle, and those payments represent roughly 15% of Medicare spending in a given year. However, this "flattening" alone would not necessarily reduce geographic variation at the HRR level. For example, imagine that all geographic variation across HRRs was due to variations in outpatient physician visits alone, and that inpatient and post acute care treatment and spending averaged exactly the same in each HRR (though it still would vary among providers inside of each HRR). In that case, the bundled payment scenario would still reduce variation within each HRR but have no impact on geographic variation at the HRR level. This is not the case though. As shown in Figure 2, the same HRRs with high overall spending also tend to have high spending on the bundles of care affected by the policy. Therefore, the policy would result in a reduction in payments to high-spending areas and an increase in payments to low-spending areas, thereby decreasing geographic variation.

There are several reasons the estimated reduction in geographic variation due to bundled payment is modest, however. First, approximately half of the spending on the bundles is related to the facility payment for the hospitalization occurring at the beginning of the bundle. That payment does not change under the bundled payment policy—hospitalizations are currently paid for under the Inpatient Prospective Payment System. Thus, differences in the amount spent on bundles under the new policy are driven by differences in what happens after the inpatient admission—mainly variation in readmission rates and post acute care use by region. Second, only 15% of Medicare spending was captured by the conditions we selected for bundled payment, after excluding providers with a low volume of care for any given bundle from the policy scenario. Lastly, overall spending on bundles in a region is a function of cost per bundle and number of bundles per capita. Bundled payment does not directly address the considerable variation across HRRs in the number of bundles provided. It is possible a bundled payment program could result in changes in the volume of bundles provided, but we lacked a solid evidence base to estimate the direction or magnitude of an expected effect.

Enrollment of Medicare beneficiaries in ACOs would reduce geographic variation in Medicare spending if 2 conditions were met: 1) ACOs do indeed achieve cost savings (assumed in our scenario), and 2) ACOs are more likely to form in higher-cost areas and/or result in larger savings in higher-cost areas. Although we assumed a modest degree of enhanced savings in high-cost areas, the lack

Figure 2. Total Spending vs Bundle Spending per Capita, by HRR, 2008



HRR indicates Hospital Referral Region.

of a strong association between area-level ACO formation and Medicare spending ensures the lack of an effect on geographic variation. Figure 3 plots participation in ACOs at the HRR level against HRR-level spending.

Slightly higher ACO penetration exists in higher-cost HRRs but the relationship is weak ($r = 0.05$; $P = .34$). As a result, we estimate that ACOs will result in lower Medicare payments to areas with both high and low baseline spending, with little effect on the extent of geographic variation in spending.

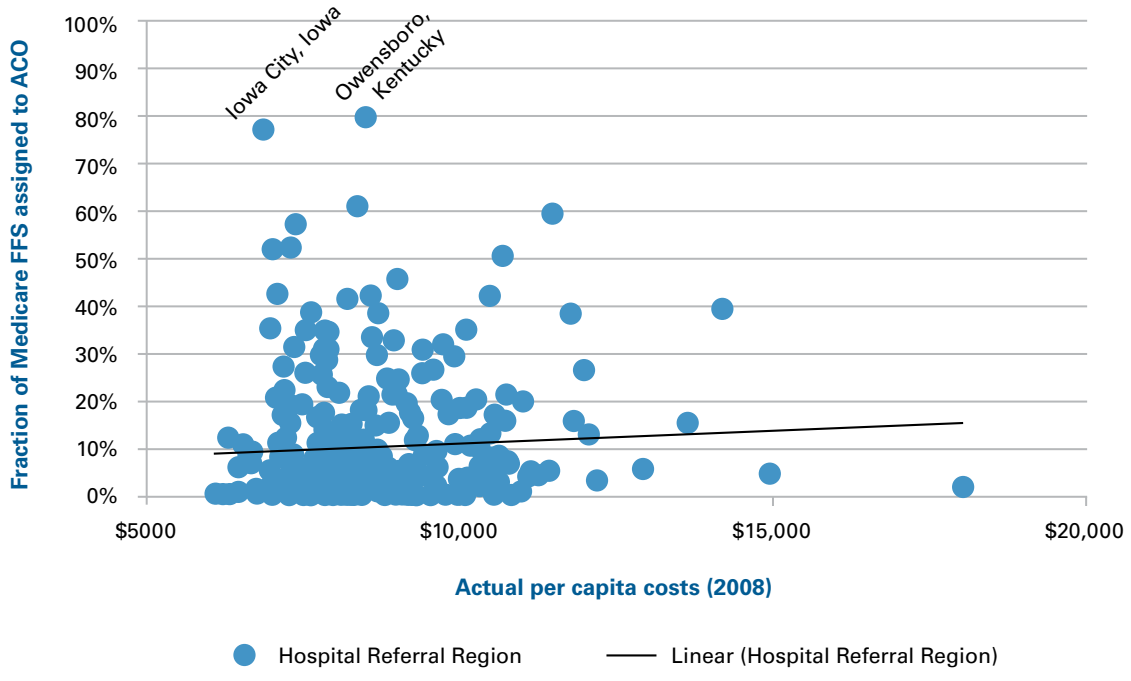
DISCUSSION

Congress is seeking mechanisms to decrease geographic variation in spending, and direct interventions, such as payment rate adjustments to all providers in a region based on spending levels, would certainly be effective in reducing variation. Yet because these may negatively impact low-cost providers in high-spending regions, the IOM Committee on Geographic Variation in Health Care Spending and Promotion of High-Value Care has argued that such changes are an overly blunt instrument. The Committee has argued that provider-focused payment reform policies should be promoted. It is important to understand whether such policies reduce geographic variation in spending.

We estimated the impact on geographic variation in spending of 3 policies (P4P, bundled payment, ACOs) that focus on individual providers, are at the forefront of healthcare payment policy, and could theoretically decrease geographic variation in spending. Each scenario assumed that a sizable fraction of Medicare spending (approximately 10%-15%) would be directly affected by the new payment policy in any given year. The number of beneficiaries affected would be potentially even higher—for example, those not in ACOs may still share physicians with those who are; many beneficiaries are cared for in hospitals or other institutions affected by the bundled payment or P4P policies. The policy scenarios therefore result in substantial reallocations of Medicare payments to providers compared with the status quo. However, we estimated that P4P and ACO scenarios would not change geographic variation at all, and that the bundled payment scenario would only modestly decrease geographic variation—as a point of comparison, the reduction is about half as much as would be achieved from simply removing teaching, outlier, and area wage and input cost adjustments to Medicare payment rates.

As further illustration, the impacts of each of the policies on Medicare spending in selected HRRs from each spending quintile is shown in Table 2. In the high-spending Miami, Florida area, the bundled payment policy reduces

Figure 3. Percentage of Medicare FFS Beneficiaries in an ACO by Area vs Medicare per Capita Spending in the HRR



ACO indicates accountable care organization; FFS, fee-for-service; HRR, Hospital Referral Region.

spending by roughly $400 per beneficiary (from $18,017 to $17,598) and raises spending slightly in low-spending Rapid City, South Dakota. Impacts on other HRRs and of other policies are generally less than $100 per beneficiary.

It may not be surprising that we found little impact of P4P and ACOs on geographic variation in spending. For P4P to decrease geographic variation in spending, there must be a relationship between spending and quality, and prior work has documented no consistent relationship between these two factors. For ACOs to decrease geographic variation in spending, they must preferentially locate in geographic areas with high spending; prior work has provided mixed results as to whether ACOs are preferentially forming in such regions. Nevertheless, given continued uncertainty, our results emphasize that such policies currently being promoted would be unlikely to reduce geographic variation in Medicare spending.

As the IOM itself has noted, it is unclear whether reducing geographic variation across HRRs is a good metric of successful policy interventions or a national priority. Medical practice is not homogeneous within HRRs, and variation in care between *providers* instead of *regions* might prove a better target for policy. Also, measures of geographic variation in total Medicare spending does not account for the important distinction between high-value and low-value spending.

That the policies we investigated had limited impact on geographic variation in spending does not mean they would be ineffective—they were not designed primarily to influence variation. The 3 policies would have substantial effects on Medicare payments to providers, however. As a result, P4P may drive quality improvement; bundled payment and ACOs may improve care and reduce costs. They might also reduce variation in spending among providers within HRRs, but we did not focus on variation at that level. Our results should therefore not be interpreted as evidence that these provider-focused policies are not useful.

To the extent that reduction in geographic variation in Medicare spending remains a national priority, our results provide insight on how the policies we investigated could be adjusted to achieve that goal. Instead of the set of measures we employed, a set of P4P quality measures could be identified in which high-cost areas of the United States have particularly low quality (eg, readmission rates); that would ensure a transfer of funds from high-cost regions with poor quality scores to low-cost regions

Table 2. Average per Capita Cost for Selected HRRs and Difference Under Each Policy

HRR	Per Capita Cost	ACO	P4P	BP
South Dakota - Rapid City	$6095	$6075	$5975	$6164
Arizona - Tucson	$7632	$7577	$7571	$7655
Missouri - Kansas City	$8399	$8389	$8491	$8417
Ohio - Cleveland	$9379	$9220	$9309	$9314
Florida - Miami	$18,017	$17,872	$18,256	$17,598

ACO indicates accountable care organization; BP, bundled payment; HRR, Hospital Referral Region; P4P, pay-for-performance.

with high scores. Also, policy makers could identify barriers to ACO formation in high-cost areas and consider ways to encourage such ACOs to develop. The reach of bundled payment could be extended by broadening the definition of spending included within the bundle (for example, increasing time period to 90 days) or by applying the policy to additional conditions. Applying bundled payment only to hospitals exceeding a minimum volume of bundles could reduce financial risk, but may reduce the impact on geographic variation as well.

We also acknowledge that other interventions could be employed (or are underway) that could also result in a reduction in geographic variation in Medicare spending. For example, adjustments to the Medicare Physician Fee Schedule that favor primary care relative to specialty care could reduce variation if high-cost areas tend to use more specialty care.[11] If high-cost regions have more inefficient or low-value care, then policies that directly target inefficient care such as potentially avoidable hospitalizations may be another mechanism to reduce geographic variation. Whether high-cost regions have much higher prevalence of low-value care is unclear.[12]

Limitations

Our estimates have some important limitations. First, the scenarios were designed to represent realistic versions of policies that could be implemented in the near future. We therefore relied upon scenarios that closely resembled current Medicare pilots or programs. However, different implementations of these policies could result in a different impact on spending. We explored some of these alternatives in our sensitivity analyses. Second, our results are limited by the available data. For example, in our ACO analyses we allocated beneficiaries to HRRs based on the location of primary care physicians, which only approximates true beneficiary locations. Also, a new set of ACOs was announced in January 2013, too late for inclusion in our analysis. It is possible that inclusion of these newest ACOs would alter our results.

Third, we focused on geographic variation in spending across HRRs. While HRRs are commonly used to examine geographic variation, we recognize that there is notable heterogeneity in spending within HRRs.[6,13] Finally, we made only limited assumptions about provider behavior in response to these policies that we felt had a plausible basis in the literature. For example, in the case of bundled payment, we assumed that providers would react to the payment change by either reducing utilization within bundles of services or accepting reduced margins, but that they would not change the number of bundles provided or utilization of services outside of the bundle. However, we acknowledge that if actual behaviors differ systematically from our assumptions—and in particular, if providers in high-cost regions reacted differently from those in low-cost regions—the impact of these policies on geographic variation in spending could differ. As these policies begin to be implemented in pilot form, there may be evidence forthcoming on behavioral responses that would improve future policy design.

CONCLUSIONS

In summary, our results are useful to policy makers seeking solutions to the problem of unwarranted geographic variation in spending. Under a set of reasonable choices for implementing the policies we analyzed, we find that while they would reallocate a substantial portion of Medicare payments, P4P and ACOs are unlikely to reduce geographic variation in spending, and bundled payment would only modestly do so. The policies could be reengineered somewhat to have greater impact on this metric, but it is unclear if reduction in geographic variation in Medicare should be a goal, in and of itself, rather than more efficient delivery of care.

Author Affiliations: RAND Corporation (DA), Boston, MA; Department of Health Care Policy, Harvard Medical School (AM), Boston, MA; RAND Corporation, Arlington, VA (PH), Santa Monica, CA (PJH, CL, VS); Paul Merage School of Business at University of California, Irvine (AA), Irvine, CA.

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Address correspondence to: David Auerbach, PhD, MS, RAND Corporation, 20 Park Plz, Ste 920, Boston, MA 02116. E-mail: davea1969@yahoo.com.

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eAppendix. Detailed Methods, Scenarios and Scenario Results

APPENDIX SECTION 1. PAY-FOR-PERFORMANCE

1.1 – Pay-for-Performance (P4P) Methods

This Appendix describes in more detail the methods and data used to model the impact of P4P on Medicare spending and geographic variation in Medicare spending. We modeled the effect of 3 national Medicare P4P initiatives on geographic variation in Medicare spending. Our goal was to assess whether these programs will attenuate or increase differences in spending between high and low cost regions.

The modeled P4P policies are based on existing or pilot Medicare P4P (also known as value-based purchasing) initiatives that target: 1) hospitals, 2) nursing homes, and 3) home-health agencies. In our models, we have changed several key aspects of some of the existing or pilot Medicare P4P programs and these changes are noted below. These changes were primarily made for consistency and to ensure a common structure (eg, how much money is tied to incentives) across the 3 P4P programs. Some changes were made because we lacked certain data elements. Our goal was to estimate the impact of more robust P4P program and for that reason, we increased the fraction of money devoted to incentives in some scenarios.

The key steps in the analysis are outlined in Table A.1.1 below. For each hospital, nursing home, and home health agency, we first calculated total Medicare payments to that provider in 2008. Then using publicly available quality data on the quality measures used in the P4P program, we estimated incentive bonuses or penalties that would be paid to each provider under the P4P program. Based on the enrollee's residence, we assigned each service by a hospital, nursing home, or home-health agency to an HRR. We then estimated HRR-level changes in payment due to P4P bonuses and penalties for overall spending, and separately for nursing home,, inpatient, and home health spending by HRR.

Table A.1.1. Steps in P4P Analysis Plan

1.	Calculate baseline total payments to each provider in the nation
2.	Subtract a percentage of all payments (2% or 15%) to provider to create a pool of incentive payments
3.	For each provider calculate quality score (incorporating behavioral change or assuming no behavioral change)
4.	Based on quality score determine a percentage change in payment for each provider.
5.	Calculate quality-adjusted total payments to each provider in nation
6.	Aggregate payments to providers by HRR
7.	Characterize changes in geographic variation and total Medicare spending

To estimate the range of the impact, we modeled 5 scenarios in which we varied several key program design parameters in the P4P programs. The modeled P4P programs only included incentives for quality of care. None of these programs, as currently designed, tie incentives to costs or resource use/efficiency of care. By design, the P4P programs we modeled did not impact overall Medicare spending. This is consistent with budget-neutral CMS value-based purchasing programs that have been implemented in demonstration or pilot form.

Data

Data on Inpatient, Nursing Home, and Home Health Spending

The data for the analysis consisted of the following: 100% MedPAR FFS claims for acute hospitals and skilled nursing facilities100% home health standard analytic files (SAF). We also used the 100% Medicare denominator file, provider of services files.

Data on Total Medicare Spending by HRR

We obtained data on total Medicare spending by HRR using published data by the IOM entitled "HRR Level Demographic, Cost, Utilization, and Quality Data."[1] The underlying data comes from the CMS Chronic Conditions Warehouse[2] which contains all Medicare claims for beneficiaries who are enrolled in the fee-for-service (FFS) program as well as enrollment and eligibility data. The analyses were conducted by the Center for Medicare and Medicaid Services.

Data on Quality of Hospitals, Nursing Homes, and Home Health Agencies

We aggregated quality data from a variety of sources. These quality data were then used as inputs in computing composite quality scores for each provider that determined their payment under the P4P programs. In general, our goal was to obtain data from the most recent year available and historical data from 2 years prior to the most recent year available. This was consistent with the lag period for the inpatient hospital VBP program developed by CMS. Much of our data came from publicly available files on quality measures from the Home Health Compare[3] and Nursing Home Compare[4] websites. We used the most recent data available. The quality data for home health agencies covered the reporting periods of 2011 and 2009. For nursing homes, we obtained staffing data from 2012, resident outcome data from 2010 and 2008, and deficiency data from 2011 and 2009. These quality data were supplemented by data from Medicare's Online Survey, Certification and Reporting (OSCAR) and Minimum Data Set (MDS) files.

For hospitals, we obtained the proposed Value-Based Purchasing Program (VBP) Adjustment Factors for FY 2103 directly from CMS.[5] These adjustment factors were reported for each participating hospital and allowed us to directly compute incentive payments, without needing to compute each hospital's quality scores.

In some analyses, we used aggregate quality scores at the HRR-level. We obtained aggregate scores for hospitals from the IOM HRR-level spreadsheet and generated analogous payment-weighted average quality scores from our claims data for home health agencies and nursing homes.

Enrollee Population Studied (inclusion and exclusion criteria)

The study population for all analyses included Medicare fee-for-service beneficiaries aged 65 and older who were enrolled in Parts A and B for the entire year or who were enrolled in Parts A and B until their death.

Beneficiaries excluded from our analysis were those who: enrolled at any time in a Medicare Advantage plan, became eligible after January 1, 2008, had only Part A or Part B benefits, were disabled or had end stage renal disease, and lived outside the United States (eg, Puerto Rico). In total, our study population includes approximately 54% of the total Medicare population for 2008.

We excluded Maryland providers from the P4P programs. Maryland hospitals are paid using an all-payer system and were exempted from the FY 2013 Medicare Hospital VBP program. To maintain consistency across all P4P programs, we excluded Maryland providers from the analyses.

Assigning Medicare Beneficiaries to a Hospital Referral Region (HRR)

Based on each beneficiary's zip code in the Denominator file, we assigned the beneficiary to an HRR. We used a crosswalk that has been made publicly available by researchers at Dartmouth.[6] Beneficiaries with invalid zip codes (eg, 00000) were excluded from the analysis.

Addressing Area-Level and Other Adjustments to Medicare Payments

Medicare payments were price-standardized to omit DSH/IME payments and account for area-level wage and price adjustments in Scenario 5. In this scenario, differences in spending across regions can be attributed to differences in utilization without being confounded by other factors such as having a disproportionate share of teaching hospitals. To standardize payments for each HRR, we applied the ratio of standardized-to-actual spending for each provider type as reported in the IOM HRR-level data for 2008. In all other scenarios, total Medicare payments are used.

How P4P Programs Were Modeled

Our analyses were modeled after actual Medicare VBP programs and demonstrations for hospitals, home health and nursing homes. Whenever possible, we used the same methods outlined by CMS to compute quality scores from existing quality measures. Quality scores were then mapped to incentive payments. While we used the actual quality measures in each of the 3 programs, our models differed from the programs in 2 ways: (1) what fraction of spending is allocated to incentive payments and (2) how those incentive dollars are allocated.

The amount of money allocated to incentives was measured as a fraction of overall Medicare reimbursements for each provider type (eg, total payments to home health agencies). We modeled 2 levels of incentives, 2% and 15%. The conservative program (2%) is consistent with current P4P programs. The robust program (15%) reflects the Committee's desire for a more aggressive P4P program. To remain budget-neutral, we generated a pool of incentive payments by decreasing all providers' payments by an equal amount. For example, all hospital inpatient payments were reduced ("withheld") by 2% or 15%. The money in this incentive pool was allocated to providers qualifying for incentive payments.

We modeled 2 mechanisms to allocate the incentive dollars: tournament and linear-exchange curve. The tournament mechanism is based on the CMS nursing home P4P program while the linear-exchange curve is based on the CMS hospital P4P program. We chose to model both mechanisms of allocating dollars across *all 3* P4P programs because the mechanism of distributing incentives could have an impact on geographic variation in spending and therefore it was important to be consistent across the 3 programs.

In the sections below, we outline: 1) how quality scores are computed in each P4P program and 2) how incentive dollars are allocated under each of the 5 scenarios.

How Quality Scores Were Computed

Hospitals

Our hospital model was based on the Medicare Hospital VBP program that was implemented nationally in FY 2013.[7] In prior work, CMS computed quality scores for each hospital and used

those scores to generate their likely incentive payments. These incentive payments were distributed as proposed "Adjustment Factors" for FY 2013. Instead of repeating this process, we used the proposed Adjustment Factors for FY 2103 from CMS to compute incentive payments for participating hospitals. The adjustment factors (which range from 0.992 to 1.009) were multiplied by base Medicare payments to determine total payments under P4P. We normalized these adjustment factors so that, when applied to base payments, total national payments equaled the 2008 value rather than Medicare payments in 2013. This maintains budget neutrality. We also modified the adjustment factors to generate a 2% or 15% incentive pool rather than the 1% pool that was implemented by CMS for FY2013. For future years, the Hospital VBP program will be using 2%.

Home Health

Our home health model was based on the CMS Home Health Pay-For-Performance Demonstration, which was implemented in 7 states between January 2008-December 2009.[8] This demonstration used a tournament-style approach to allocate incentive payments to the top 20% of providers in achievement and improvement for each of 7 quality measures. The total incentive pool was allocated to each of the measures (separately for achievement and improvement) based on the percentages shown in Appendix Table 2 below. Providers could earn incentive payments for achievement on some measures and improvement on other measures.

Table A.1.2. Quality Measures Used in Home Health Value-Based Purchasing Program

Quality Measure	Achievement Pool	Improvement Pool	Total
Incidence of Acute Care Hospitalization	22.5 %	7.5 %	30 %
Incidence of Any Emergent Care	15 %	5 %	20 %
Improvement in Ambulation / Locomotion	7.5 %	2.5 %	10 %
Improvement in Bathing	7.5 %	2.5 %	10 %
Improvement in Management of Oral Medications	7.5 %	2.5 %	10 %
Improvement in Status of Surgical Wounds	7.5 %	2.5 %	10 %
Improvement in Transferring	7.5 %	2.5 %	10 %
Total	75 %	25 %	100 %

To maintain consistency with the hospital and nursing home programs, which map a single composite quality score to a single incentive payment, we modified the design of the home health program to mimic the hospital VBP program. We preserved the use of the 7 quality measures and the relative weights of these measures from the home health demonstration, but followed the hospital VBP approach to allocating payments. Specifically, the approach for computing quality scores, based on the hospital program, proceeded in 3 steps.

First, we computed "achievement" and "improvement" scores for each quality measure. We used the 7[9] process and outcome quality scores that were identified in the home health demonstration.

- $q_{im}^{Achieve}$ is the achievement score for provider i for measure m. This was calculated according to the equation: $q_{im}^{Achieve} = 9 \cdot \left(\frac{s_{im} - k_m^{Achieve}}{k_m^{Bench} - k_m^{Achieve}}\right) + 0.5$ and rounded to the nearest whole number. s_{im} is the reported value of the quality measure in the current year, k_m^{Bench} is the mean of the top decile of the distribution for measure m in the

baseline year, and $k_m^{Achieve}$ is the median of the distribution for measure m in the baseline year.

- $q_{im}^{Improve}$ is the improvement score for provider i for measure m. This was calculated according to the equation: $q_{im}^{Improve} = 10 \cdot \left(\frac{s_{im} - s_{im}^{Baseline}}{k_m^{Bench} - s_{im}^{Baseline}}\right) - 0.5$ and rounded to the nearest whole number. s_{im} is the reported value of the quality measure in the current year, $s_{im}^{Baseline}$ is the reported value of the quality measure in the baseline year, and k_m^{Bench} is the mean of the top decile of the distribution for measure m in the baseline year.

Second, we computed composite quality scores for subsets of similar quality measures. In the hospital VBP program, there were separate scores for "Patient Experience of Care" measures and "Clinical Process of Care" measures. In adapting this to the home health case, we computed separate scores for the 2 "Clinical Outcome" measures (ie, Incidence of Acute Care Hospitalization and Incidence of Any Emergent Care) and the remaining 5 "Clinical Process of Care" measures. To compute the "Clinical Outcome" score, we first took the maximum of the achievement or improvement score for each of the 5 measures (each on a 0-10 point scale). We then divided the sum of these maximum scores by the total number of points possible to generate a score from 0-10.[10] The "Clinical Process of Care" score was computed analogously.

Third, we computed the overall composite quality score: Total Quality Score = 0.5* Clinical Process of Care + 0.5* Clinical Outcome. We used weights equal to 0.5 to mimic the weights used for the process (0.3 + 0.2) and outcome (0.1 * 5) measures in the home health demonstration as shown in Appendix Table 1.2.

The key limitations in applying the hospital algorithm to compute home health scores were: (1) achievement and improvement are weighted 3:1 in the home health demonstration, but get equal weight in the hospital VBP program (ie, the maximum of achievement and improvement is selected); (2) the measures "Incidence of Acute Care Hospitalization" and "Incidence of Any Emergent Care" measures are weighted 3:2 in the home health demo, but get equal weight in the hospital VBP program; 3) providers can receive incentive payments for some quality measures and not others in the home health demonstration, but receive incentive payments based on only a composite quality score in the hospital demonstration.

Nursing Homes

Our nursing home P4P program is based on the CMS Nursing Home Quality-Based Purchasing Demonstration[11], which was implemented in 3 states (Arizona, New York, and Wisconsin) and 171 nursing homes between July 2008 – June 2012. A detailed description of the Demonstration can be found elsewhere.[12]

The demonstration was designed to ensure budget neutrality, but used a different design from other Medicare P4P programs. The incentive pool is created by the money Medicare saves via avoidable hospitalizations. The assumption is that nursing homes that improve quality will drive decreases in avoidable hospitalizations. An incentive pool was created for each year for each State in the demonstration. The incentive pool was the savings in excess of 2.3% of total Medicare expenditures.

In the Demonstration, nursing homes' performance was assessed on 4 domains: 1) staffing, 2) appropriate hospitalizations, 3) outcome measures, and 4) survey deficiencies (Table A.1.3).

Table A.1.3. Quality Domains Used in Nursing Home Quality-Based Purchasing Demonstration

Quality Domain	Total
Staffing	30 points
Hospitalization	30 points
Resident Outcomes	20 points
Survey Deficiencies	20 points
Total	100 points

Each domain had specific quality measures and unique point allocations (Table A.1.4). For example, for staffing, there were 3 measures, registered nurse hours per resident day (10 points), licensed nursing staff staffing (5 points), total nursing hours per day (divided into licensed nursing and certified nurse assistant, 5 points each), and nursing staff turnover (10 points). The nursing homes were ranked to generate a point total using the following formula: # of points = percentile rank*.10. Nursing homes obtained an extra 0.1 points if they were in the 99th percentile. In contrast, for the resident outcome measures, a nursing home received zero points if they were at or below the 5th percentile and the maximum points at or above the 95th percentile. Within the 5th and 95th percentile they used the following formula, points earned = maximum number of points for measure * (nursing home value for measure-5th percentile value of measure)/(95th percentile value of measure -5th percentile value of measure).

Separate measures were included for residents with short versus long stays. Some nursing homes only care for short-stay or long-stay residents. There were also minimum requirements for how many measures on which a nursing home must be rated upon for the nursing home to be eligible for P4P.

An overall achievement and improvement score were generated from the total points obtained from each measure. Nursing homes with an overall performance that was in the top 20 percent of *achievement* received incentive payments. Nursing homes in the top 20 percent of *improvement* would qualify for a performance payment in recognition of their improved performance, as long as their performance level was at least as high as the 40th percentile. Among nursing homes in the top 20 percent, nursing homes in the top decile received more payments than those in the second decile.

To maintain consistency with the hospital and home health programs, we made several key changes to the nursing home program. First, several of the quality measures were not available to us (Table A.1.4). For example, the staff turnover measure was based on direct payroll data from the nursing homes, which is not publicly available for all nursing homes. We re-weighted each of 3 domains for which we had quality measures, 43% staffing, 29% resident outcomes, and 29% survey deficiencies.

Second, we mimicked the inpatient P4P program's design when generating achievement and improvement scores (details are available elsewhere and outlined in the hospital section above[7]). In short, for each quality measure, we generated an achievement and benchmark thresholds. The achievement threshold was the median performance in the base year. The benchmark was the mean performance among the top decile of performers in the base year. The achievement score for a nursing home for given measure was 0 to 10 points. If the nursing home scored below the achievement threshold they received 0 points. If the nursing home scored above the benchmark threshold they received 10 points. Nursing homes that scored between the achievement and benchmark thresholds received 1 to 9 points. Each nursing home received an

improvement score = (9*(current year's core – base year's score)/(benchmark threshold – base year's score))-0.5. All scores were rounded to nearest whole number. For each measure, the nursing home was assigned the greater of the achievement and improvement score. If there were no base-year data, the nursing home could only receive an achievement score. For staffing measures, there were no base year data. We calculated both the achievement and benchmark thresholds using the most recent data.

Table A.1.4. Quality Measures Used in Nursing Home Quality-Based Purchasing Demonstration by Domain

Quality Measures	Included in RAND Modeling
Domain: Nurse Staffing	
Nursing hours per resident day	X
Total nursing hours per resident day	X
Total nursing staff turnover percentage	
Domain: Hospitalizations	
Percent of residents w/ a potentially avoidable hospitalization	
Percent of residents w/ a potentially avoidable hospitalization	
Domain: Residency Outcomes	
Percent of residents whose need for help with daily activities has increased	X
Percent of residents whose ability to move about in and around their room worsened	X
Percent of high risk residents who have pressure sores	X
Percent of residents who had a catheter inserted and left in their bladder	X
of residents who were physically restrained	X
Percent of residents w/ improving level of ADL functioning	x[13]
Percent of residents who improve status on mid-loss ADL functioning (transfer, locomotion) or remain completely independent in mid-loss ADLs	x
Percent of residents with failure to improve bladder incontinence	X
Domain: Survey Deficiencies	
Survey performance score	X[14]

Finally, we calculated a total score for each domain and then based on the domain weights noted above, calculated a total quality score for each provider.

How the Behavioral Response Was Modeled

Modeling the behavioral effects of P4P on quality presented a challenge. Despite widespread interest in P4P, research on CMS demonstrations and private-sector P4P programs has found that P4P programs have had, at most, a modest impact on overall quality.[15-17] However, it is possible that larger payment incentives and permanent programs, rather than demonstrations, will lead to

larger effects. To incorporate behavioral effects of the policy (ie, changes in quality), under Scenario 4, we assumed there will be an overall improvement in quality by on average 10% across all providers. We also assumed that the improvement would be largest among those who started at a low baseline and smallest among those who had the highest quality at baseline, thus narrowing the quality gap. To do this we reduced the gap between a provider's quality score at baseline and the maximum possible score by 5%, ie:

$$Quality\ Score' = Quality\ Score + (Max\ Possible\ Score - Quality\ Score) * 0.05.$$

This approach generated an average increase in quality scores of nearly 10% for the 3 provider types. Many of the quality metrics are scaled from 0 to 100% and the top providers are already at 100%. This "ceiling effect" constrains any quality improvement among these top providers. Together these modeled changes compressed the distribution of quality across providers and therefore led to less re-distribution of money across HRRs.

How Incentive Dollars Were Allocated to Providers

In our next step, we computed incentive payments as a function of each provider's composite quality score. Providers did not receive incentive payments if they were ineligible for the P4P program or did not report quality measures. For example, the hospital P4P program excludes hospitals with fewer than30 hospitalizations in a year for the conditions studied and those hospitals designated by Medicare as critical access hospitals (CAHs).

Incentive payments were computed as a percentage of baseline Medicare payments for each provider. The hospital VBP program uses the base operating diagnostic-related group (DRG) payment amount as the baseline, and we follow this approach. Using the 100% Medicare claims files, we calculated providers' total payments from Medicare in 2008 subtracting DSH, IME, and outlier payments. We then subtracted 2% or 15%, (conservative or robust programs, respectively) of all payments to all providers in the nation. This created a pool of incentive dollars. The incentive pool dollars were then allocated across providers by either the tournament or linear exchange curve mechanisms.

In the tournament mechanism, we identified the top 20 percent of providers in terms of their composite quality scores. The top 20 percent received payments from the incentive pool, while the remaining providers each experienced a loss of 2% or 15%. Each provider's share of the incentive dollars was proportional to the share of total Medicare reimbursement received by the provider in that year.

In the linear exchange curve method, we allocated incentive dollars on a continuum. Providers with the worst performance receive no incentives and as performance increases providers get larger and larger incentives. Incentives were allocated to providers as a percentage increase proportional to their composite quality score. The slope of the linear exchange function was set to achieve budget neutrality based on total Medicare reimbursement. Again, total Medicare reimbursement was based on reimbursement calculated from the base rate, excluding DSH, IME, and outliers.

Finally, we summed the incentive payments for each provider with their base payment and their adjustment payments (IME, DSH, and outliers) to compute total Medicare payments under each P4P scenario. The baseline is simply the total payments for each provider from the 100% claims data. For providers who were ineligible for P4P (eg, missing quality measures), their total Medicare payments stayed constant under P4P.

Aggregating Incentive Payments to the HRR Level

After determining each provider's total payments, both under the baseline and each of the P4P scenarios, we allocated those payments to HRRs based on the zip code of residence of the beneficiary. We then summed total payments within each HRR for hospitals, nursing homes, and home health providers. To compute total Medicare payments for HRRs, we used the 2008 IOM HRR-level spreadsheet. We applied the incentives as a percentage change in base payments to the IOM data for hospitals, nursing homes, and home health and then added all other Medicare payments (eg, physician services, prescription drugs, durable medical equipment, etc.) to these totals by HRR. Given small differences in study samples between the claims data and the IOM data, we applied a scalar adjustment factor to normalize our claims data to sum to the total payments in the IOM data for hospitals, nursing homes, and home health.

The HRR total Medicare payments and component payments were used to calculate measures of regional variation in spending (eg, coefficient of variation, ratio of 75^{th} to 25^{th} percentile costs) at baseline and under the modeled policies. These values were also used to describe the characteristics of HRRs and providers experiencing large and small changes in Medicare payments.

1.2 – Pay-for-Performance (P4P) Scenarios

Summary of Scenarios in Models

Table A.1.5 below summarizes the 5 scenarios that were modeled. Scenarios 1 and 2 both assumed that 2% of total payments are allocated as incentive payments, but they varied the method by which incentives are allocated. In Scenarios 3 and 4 we assumed that 15% of payments are allocated as incentives. We did not model a tournament style allocation of incentives under the robust program because such a large shift of dollars to a small set of providers does not seem realistic. We only modeled a behavioral response under the more robust program (15% of payments tied to incentives) where such a response is more likely. Scenario 5 is similar to Scenario 3, but we excluded area-level adjustments, medical education, and DSH from provider payments.

Table A.1.5. P4P Scenarios Modeled

	Scenarios				
	1	**2**	**3**	**4**	**5**
Fraction of spending in incentives					
Conservative program – 2%	X	X			
Robust program – 15%			X	X	X
How incentives are allocated					
Only top performers (tournament style)	X				
Linear exchange function		X	X	X	X
Behavioral response					
No	X	X	X		X
Yes				X	
Payment adjustments					
Includes all adjustments	X	X	X	X	
DSH/IME and geographic adjustments not included					X

S1 Conservative program, tournament style, with all adjustments.
S2 Conservative program, linear exchange function, with all adjustments.
S3 Robust program, linear exchange function, with all adjustments.
S4 Robust program, linear exchange function, with quality improvement behavioral response and all adjustments.
S5 Robust program, linear exchange function, without DSH/IME and geographic adjustments.

1.3 – Pay-for-Performance (P4P) Scenario Results

Results from the above 5 scenarios are shown in Table A.1.6 below. Scenario 5 is compared with a separate baseline resulting from the standardized spending adjustments.

Table A.1.6. Impact of P4P Programs on Total per Beneficiary Medicare Spending and Geographic Variation in Spending

	Actual Medicare Spending					Standardized Medicare Spending	
	Baseline	**Scenario 1 (Tourn, 2%)**	**Scenario 2 (Linear, 2%)**	**Scenario 3 (Linear, 15%)**	**Scenario 4 (Behav, Linear, 15%)**	**Baseline**	**Scenario 5 (Linear 15%)**
Per Medicare Beneficiary Spending (Mean $2008)	9036.9	9036.9	9036.9	9036.9	9036.9	8660.3	8660.3
Coefficient of Variation (Across HRRs)	0.171	0.172	0.171	0.171	0.171	0.159	0.160
75th/25th (Across HRRs)	1.229	1.227	1.228	1.226	1.226	1.224	1.221

APPENDIX SECTION 2 – BUNDLED PAYMENT

2.1 – Bundled Payment (BP) Methods

Constructing Historical Bundled Episodes

The bundled payment baseline and modeled scenarios are all based on historical spending patterns. Our first step was to calculate bundle costs using 2007 to 2008 Medicare claims data.

Data Sources

The base data for the analysis consisted of the following: 100% MedPAR FFS claims for acute hospitals, skilled nursing facilities, inpatient rehabilitation facilities, and long term care hospitals; 100% home health standard analytic files (SAF), 5% Carrier SAF claims, 5% Outpatient SAF claims, and 5% Inpatient SAF claims. We also used the 100% Medicare denominator file, provider of services files, and Acute and Inpatient Rehabilitation Facility Impact files.

Episode Definition

Bundled episodes were identified by acute inpatient discharges and included the index hospitalization and other services provided during a 30-day post discharge period. We examined inpatient discharges occurring from December 2, 2007 through December 1, 2008 (with episode end dates spanning from January 1 through December 31, 2008). We included acute hospitalizations for all of the 27 MS-DRGs associated with the 10 study conditions, which were chosen on the basis of high historical Medicare utilization of acute and post acute care (Appendix Table A.2.1). Specifically, these 10 conditions were among the top twenty in terms of volume of hospital stays in FY 2007 and 2008.[18] The 10 conditions include the top 5 conditions in terms of volume and 5 other conditions that were either high volume users of post acute care (eg, stroke, hip fracture) or served as important examples of medical conditions (eg, acute myocardial infarction). The MS-DRG system was implemented in FY 2008 (starting in October 2007). There were no substantive changes in the definitions for FY 2009 (starting in October 2008) that affected the conditions in our sample.

Table A.2.1. Clinical Conditions and Related MS-DRGs Included in the Hypothetical Medicare Bundled Payment Program

Condition	MS-DRGs
Acute Myocardial Infarction	280, 281, 282
Congestive Heart Failure	291, 292, 293
Chronic Obstructive Pulmonary Disease	190, 191, 192
Gastrointestinal Bleed	377, 378, 379
Hip Fracture	480, 481, 482
Kidney/Urinary Tract Infection	689, 690
Lower Extremity Joint Replacement	469, 470
Pneumonia	193, 194, 195
Septicemia	871, 872
Stroke	064, 065, 066

Exclusions

We made the following exclusions:

- Episodes triggered by index stays (in the first month) that were themselves 30-day readmissions for prior index stays prior to our sample period.
- Index stays in IPPS exempt acute hospitals (ie, critical access hospitals), although we counted readmissions in such hospitals. We use the last 4 digits of the Medicare provider number to identify provider types: we categorize IPPS facilities as code ranges 0001-1199 and 1300-1399.
- Index stays in Maryland hospitals or beneficiaries from Maryland.
- Index stays outside of 50 states +DC
- Index stays that were transfers
- Patients who died in the hospital
- Beneficiaries without continuous Part A and B during 2007 or 2008 (based whether the index hospital discharge occurred in 2007 or 2008). If patients died, we required continuous Part A and Part B up through the month when they died.
- Aged into Medicare during 2007 or 2008 (depending on year of index hospital discharge)
- Any months of MA enrollment in 2007 or 2008 (depending on year of index hospital discharge)
- Medicare eligible because disabled or ESRD in 2007 or 2008 (depending on year of index hospital discharge)

Identifying Bundled Services: 100% Data

For the services covered in the 100% data (listed below), we used study-assigned beneficiary identifiers to identify utilization in the 30-day period following the discharge from the index hospitalization. Again, we identified provider types using the last 4 digits of Medicare provider numbers. Specifically, we identified the following services in the 100% data:

- Acute inpatient facility (readmissions): acute hospital admissions for a beneficiary with dates of admission <30 days from the discharge date of the index discharge (we include psych hospitals, cancer hospitals, and critical access hospitals in this definition, although they form a small proportion of total readmissions).
- Long term care hospital (provider number 2000-2299) admissions <30 days from discharge date
- Inpatient rehabilitation facility (provider number 3025-2099) and admissions<30 days from discharge date
- Skilled nursing facility (provider numbers 5000-6499) and admissions<30 days from discharge date
- Home health: admissions<30 days from discharge date of index discharge
- If post acute episodes straddle the 30-day post discharge period, then we only include the prorated amount occurring within the 30-day post discharge period in the historical episode spending.

Identifying Bundled Services: 5% Data

We only had access to 5% Carrier and Outpatient claims. As a result, we calculated geographic cell-level carrier and outpatient measures for each MS-DRG, which we then merged into the bundle-level file. The specific services we obtain from the 5% claims include outpatient, ambulatory surgery center, evaluation and management, procedures, imaging, lab use, other

tests, Part B drugs, and other Part B use. We more precisely describe the identification of specific services in the adjustment methodology section below.

The construction of cell-level averages from the 5% claims data occurred as follows. First, we identified eligible acute discharges in the 5% Inpatient SAF claims data. Then, using study-assigned beneficiary-IDs we linked the discharges to service use in the Carrier and Outpatient 5% claims. Then, we take geographic means from the 5% data. Due to small sample sizes, we use a hierarchical approach and use the smallest geographic area that has at least 20 episodes for the MS-DRG: HRR, state, census division. In HRRs where a smaller geographic area has at least 10 episodes and the next larger geographic area has at least 20 episodes, we used the average of the 2 geographic area means.

Strategy to Incorporate CMS Payment Adjustments

Adjustments Overview

In each rate-setting approach, we adjusted the national base rate to reflect geographic variation in wages, input prices, the presence of medical training programs (IME payments), the proportion of low-income patients (DSH payments), and other adjustment factors used by Medicare. CMS is likely to incorporate such adjustments in the implementation of a bundled payment policy, resulting in some degree of geographic variation in episode spending even with a national rate. This section outlines our approach for making such adjustments.

Approach

IOM has published standardized and unstandardized payments by type of service (eg, acute, skilled nursing, inpatient rehabilitation, etc.) by HRR in 2008. For each HRR, we calculated "adjustment ratios" for each type of service that reflect all the adjustments made to Medicare payments. For example, if the national base payment rate for the skilled nursing component of a bundled payment was $200 and the adjustment ratio for skilled nursing in a HRR was 0.9, the bundled payment amount for the skilled nursing component of bundles for patients in that HRR would be $200*0.9 = $180. The steps for creating the adjusted national base rates for each HRR are outlined below.

Step 1: Find the unadjusted national base rate.

We calculated the unadjusted national base rate as a 5% reduction on the national median of historical Medicare payments across episodes. Specifically, we included acute inpatient payments plus skilled nursing, inpatient rehabilitation, home health, long-term care hospital, outpatient, and carrier payments occurring within 30 days of acute discharge.

Step 2. Distribute the national base rate into separate components for each care setting.

Next, we found the average fraction of total episode payments corresponding to each care setting (acute, skilled nursing, etc.) across episodes for the entire nation. We applied these fractions to the unadjusted national base rate to create separate payment components for each care setting.

Step 3. Create HRR-level actual-to-standardized spending ratios for each care setting

The CMS-constructed database, "Table 1: HRR Level Demographic, Cost, Utilization, and Quality Data"[19] includes HRR-level actual and standardized spending for each component of the national base rate (inpatient, SNF, IRF, LTCH, outpatient, and carrier payments), where the standardization adjusts for differences in local wages or other input prices, extra payments for providers serving low-income populations or training doctors, and other adjustments.[20] We used

these measures to create actual-to-standardized spending ratios (the "adjustment ratios") for each care setting. These ratios reflect price and other adjustments for a given care setting in each HRR relative to the national standard.

Step 4. Adjust each payment component by the actual-to-standardized ratio to create HRR-specific adjusted base rates by care setting.

We multiplied the unadjusted base payments for each care setting by the actual-to-standardized ratios to create HRR-specific adjusted payments for each care setting. While the mapping from components of the national rate to adjustment ratios is straightforward for the facility payments (eg, inpatient hospital, IRF, SNF etc.), it is more complicated for the Outpatient and Carrier claims. The table below describes the mapping of outpatient and carrier claims and the associated ratio constructed from the IOM database.

Table A.2.2. Carrier and Outpatient Bundle Components and Associated Adjustment Ratio

Component	Spending measures	Adjustment ratio definition constructed from IOM database
Outpatient	All claims in Outpatient file	Hospital outpatient (OP) actual Medicare costs (facility payments for outpatient visits paid under the outpatient prospective payment system and outpatient visits at CAHs)
ASC	Carrier claims with LINE_PLACE_OF_SRVC_CD = '24' for "Ambulatory Surgical Center" and LINE_CMS_TYPE_SRVC_CD = 'F' for "ASC facility usage for surgical services" and PRVDR_SPCLTY = '49' for "Ambulatory Surgical Center" (This category should have hierarchical precedence over other carrier service types, ie, services that meet ASC criteria and also have BETOS codes listed below should be assigned to ASC only)	Ambulatory Surgery Center (ASC) actual Medicare costs
E&M	Carrier claims with BETOS = M**	Evaluation and Management (E&M) actual Medicare costs (physician claims for office visits, hospital visits, ER visits, nursing home/home visits, specialist visits, and consultations)
Procedures	Carrier claims with BETOS = P** except Anesthesia	Procedure (PROC) actual Medicare costs (physician claims for major other procedures, major cardio procedures, major orthopedic procedures, eye procedures, ambulatory procedures, minor procedures, oncology procedures, endoscopy, and dialysis)
Imaging	Carrier claims with BETOS = I**	Imaging (IMG) actual Medicare costs (advanced imaging, standard imaging, echography, and imaging procedures)
Lab	Carrier claims with BETOS = T1*	Lab Tests (LABTST) actual Medicare cost
Other Tests	Carrier claims with BETOS = T2*	Other Tests (OTHTST) actual Medicare cost

Component	Spending measures	Adjustment ratio definition constructed from IOM database
Part B drugs	Carrier claims with BETOS: 01D chemotherapy 01E other drugs	Part B Drug (DRUG) actual Medicare cost (drugs paid for under Medicare Part B; does not include payments made to plans under Medicare Part D)
Part B other	All other carrier claims (except DME) including: P01 Anesthesia 01B chiropractic 01C enteral and parenteral	Part B Other (OTHER) actual Medicare cost (anesthesia, ambulance services, chiropractic services, enteral and parenteral nutrition services, vision/hearing/speech services, and services provided in outpatient rehab facilities, comprehensive outpatient rehab facilities, and community mental health centers)

BETOS = Berenson-Eggers Type of Service codes. This is a system used to categorize claims.[21]

Step 5. Aggregate the adjusted care components within HRR to create HRR-specific adjusted national base rates.

Finally, we aggregated the adjusted payment components across care settings included in the episode to create an HRR-specific adjusted national payment rate.

An alternative approach to Steps 1-5 would involve (1) calculating a 5% reduction off of median payments for each care setting (or some discount off of median payments in each care setting), (2) adjusting each component using the HRR-specific adjustment factors, and (3) summing adjusted components across care settings to create the HRR-specific adjusted national payment rate. However, the sum of median payments in each care setting does not necessarily equal the median of overall bundled episode spending. We thought it was conceptually clearer to base the bundled rate as a percentage reduction off the median of historical bundled episode payments rather than the sum of median component payments. The results are unlikely to vary significantly between the 2 approaches.

Strengths and Weaknesses of Standardization Approach

This approach is straightforward to implement and the standardization is consistent with that in the baseline CMS database. In reality, these adjustments would be made at a provider rather than HRR-level, but this approach preserves variation in spending at the HRR-level, which is the outcome of interest for the study.

Our results for Scenario 3 (lower of the national base rate and a hospital-specific historical payment) may differ from an approach that makes adjustments at the provider level. However, we do not anticipate this to dramatically impact estimated changes in geographical variation in spending.

Calculation of HRR-Level per Beneficiary Medicare Spending on Bundled Services and HRR Level Total Medicare Spending Under Baseline and Alternative Scenarios

Our main results are HRR-level per beneficiary Medicare spending on bundled services and total per beneficiary Medicare spending at baseline (ie, under historical episode spending) and under each alternative payment rate scenario. In each case, we start with episode-level data with the historical payment and each alternative rate. Then, we aggregate the episode-level data to the HRR-level.

For results examining per-beneficiary Medicare spending on bundled services, we divided the aggregate spending by the number of Medicare beneficiaries in the HRR (from the IOM spreadsheet described in the prior section). Then, we calculated average per-beneficiary spending across HRRs (weighted by the number of beneficiaries) and variation in per-beneficiary spending across HRRs as measured by across-HRR coefficient of variation (using HRR-level standard deviation divided by the unweighted across-HRR mean) and the 75th to 25th percentile (in the HRR-level distribution).

For results examining per-beneficiary total Medicare spending, we calculated *changes* in aggregate HRR-level payments under each payment rate scenario relative to the baseline case. Then, we applied these changes to the total Medicare spending from the IOM spreadsheet to find the new level of total Medicare spending, and divide by the number of beneficiaries. Finally, we found average across HRR total Medicare spending per beneficiary (weighting by number of beneficiaries), the HRR-level coefficient of variation, and 75th to 25th payment ratio (in the HRR-level distribution).

Standardization Strategy in Provider-Level Episode Comparisons

Finally, we compared standardized measures of Medicare spending for each component of the bundle at the provider level. In order to ensure that the provider-level results are not driven by low-volume providers, we enforced a volume threshold of 10 to be included in the analysis. Because these comparisons are at the provider rather than HRR-level, the HRR-level adjustment factors are less appropriate. Instead, we used an approach developed by Gottlieb et al.[22] to standardize each component of the bundle. Due to missing information needed to construct standardized payments, we drop 6% of episodes compared with the analyses with non-price standardized data.

Wage Index

First we generated a wage index measure. We used the CBSA-specific Medicare wage index for 2008. Then we found the following adjusted wage index.

$$WI_m = 0.25+0.75*(\text{CBSA wage index}) \qquad (1)$$

Initial Acute Payments

To generate the index hospitalization standardized payments, we calculated (2) below:

Acute hospital expenditures (HE) for condition *k* for individual *i* and region *j*

$$HE_{ikj} = P * DRG_k + OUTLIER_{ik}/WI_j \qquad (2)$$

P = national DRG price in FY 2008 or 2009
DRG_k = the weight for procedure *k*
OUTLIER is the outlier payment on claim
WI index factor calculated in (1)

Readmission Acute Payments

We used the same formula as in the initial acute, using the relevant MS-DRG weight if it is a different than the original, but prorating the amount if the episode straddled the 30-day post discharge period.

Skilled Nursing Payments

For skilled nursing we normalized actual payments by the wage index in 1. Again, we prorated if the skilled nursing stay straddles the 30-day post discharge period.

Standardized payments = Actual payments/ wage index

Long-Term Care Hospital Payments

For long-term care hospitals, similar to skilled nursing, we normalized the actual payments by the wage index in (1), and then prorate.

Standardized payments= Actual payments (including outliers)/ wage index

Home Health Payments

Gottlieb does not propose a standardization approach for home healthcare.[23] We used the same wage-index methodology because labor adjustments are applied to 77% of home health payment close to the 75% weighting in the formula above.

Standardized payments = Actual payments / wage index

Inpatient Rehabilitation Facilities

For IRFs, we took total payments, subtracted IME and DSH adjustments from the claim, and deflated any "rural" adjustment to the payment. Then, we adjusted by the wage index as above. Finally, we prorated if the IRF stay straddled the 30-day post discharge episode.

2.2 – Bundled Payment (BP) Scenarios

Modeling Alternative Bundled Payment Rates

We modeled 7 scenarios that primarily varied the method used to determine the bundled payment rates (Table 3.2). The first bundled payment scenario is a single national base rate. The base rate for each bundle (defined by MS-DRG) was calculated as a 5% discount off the national median Medicare payment amount. This scenario is consistent with a fully implemented Medicare prospective payment system for bundled care.

Table A.2.3. Bundled Payment Scenarios Modeled

	Scenarios						
	1	**2**	**3**	**4**	**5**	**6**	**7**
Minimum volume threshold for participation							
No minimum volume threshold	X						X
Provider≥10 bundles for each MS-DRG		X	X	X	X	X	
How bundled payment rate will be determined							
National base rate (5% reduction off historical median)	X	X				X	X
Lower of national base rate or hospital-specific historical rate			X				
Blend of national base rate, hospital-specific				X			
Budget-neutral national rate					X		
National rate, acute + post acute only						X	
Geographic price adjustments							
Includes all adjustments	X	X	X	X	X	X	
DSH/IME and geographic adjustments not included							X

S1. National base rate with payment adjustments.
S2. National base rate with payment adjustments and a volume threshold ≥10.
S3. Lower of national and historical provider payment, volume threshold ≥10.
S4. Blend of national and historical provider payment, volume threshold ≥10.
S5. National base rate with payment adjustments, volume threshold ≥10, budget neutral.
S6. National base rate with payment adjustments, volume threshold ≥10, post acute only.
S7. Price standardized national rate, no volume threshold.

The second bundled payment scenario is identical to Scenario 1 but includes a minimum volume threshold of 10 bundles per year. Any hospital that provides fewer than 10 of a particular MS-DRG would continue to receive status quo payments for that bundle. This scenario is designed to limit the financial risk of bundled payment to low-volume providers.

The third scenario sets a payment rate that is the minimum of: a) the national base payment rate from Scenario 2 and b) the provider-specific baseline payment. That is, if providers' baseline payments are above the national base rate, then they receive the adjusted base rate; otherwise they receive their baseline payment. This approach is similar to payments under the Tax Equity and Fiscal Responsibility Act, in which hospitals were paid based on incurred costs subject to a limit.

The fourth scenario uses a blend of 50% of the adjusted national base price (as in Scenario 2) and 50% of the hospital-specific baseline payment. This scenario is similar to periods of transition to Medicare prospective payment systems, where providers have typically been paid a blended payment, with the proportion of the payment for the national base price increasing over time. Therefore, this approach would represent a plausible near-term scenario where Medicare would be in the midst of a transition to a national bundled payment rate.

The fifth scenario is a budget-neutral version of Scenario 2. It uses a national base rate and a minimum volume threshold, but then applies a global adjustment factor so that total payments

for bundled services do not change relative to the status quo. In contrast to the other scenarios, in Scenario 5 we are assuming that Medicare will choose to implement a bundled payment program that does not reduce overall spending.

The sixth scenario includes only the index hospitalization plus post acute care and additional hospitalizations occurring within 30 days of acute discharge. This scenario reflects a bundled payment program that includes facility-based providers, preserving status quo payment methods for physician professional services. This approach recognizes that a facility-based program may be more feasible than a program including physicians, while achieving many of the benefits, since the majority of spending in bundles is for facility-based services.

Finally, the seventh scenario is equivalent to the first scenario (national rate without a volume threshold), but unlike the other 6 scenarios, prices are standardized to remove payment amounts related to area input prices, medical education, and disproportionate share hospital status on geographic variation in spending. This scenario allows one to distinguish geographic variation in spending that is due to the volume of bundles versus geographic variation in payment rates per bundle.

These 7 scenarios fall into 3 general categories: (1) a national rate, (2) the lower of national and historical provider payment, and (3) a blend of the national rate and historical provider payment. In this section, we discuss the construction of each general case, and specific details of individual scenarios.

National Rate (S1, S2, S5, S6, S7)

Scenario 1:

- Step 1: Calculate total episode payments for each historical bundled episode (acute inpatient payments plus skilled nursing, inpatient rehabilitation, home health, long-term care hospital, outpatient, and carrier payments)
- Step 2: Find the median episode payment, reduce by 5% to create unadjusted national base rate
- Step 3: Find the average proportion of total episode payments in each care setting (eg, fraction acute inpatient, SNF, IRF, etc)
- Step 4: Multiply fraction for each care setting by unadjusted national base rate to produce base payment components by care setting.
- Step 5: Adjust each base payment component by HRR-level adjustment factor (described in next section) to create HRR-specific adjusted base payment components.
- Step 6: Aggregate across care-settings to create adjusted national base rate

How Scenario 2 Differs from Scenario 1

Acute providers with fewer than 10 cases are exempt from policy; we assumed that each episode receives historical payment.

How Scenario 5 Differs from Scenario 1

Acute providers with fewer than 10 cases are exempt from policy; we assumed that for each episode receives historical payment. It is budget neutral, so we used the mean episode payment in Step 2. In addition, after Step 6 we applied a global adjustment factor to enforce that mean episode payment under policy is equal to pre-policy mean.

How Scenario 6 Differs from Scenario 1

Acute providers with fewer than 10 cases are exempt from policy; we assumed that each episode receives historical payment. Only the index hospitalization, readmissions, and post acute care were included in the bundle.

How Scenario 7 Differs from Scenario 1

It is price standardized, so we used the unadjusted national base rate as the new rate. Baseline scenario is standardized by a weighted average of the inverse of the HRR-level adjustment factors for each component (described in next section).

Lower of Adjusted National Base Rate and Hospital-Specific Historical Spending (S3)

- Step 1: Find the average historical episode payment for each discharging acute provider.
- Step 2: Find the lower of the average provider historical episode payment and the adjusted national base rate, and this will be the payment rate.
- Step 3: If a discharging acute provider has a volume less than 10, then each episode for that provider will receive the historical episode payment.

Blend of Adjusted National Base Rate and Hospital-Specific Historical Spending (S4)

- Step 1: Payment rate is 50% adjusted national base rate and 50% provider-level historical episode spending.
- Step 2: If a discharging acute provider has a volume less than 10, then each episode for that provider will receive the historical episode payment.

2.3 – Bundled Payment (BP) Scenario Results

Table A.2.4. Impact of Bundled Payment on Total per Beneficiary Medicare Spending and Geographic Variation in Spending

	Scenarios									
	B1-5	**S1**	**S2**	**S3**	**S4**	**S5**	**B6**	**S6**	**B7**	**S7**
Spending on bundled services per beneficiary (% decrease)	$9037	$8844 (2%)	$8865 (2%)	$8845 (2%)	$8951 (1%)	$9037 (0%)	$9037	$8874 (2%)	$8660	$8383 (3%)
Coefficient of variation (across HRRs)	0.171	0.167	0.166	0.168	0.169	0.165	0.171	0.167	0.159	0.156
75th/25th (Across HRRs)	1.229	1.213	1.213	1.218	1.222	1.214	1.229	1.214	1.224	1.215

B1-5 Base case for Scenarios 1-5
S1 National rate, no volume threshold
S2 National rate, volume ≥10
S3 Lower of national and historical rate, volume ≥10
S4 Blended rate, volume ≥10
S5 National rate, budget neutral, volume ≥10
B6 Base case for Scenario 6
S6 National rate, acute and post acute only, volume ≥10
B7 Base case for Scenario 7
S7 Price standardized national rate, no volume threshold

APPENDIX SECTION 3 – ACCOUNTABLE CARE ORGANIZATIONS (ACO)

3.1 – ACO methods

We describe first our methods for the analysis of the geographic distribution of beneficiaries assigned to ACOs and the savings to the Medicare program that could result, at the level of the HRR. We describe separately the methods used for assigning beneficiaries to Medicare ACOs, private ACO-like entities, and 'projected' or forecast ACOs. To be consistent with the other 2 policy interventions, we excluded HRRs located in Maryland from our analysis.

Geographic Distribution of Beneficiaries Covered by Medicare ACOs

We first estimated the geographic distribution of the beneficiaries covered by ACO's participating in Medicare's existing ACO programs. For the Pioneer ACO program, data on the geographic distribution of beneficiaries were obtained directly from representatives for the Centers for Medicare and Medicaid Innovation (CMI).

However, similar data on ACOs participating in the Medicare Shared Savings (SSP) program were not available and consequently had to be approximated using several sources of data as described in the following section.

CMS selected ACOs to participate in the SSP program in 2 rounds. The first round was completed in April 2012 and covered 27 ACOs. In their announcement, the agency provided information on the number of beneficiaries expected to be managed by each of the participating provider organizations. However, information on the locations of each ACO's beneficiaries was not released. In order to approximate the HRR locations of the beneficiaries for the April ACOs, we started by using each ACO's website and physician network search engines to estimate the number and location of each ACO's primary care providers (PCPs), specifically those physicians specializing in internal medicine, family medicine, and geriatric medicine. The beneficiaries covered by each ACO were then allocated to HRRs in proportion to the geographic location of the ACO's PCPs. When information on PCP locations was not available, we allocated beneficiaries in proportion to distribution of provider clinics or hospitals by HRR, where we placed an equal weight on each clinic or hospital.

In July, a second round of 89 ACOs was selected to participate in the SSP program and projected by CMI to cover 1.2 million Medicare beneficiaries. However, as of this writing, the agency has not released information on how many beneficiaries each individual ACO is expected to manage, thus presenting the dual challenge of approximating both the number and location of each ACO's beneficiaries. We approximated the number of beneficiaries in each ACO as being proportional to the number of PCPs that we identified as being associated with the ACO, with the additional caveat that each ACO had a minimum of 5000 beneficiaries. PCPs were identified using the same approach described for the April ACOs. To approximate the geographic location of beneficiaries, we again used publicly available information on the location of each ACO's PCPs, clinics, and/or hospitals.

Unlike the April SSP ACOs, some of the 89 July SSP ACOs did not publish sufficient PCP, clinic, or hospital information on their websites to approximate the number of beneficiaries in each ACO and their location. In those cases, we attributed an average number of beneficiaries to the ACO based on the location of the ACO headquarters – that is, the geographic distribution of the beneficiaries was approximated by allocating 50 percent to the HRR where the ACO's headquarters was located and the remaining 50 percent evenly across adjacent HRRs.

Geographic Distribution of Beneficiaries Covered by Private ACO-like Entities

In some of our scenarios, we incorporated information on private ACOs. These ACOs were identified using data on integrated provider organizations and provider groups that have expressed interest in developing ACOs through the following ACO collaborative and learning networks:

- Dartmouth-Brookings ACO learning network
- Council of Affordable Physician Practices
- CMS physician group demonstration participants[24]
- Premier's Partnership for Care Transformation Implementation Initiative

We initially identified a total of 81 prospective ACOs, after ruling some out that were insurer or pharmaceutical-based organizations and did not include physician or hospital providers. We excluded 4 additional organizations because of insufficient information on their provider networks leaving us with a final total of 77 prospective ACOs. The geographic distribution of the beneficiaries covered by these prospective ACOs was estimated using a method similar to the one employed for the July wave of the SSP program. First, for each prospective ACO, the PCPs and their respective location were identified using the provider organization's website physician network search feature. This geographic distribution was then converted to an approximation of the geographic distribution of covered beneficiaries using the HRR specific average Medicare Fee-For-Service patient panel size. The total number of beneficiaries covered by each prospective ACO was then scaled down by 50 percent to account for limited participation among each organization's total network of PCPs and to be consistent with the average size of the Medicare ACOs.

Once we developed a baseline approximation for the geographic distribution of Medicare beneficiaries participating in existing ACOs and potential ACOs, we employed several steps to convert that to a percentage participation in ACOs among an HRR's FFS beneficiaries. First, our ACO enrollee data were for 2012, but all of the modeling work is based on the 2008 baseline data. Thus, we had to approximate Medicare FFS enrollment in 2012 (which is not currently available) by HRR to provide a comparable denominator. Towards this end, we extrapolated FFS enrollment based on the trend observed from 2007 to 2010.

A second step was required because our enrollment numerator and FFS enrollment in the denominator were not based on consistent universes of beneficiaries. Specifically, the 2008 baseline data we used was composed of only elderly FFS beneficiaries while our ACO enrollment figures include some disabled and ESRD beneficiaries who are under 65. We further adjusted our denominator to account for these enrollees.

In HRRs where the number of allocated beneficiaries (the numerator) exceeded the recorded total number of beneficiaries (the denominator), we capped the total allocation at 80 percent of recorded number of beneficiaries. This allocation ceiling was applied only to the Owensboro, KY HRR.

Projecting the Geographic Distribution of Beneficiaries Covered by Future ACOs ('projected' ACOs)

In order to examine the effects of an expanded Medicare ACO program (Scenarios 3-5), we needed to project the geographic distribution of beneficiaries covered by ACOs for ACOs that do not yet exist. Based on feedback from the Committee, we chose to target a national participation rate among Medicare FFS beneficiaries of 20% - double the participation rate resulting from the

allocation of beneficiaries from the Medicare ACO programs and the Private ACOs (10.1%). We assumed that the ACOs with the additional 9.9% of FFS beneficiaries would be formed in HRRs that were similar to HRRs currently with ACOs. Specifically, we used Medicare and private participation, at the HRR level as the dependent variable in a regression with HRR-level factors on the right hand side, and imputed additional FFS ACO participation in proportion to the predicted values from the regression.

We adopted a fractional logit model[25] rather than a linear probability model for 2 reasons. First, since the dependent variable is in percentage points, applying a linear probability model would result in various issues such as heteroscedasticity, a nonnormal error term, and nonlinearity in the effects of predictors. Second, predicted penetration rates could either be less than zero or greater than 1. We used a generalized linear model with a logit link function and a binomial family. The model was estimated using the quasi-likelihood method. It takes the following form:

$$g^{-1}(P_i) = \beta_0 + X_i\beta_1$$

Where g is a logit link function, the family is binomial, P_i is the ACO penetration rate in HRR i, X_i is a vector of HRR level characteristics of HRR i, βs are parameters to be estimated. Robust standard errors were used in the model. HRR level characteristics included population, income, physician supply, Medicare Advantage penetration, hospital market characteristics, Medicare spending and its growth rate. Specific measures and data sources are shown below.

Table A.3.1. Independent Variables In The ACO Penetration Prediction Model

Independent variables	Year	Data source
Logged population	2010	Census Bureau[26]
Logged population density (# per square mile)	2010	Census Bureau[27]
Logged median household income	2008	Dartmouth[28]
PCP per 100,000 residents	2006	Dartmouth[29]
Proportion of physicians in a group with 10 or more physicians	2010	SK&A[30]
Proportion of PCPs accepting Medicare patients	2010	SK&A
MA penetration rate	2008	Medicare Claims
Hospital Herfindahl Index	2010	AHA
Proportion of hospitals affiliated with a system	2010	AHA
Proportion of hospital revenue from capitation or risk-sharing contracts	2010	AHA
Proportion of hospitals that have a joint venture with physicians or physician groups	2010	AHA
Medicare spending per beneficiary (actual costs)	2010	IOM[19]
Growth rate in Medicare spending per beneficiary	2007-2010	IOM

Marginal effects were calculated based on 1 standard deviation change in an independent variable of interest while all other variables were set at the mean level.

Following the regression, we scaled our baseline estimates of beneficiary participation in ACOs according to the predicted participation rates under an expanded Medicare ACO program until total participation reached 20%.

Expected Medicare ACO Program Savings Rate

The scenarios varied in the assumed savings experienced by Medicare as a result of ACOs. Both the Congressional Budget Office and CMS estimate that ACOs would save Medicare through changes in provider behavior that reduce expenditures on the part of enrolled beneficiaries that outweigh, on net, the shared savings bonus payments.[31,32] Those savings amount to roughly 1% per enrolled beneficiary (which implies a substantially larger reduction in overall expenditures because Medicare retains only a minority of the overall savings while the organization retains the remainder). This level of savings is consistent with other situations when providers face risk of total costs.[33,34]

Across the scenarios, we used low and high-savings scenarios that are based on this 1% savings estimate. We varied the savings rate, because of the uncertainty surrounding these savings estimates. For the SSP ACOs we assumed a 0.5% savings in the low scenario and 3% savings in the high scenario. For the Pioneer ACOs we assumed a 1% savings in the low scenario and 5% savings in the high scenario. We assumed a higher savings estimate for the Pioneer ACOs due to the higher risk faced by those organizations (though we remain agnostic about whether the higher savings are a direct result of the greater risk, or whether organizations with a greater capacity to achieve savings self-select into the Pioneer program).

Finally, we employed 1 additional important variation in the expected reduction in Medicare spending by ACOs. The 'scaled savings' scenarios (Scenarios 4 and 5) employed the assumption that a *higher* degree of savings is expected among ACOs in higher-cost areas. This is a distinct possibility if high-cost areas have a relatively high proportion of beneficiaries with poor health status or inefficient practices, affording more opportunities for reductions in spending.[35] Note that this assumption, by itself, would result in a reduction in the geographic variation in Medicare spending even if ACO formation were evenly distributed across the US; the higher-cost areas would face a bigger spending reduction than the lower-cost areas. In these scenarios, the default savings rate was multiplied by the ratio of per beneficiary spending in the HRR of the ACO to overall mean spending across the US.

We made several additional assumptions in the implementation of those savings rates. First, in the case of private and projected ACOs, we had to allocate their participants to either the SSP-level savings rate or the Pioneer level. Those allocations were made in proportion to existing ratios of SSP and Pioneer participation within the HRR.

A second adjustment made to savings estimates was based on the fact that the ACO spending targets are updated based partly (in the case of the Pioneers) or fully (in the case of the SSP ACOs) on national average increases in Medicare spending. Thus, ACOs in areas of the country that face systematically high growth in spending would have to achieve even greater reductions in spending estimates (ie, they begin at a relative disadvantage) to achieve shared savings and, likewise, are more likely to end up paying Medicare for shared losses.[36]

To account for this effect, we modeled adjustments in Medicare savings attributable to ACOs accounting for each ACO's ability to reduce its own expected spending relative to its target (based on the HRR where its enrollees were located). These adjustments were applied at the HRR level and calculated in 3 steps. In the first step, we approximated the counterfactual per beneficiary spending in an HRR absent any ACO intervention – assuming prior local growth trends continue. This was estimated by inflating the baseline estimates of HRR per beneficiary costs by their average spending growth rates for the prior 3 years as estimated by McWilliams.[36] The second step was to apply the assumed behavioral savings rates described in the main report above. The last step was to calculate the effective per beneficiary savings by multiplying the

difference between the baseline estimates of HRR per beneficiary costs and the Medicare per beneficiary spending calculated in the second step by 70 percent, the rate at which savings relative to the Medicare benchmark are remitted to ACOs. The sum of the per-beneficiary savings remitted by Medicare and the realized Medicare per beneficiary spending represents the total per beneficiary spending by Medicare. The ratio of this sum to the counterfactual per beneficiary spending calculated in the first step represents the total spending as a percent of spending absent intervention. The final effective HRR savings rate is represented by 1 minus this ratio.

Estimating Effective Savings by HRR

For a given geographic distribution of beneficiaries covered by ACOs participating in the Pioneer and SSP program, the effective savings rate for an HRR was calculated by first multiplying the expected savings rate for each program (as defined by the scenario) by the proportion of beneficiaries within an HRR that was covered by an ACO participating in the corresponding program. The sum of the products was taken to represent the effective savings rate.

3.2 – Accountable Care Organization (ACO) Scenarios

Table A.3.2. ACO Scenarios Modeled

	Scenarios				
	1	**2**	**3**	**4**	**5**
% of Medicare FFS beneficiaries enrolled					
Low: 5%	X	X			
High: 20%			X	X	X
Medicare savings per enrolled Beneficiary					
Low: 0.5% (Shared Savings); 1%, (Pioneer)	X				
High: 3% (Shared Savings); 5% (Pioneer)		X	X		
Scaled: High x (HRR per beneficiary spending relative to mean)				X	X
Geographic price adjustments					
Includes all adjustments	X	X	X	X	
DSH/IME and geographic adjustments not included					X

S1 Low enrollment, low savings rate, includes all geographic adjustments
S2 Low enrollment, high savings rate, includes all geographic adjustments
S3 High enrollment, high savings rate, includes all geographic adjustments
S4 High enrollment, scaled savings rate, includes all geographic adjustments
S5 High enrollment, high savings rate, DSH/IME and geographic adjustments not included

3.2 – Accountable Care Organizations (ACO) Scenario Results

Table A.3.3. Impact of ACOs on Total per Beneficiary Medicare Spending and Geographic Variation in Spending

	Scenarios						
Description	**Baseline**	**1**	**2**	**3**	**4**	**Baseline**	**5**
	(Actual costs)	(low pen, low savings)	(low pen, high savings)	(high pen, high savings)	(scaled savings)	(Standardized costs)	(scaled savings, standardized costs)
Total Spending per beneficiary ($, % Decrease)	$9037	$9031 –0.07%	$9018 –0.21%	$8965 –0.80%	$8964 –0.81%	$8660	$8593 –0.77%
Coefficient of Variation	0.1714	0.1711	0.1711	0.1705	0.1699	0.1594	0.1592
75th / 25th Percentile	1.2289	1.2277	1.2246	1.2287	1.2263	1.2242	1.2222

APPENDIX SECTION 4 – TABLE OF IMPACTS FOR EACH HRR UNDER EACH POLICY

We now display the results for each HRR under the scenario within each policy type (ACOs, bundled payment, pay-for-performance) that was selected for inclusion in the main body of the manuscript. This is scenario 4 in the ACO section, scenario 3 in the pay-for-performance section and scenario 2 in the bundled payment section.

HRR name	Base spending	Total spending under each policy			Percentage change in baseline spending under each policy		
		ACO	P4P	BP	ACO	P4P	BP
SD - Rapid City	$6,095	$6,075	$5,975	$6,164	-0.3%	-2.0%	1.1%
CO - Grand Junction	$6,193	$6,171	$6,232	$6,251	-0.3%	0.6%	0.9%
HI - Honolulu	$6,198	$6,170	$6,138	$6,280	-0.4%	-1.0%	1.3%
MT - Missoula	$6,297	$6,281	$6,245	$6,389	-0.2%	-0.8%	1.5%
IA - Dubuque	$6,305	$6,337	$6,298	$6,393	0.5%	-0.1%	1.4%
ND - Bismarck	$6,311	$6,279	$6,352	$6,392	-0.5%	0.6%	1.3%
ND - Minot	$6,319	$6,306	$6,286	$6,331	-0.2%	-0.5%	0.2%
OR - Salem	$6,341	$6,296	$6,316	$6,449	-0.7%	-0.4%	1.7%
OR - Eugene	$6,463	$6,423	$6,432	$6,550	-0.6%	-0.5%	1.3%
OR - Medford	$6,463	$6,456	$6,429	$6,593	-0.1%	-0.5%	2.0%
WI - La Crosse	$6,523	$6,458	$6,538	$6,565	-1.0%	0.2%	0.6%
ND - Fargo/Moorhead MN	$6,602	$6,582	$6,534	$6,659	-0.3%	-1.0%	0.9%
MT - Billings	$6,679	$6,664	$6,750	$6,766	-0.2%	1.1%	1.3%
NM - Albuquerque	$6,690	$6,642	$6,653	$6,745	-0.7%	-0.5%	0.8%
ID - Boise	$6,708	$6,684	$6,657	$6,752	-0.4%	-0.8%	0.7%
ID - Idaho Falls	$6,737	$6,722	$6,824	$6,799	-0.2%	1.3%	0.9%
SD - Sioux Falls	$6,740	$6,725	$6,726	$6,793	-0.2%	-0.2%	0.8%
OR - Bend	$6,826	$6,791	$6,520	$6,932	-0.5%	-4.5%	1.6%
IA - Iowa City	$6,864	$6,530	$6,828	$6,993	-4.9%	-0.5%	1.9%
IA - Cedar Rapids	$6,952	$6,785	$6,928	$7,106	-2.4%	-0.4%	2.2%
IA - Mason City	$6,957	$6,920	$7,008	$7,060	-0.5%	0.7%	1.5%
NC - Asheville	$6,991	$6,988	$7,110	$7,058	0.0%	1.7%	1.0%
NY - Binghamton	$7,018	$6,961	$6,963	$7,121	-0.8%	-0.8%	1.5%
WI - Appleton	$7,020	$6,788	$7,016	$7,085	-3.3%	0.0%	0.9%
VA - Newport News	$7,042	$7,001	$7,169	$7,133	-0.6%	1.8%	1.3%
WY - Casper	$7,046	$7,038	$6,997	$7,044	-0.1%	-0.7%	0.0%
IA - Des Moines	$7,053	$6,971	$7,052	$7,133	-1.2%	0.0%	1.1%
NV - Reno	$7,056	$7,040	$7,046	$7,139	-0.2%	-0.1%	1.2%
OR - Portland	$7,080	$7,046	$7,099	$7,186	-0.5%	0.3%	1.5%
WA - Everett	$7,087	$7,085	$7,179	$7,214	0.0%	1.3%	1.8%
MN - Rochester	$7,097	$7,078	$7,190	$7,181	-0.3%	1.3%	1.2%

WA - Olympia	$7,102	$7,069	$7,119	$7,199	-0.5%	0.2%	1.4%
AR - Springdale	$7,113	$7,086	$7,183	$7,111	-0.4%	1.0%	0.0%
VA - Charlottesville	$7,125	$7,121	$7,016	$7,251	-0.1%	-1.5%	1.8%
MO - Springfield	$7,153	$7,113	$7,051	$7,224	-0.6%	-1.4%	1.0%
IA - Sioux City	$7,163	$7,088	$7,156	$7,263	-1.0%	-0.1%	1.4%
CA - San Luis Obispo	$7,194	$7,118	$7,227	$7,272	-1.1%	0.4%	1.1%
CO - Fort Collins	$7,201	$7,187	$7,235	$7,218	-0.2%	0.5%	0.2%
WI - Madison	$7,204	$7,132	$7,240	$7,283	-1.0%	0.5%	1.1%
WI - Green Bay	$7,204	$7,119	$7,184	$7,293	-1.2%	-0.3%	1.2%
MN - Duluth	$7,224	$7,167	$7,130	$7,205	-0.8%	-1.3%	-0.3%
VA - Roanoke	$7,234	$7,215	$7,301	$7,289	-0.3%	0.9%	0.8%
WA - Yakima	$7,246	$7,228	$7,178	$7,381	-0.3%	-0.9%	1.9%
UT - Ogden	$7,259	$7,205	$7,392	$7,339	-0.7%	1.8%	1.1%
VA - Winchester	$7,262	$7,224	$7,185	$7,358	-0.5%	-1.1%	1.3%
PA - Sayre	$7,268	$7,226	$7,124	$7,331	-0.6%	-2.0%	0.9%
IL - Bloomington	$7,288	$7,117	$7,207	$7,364	-2.4%	-1.1%	1.0%
UT - Salt Lake City	$7,290	$7,223	$7,338	$7,339	-0.9%	0.7%	0.7%
KS - Topeka	$7,302	$7,269	$7,348	$7,292	-0.5%	0.6%	-0.1%
NC - Hickory	$7,310	$7,327	$7,442	$7,380	0.2%	1.8%	1.0%
VT - Burlington	$7,317	$7,315	$7,221	$7,401	0.0%	-1.3%	1.1%
WI - Marshfield	$7,329	$7,196	$7,427	$7,429	-1.8%	1.3%	1.4%
NY - Rochester	$7,329	$7,316	$7,339	$7,424	-0.2%	0.1%	1.3%
WI - Neenah	$7,363	$7,151	$7,367	$7,437	-2.9%	0.1%	1.0%
MT - Great Falls	$7,372	$7,330	$7,400	$7,409	-0.6%	0.4%	0.5%
NY - Syracuse	$7,373	$7,357	$7,173	$7,417	-0.2%	-2.7%	0.6%
MN - Minneapolis	$7,377	$7,193	$7,395	$7,452	-2.5%	0.2%	1.0%
WA - Seattle	$7,378	$7,355	$7,360	$7,490	-0.3%	-0.3%	1.5%
MI - Traverse City	$7,395	$7,349	$7,635	$7,594	-0.6%	3.2%	2.7%
WA - Spokane	$7,409	$7,382	$7,406	$7,486	-0.4%	-0.1%	1.0%
CO - Pueblo	$7,412	$7,393	$7,440	$7,448	-0.2%	0.4%	0.5%
CO - Colorado Springs	$7,443	$7,420	$7,313	$7,466	-0.3%	-1.7%	0.3%
AK - Anchorage	$7,451	$7,445	$7,482	$7,549	-0.1%	0.4%	1.3%
VA - Lynchburg	$7,454	$7,432	$7,618	$7,526	-0.3%	2.2%	1.0%
MI - Marquette	$7,474	$7,439	$7,421	$7,536	-0.5%	-0.7%	0.8%
MN - St. Cloud	$7,474	$7,389	$7,377	$7,553	-1.1%	-1.3%	1.1%
ME - Portland	$7,494	$7,431	$7,716	$7,486	-0.8%	3.0%	-0.1%
ND - Grand Forks	$7,497	$7,469	$7,224	$7,521	-0.4%	-3.6%	0.3%
IA - Davenport	$7,532	$7,447	$7,600	$7,634	-1.1%	0.9%	1.4%
NC - Greensboro	$7,540	$7,558	$7,560	$7,643	0.2%	0.3%	1.4%
IL - Springfield	$7,554	$7,527	$7,460	$7,672	-0.4%	-1.2%	1.6%
GA - Albany	$7,558	$7,531	$7,480	$7,581	-0.4%	-1.0%	0.3%
CA - Santa Barbara	$7,566	$7,525	$7,499	$7,621	-0.5%	-0.9%	0.7%
WA - Tacoma	$7,615	$7,556	$7,639	$7,733	-0.8%	0.3%	1.6%

VA - Arlington	$7,624	$7,574	$7,647	$7,715	-0.7%	0.3%	1.2%
MN - St. Paul	$7,626	$7,508	$7,700	$7,699	-1.5%	1.0%	1.0%
AZ - Tucson	$7,632	$7,577	$7,571	$7,655	-0.7%	-0.8%	0.3%
IN - Lafayette	$7,641	$7,742	$7,594	$7,692	1.3%	-0.6%	0.7%
NY - Elmira	$7,681	$7,644	$7,467	$7,698	-0.5%	-2.8%	0.2%
MI - Petoskey	$7,704	$7,688	$7,876	$7,814	-0.2%	2.2%	1.4%
MO - Columbia	$7,704	$7,687	$7,772	$7,789	-0.2%	0.9%	1.1%
IA - Waterloo	$7,714	$7,567	$7,668	$7,831	-1.9%	-0.6%	1.5%
PA - Danville	$7,721	$7,626	$7,720	$7,750	-1.2%	0.0%	0.4%
WI - Wausau	$7,727	$7,634	$7,780	$7,836	-1.2%	0.7%	1.4%
NH - Lebanon	$7,784	$7,671	$7,782	$7,788	-1.5%	0.0%	0.1%
GA - Augusta	$7,802	$7,780	$7,827	$7,849	-0.3%	0.3%	0.6%
AR - Fort Smith	$7,804	$7,712	$7,778	$7,822	-1.2%	-0.3%	0.2%
CA - Redding	$7,810	$7,797	$7,746	$7,898	-0.2%	-0.8%	1.1%
VA - Richmond	$7,818	$7,728	$7,849	$7,882	-1.1%	0.4%	0.8%
KY - Paducah	$7,830	$7,781	$7,790	$7,893	-0.6%	-0.5%	0.8%
ME - Bangor	$7,830	$7,756	$8,077	$7,785	-0.9%	3.2%	-0.6%
VA - Norfolk	$7,831	$7,763	$7,864	$7,929	-0.9%	0.4%	1.3%
IN - Fort Wayne	$7,832	$7,795	$7,874	$7,839	-0.5%	0.5%	0.1%
TX - Temple	$7,834	$7,579	$7,742	$7,855	-3.3%	-1.2%	0.3%
IN - South Bend	$7,846	$7,769	$7,840	$7,922	-1.0%	-0.1%	1.0%
SC - Greenville	$7,848	$7,805	$8,125	$7,919	-0.5%	3.5%	0.9%
IL - Urbana	$7,849	$7,812	$7,800	$7,884	-0.5%	-0.6%	0.5%
IL - Peoria	$7,870	$7,758	$7,828	$7,916	-1.4%	-0.5%	0.6%
AR - Jonesboro	$7,883	$7,857	$7,803	$7,893	-0.3%	-1.0%	0.1%
NY - Albany	$7,889	$7,857	$7,854	$7,932	-0.4%	-0.4%	0.6%
NH - Manchester	$7,891	$7,797	$8,004	$7,912	-1.2%	1.4%	0.3%
CA - Sacramento	$7,892	$7,841	$7,918	$8,008	-0.6%	0.3%	1.5%
NY - Buffalo	$7,897	$7,772	$7,696	$7,927	-1.6%	-2.6%	0.4%
MO - Cape Girardeau	$7,898	$7,881	$7,893	$7,940	-0.2%	-0.1%	0.5%
NC - Durham	$7,898	$7,877	$7,977	$7,983	-0.3%	1.0%	1.1%
PA - Lancaster	$7,901	$7,781	$7,813	$7,947	-1.5%	-1.1%	0.6%
AL - Dothan	$7,902	$7,884	$8,001	$7,989	-0.2%	1.2%	1.1%
CO - Boulder	$7,904	$7,861	$7,711	$7,947	-0.5%	-2.4%	0.5%
NC - Charlotte	$7,922	$7,923	$8,064	$8,031	0.0%	1.8%	1.4%
FL - Tallahassee	$7,944	$7,929	$7,928	$7,962	-0.2%	-0.2%	0.2%
IN - Muncie	$7,945	$7,862	$8,006	$8,026	-1.0%	0.8%	1.0%
PA - Harrisburg	$7,951	$7,916	$7,902	$7,949	-0.4%	-0.6%	0.0%
NC - Greenville	$7,965	$7,938	$7,958	$8,075	-0.3%	-0.1%	1.4%
NE - Omaha	$7,979	$7,964	$8,071	$7,976	-0.2%	1.2%	0.0%
NE - Lincoln	$7,981	$7,965	$7,973	$7,942	-0.2%	-0.1%	-0.5%
TX - El Paso	$7,984	$7,931	$8,013	$7,986	-0.7%	0.4%	0.0%
WV - Charleston	$7,999	$7,979	$7,821	$8,086	-0.2%	-2.2%	1.1%

CO - Greeley	$8,002	$7,957	$8,049	$7,992	-0.6%	0.6%	-0.1%
SC - Spartanburg	$8,025	$7,978	$7,948	$8,129	-0.6%	-1.0%	1.3%
TN - Kingsport	$8,043	$7,989	$7,957	$8,140	-0.7%	-1.1%	1.2%
GA - Savannah	$8,050	$8,014	$8,047	$8,129	-0.5%	0.0%	1.0%
AR - Little Rock	$8,053	$8,048	$8,027	$8,031	-0.1%	-0.3%	-0.3%
PA - York	$8,057	$7,926	$7,823	$8,091	-1.6%	-2.9%	0.4%
MO - Joplin	$8,080	$8,019	$7,999	$8,121	-0.8%	-1.0%	0.5%
NC - Winston-Salem	$8,095	$8,031	$8,279	$8,192	-0.8%	2.3%	1.2%
KS - Wichita	$8,100	$8,078	$8,052	$8,120	-0.3%	-0.6%	0.2%
MI - Grand Rapids	$8,105	$8,023	$8,219	$8,200	-1.0%	1.4%	1.2%
AL - Huntsville	$8,116	$8,091	$8,178	$8,174	-0.3%	0.8%	0.7%
IL - Rockford	$8,116	$8,057	$8,109	$8,118	-0.7%	-0.1%	0.0%
AZ - Phoenix	$8,129	$8,090	$8,074	$8,163	-0.5%	-0.7%	0.4%
MI - Muskegon	$8,141	$8,101	$8,093	$8,207	-0.5%	-0.6%	0.8%
SC - Charleston	$8,152	$8,142	$8,347	$8,216	-0.1%	2.4%	0.8%
PA - Erie	$8,158	$8,047	$8,092	$8,152	-1.4%	-0.8%	-0.1%
GA - Columbus	$8,176	$8,154	$8,154	$8,204	-0.3%	-0.3%	0.3%
IN - Evansville	$8,181	$8,130	$7,979	$8,179	-0.6%	-2.5%	0.0%
TN - Johnson City	$8,183	$8,184	$8,079	$8,232	0.0%	-1.3%	0.6%
TX - Waco	$8,193	$8,162	$8,023	$8,239	-0.4%	-2.1%	0.6%
GA - Atlanta	$8,196	$8,173	$8,199	$8,292	-0.3%	0.0%	1.2%
TN - Knoxville	$8,211	$8,189	$8,198	$8,293	-0.3%	-0.2%	1.0%
NC - Wilmington	$8,226	$8,208	$8,396	$8,321	-0.2%	2.1%	1.2%
OK - Lawton	$8,250	$8,237	$8,170	$8,333	-0.2%	-1.0%	1.0%
CO - Denver	$8,281	$8,187	$8,317	$8,314	-1.1%	0.4%	0.4%
WV - Morgantown	$8,281	$8,228	$8,372	$8,388	-0.6%	1.1%	1.3%
CA - Chico	$8,291	$8,256	$8,092	$8,325	-0.4%	-2.4%	0.4%
FL - Ocala	$8,292	$8,261	$8,217	$8,320	-0.4%	-0.9%	0.3%
SC - Columbia	$8,295	$8,275	$8,391	$8,340	-0.2%	1.2%	0.5%
GA - Rome	$8,310	$8,268	$8,432	$8,391	-0.5%	1.5%	1.0%
MS - Tupelo	$8,314	$8,255	$8,343	$8,393	-0.7%	0.4%	1.0%
UT - Provo	$8,347	$8,258	$8,323	$8,355	-1.1%	-0.3%	0.1%
TX - San Angelo	$8,383	$8,346	$8,486	$8,370	-0.4%	1.2%	-0.2%
TN - Chattanooga	$8,389	$8,385	$8,442	$8,436	-0.1%	0.6%	0.6%
IN - Indianapolis	$8,399	$8,325	$8,354	$8,394	-0.9%	-0.5%	-0.1%
MO - Kansas City	$8,399	$8,389	$8,491	$8,417	-0.1%	1.1%	0.2%
NC - Raleigh	$8,409	$8,410	$8,374	$8,480	0.0%	-0.4%	0.8%
TX - Abilene	$8,412	$8,436	$8,444	$8,469	0.3%	0.4%	0.7%
CA - Stockton	$8,413	$8,374	$8,303	$8,494	-0.5%	-1.3%	1.0%
AL - Mobile	$8,434	$8,392	$8,603	$8,508	-0.5%	2.0%	0.9%
OK - Tulsa	$8,440	$8,408	$8,407	$8,479	-0.4%	-0.4%	0.5%
OH - Canton	$8,448	$8,380	$8,391	$8,438	-0.8%	-0.7%	-0.1%
FL - Pensacola	$8,449	$8,414	$8,637	$8,490	-0.4%	2.2%	0.5%

MI - Kalamazoo	$8,465	$8,438	$8,438	$8,575	-0.3%	-0.3%	1.3%
KY - Owensboro	$8,476	$7,917	$8,583	$8,647	-6.6%	1.3%	2.0%
TX - Odessa	$8,496	$8,512	$8,493	$8,377	0.2%	0.0%	-1.4%
WI - Milwaukee	$8,500	$8,391	$8,561	$8,565	-1.3%	0.7%	0.8%
KY - Louisville	$8,506	$8,452	$8,352	$8,570	-0.6%	-1.8%	0.8%
CA - Fresno	$8,515	$8,456	$8,373	$8,575	-0.7%	-1.7%	0.7%
IL - Aurora	$8,520	$8,496	$8,525	$8,520	-0.3%	0.1%	0.0%
AZ - Mesa	$8,530	$8,384	$8,448	$8,574	-1.7%	-1.0%	0.5%
AZ - Sun City	$8,578	$8,189	$8,378	$8,631	-4.5%	-2.3%	0.6%
TX - Bryan	$8,601	$8,444	$8,545	$8,584	-1.8%	-0.7%	-0.2%
FL - Ormond Beach	$8,611	$8,576	$8,708	$8,580	-0.4%	1.1%	-0.4%
CA - San Mateo County	$8,637	$8,609	$8,694	$8,742	-0.3%	0.7%	1.2%
PA - Reading	$8,649	$8,521	$8,609	$8,592	-1.5%	-0.5%	-0.7%
TN - Jackson	$8,667	$8,547	$8,585	$8,675	-1.4%	-1.0%	0.1%
TN - Nashville	$8,667	$8,617	$8,664	$8,705	-0.6%	0.0%	0.4%
PA - Altoona	$8,673	$8,565	$8,671	$8,640	-1.2%	0.0%	-0.4%
AL - Montgomery	$8,676	$8,661	$8,808	$8,674	-0.2%	1.5%	0.0%
MI - Saginaw	$8,680	$8,641	$8,524	$8,770	-0.4%	-1.8%	1.0%
OH - Cincinnati	$8,681	$8,644	$8,763	$8,712	-0.4%	0.9%	0.4%
TX - Austin	$8,709	$8,593	$8,780	$8,654	-1.3%	0.8%	-0.6%
OH - Dayton	$8,723	$8,662	$8,670	$8,752	-0.7%	-0.6%	0.3%
LA - Houma	$8,723	$8,701	$8,793	$8,701	-0.3%	0.8%	-0.3%
CA - Modesto	$8,735	$8,660	$8,784	$8,836	-0.9%	0.6%	1.2%
WV - Huntington	$8,745	$8,695	$8,701	$8,806	-0.6%	-0.5%	0.7%
FL - Sarasota	$8,751	$8,721	$8,958	$8,728	-0.3%	2.4%	-0.3%
OK - Oklahoma City	$8,753	$8,728	$8,725	$8,727	-0.3%	-0.3%	-0.3%
MO - St. Louis	$8,766	$8,734	$8,740	$8,801	-0.4%	-0.3%	0.4%
KY - Lexington	$8,771	$8,749	$8,754	$8,769	-0.3%	-0.2%	0.0%
CA - Salinas	$8,792	$8,742	$8,587	$8,807	-0.6%	-2.3%	0.2%
TX - Amarillo	$8,796	$8,765	$8,862	$8,792	-0.4%	0.8%	0.0%
SC - Florence	$8,813	$8,795	$8,729	$8,924	-0.2%	-1.0%	1.3%
AL - Birmingham	$8,814	$8,798	$8,998	$8,845	-0.2%	2.1%	0.3%
MI - Lansing	$8,815	$8,747	$8,663	$8,965	-0.8%	-1.7%	1.7%
OH - Columbus	$8,817	$8,785	$8,852	$8,831	-0.4%	0.4%	0.2%
CA - San Diego	$8,827	$8,679	$8,819	$8,827	-1.7%	-0.1%	0.0%
CA - Santa Rosa	$8,830	$8,761	$8,800	$8,982	-0.8%	-0.3%	1.7%
MS - Oxford	$8,835	$8,774	$8,703	$8,912	-0.7%	-1.5%	0.9%
CA - Santa Cruz	$8,857	$8,806	$8,746	$8,933	-0.6%	-1.3%	0.9%
MI - St. Joseph	$8,876	$8,791	$8,959	$9,015	-1.0%	0.9%	1.6%
MA - Springfield	$8,899	$8,907	$8,972	$8,884	0.1%	0.8%	-0.2%
FL - Gainesville	$8,921	$8,888	$9,060	$8,923	-0.4%	1.6%	0.0%
CA - Palm Springs/Rancho Mirage	$8,937	$8,758	$8,737	$9,003	-2.0%	-2.2%	0.7%

CA - San Jose	$8,950	$8,891	$8,999	$8,963	-0.7%	0.5%	0.2%
GA - Macon	$8,953	$8,935	$8,891	$9,009	-0.2%	-0.7%	0.6%
OH - Toledo	$8,979	$8,891	$8,993	$9,003	-1.0%	0.2%	0.3%
OH - Akron	$8,982	$8,818	$8,834	$8,952	-1.8%	-1.6%	-0.3%
CA - Bakersfield	$9,020	$8,862	$8,781	$9,066	-1.7%	-2.6%	0.5%
MS - Hattiesburg	$9,035	$8,992	$9,142	$9,092	-0.5%	1.2%	0.6%
KY - Covington	$9,051	$8,991	$9,008	$9,094	-0.7%	-0.5%	0.5%
TN - Memphis	$9,052	$9,025	$9,013	$9,047	-0.3%	-0.4%	0.0%
OH - Kettering	$9,081	$8,987	$9,187	$9,070	-1.0%	1.2%	-0.1%
FL - Lakeland	$9,089	$8,980	$8,998	$9,064	-1.2%	-1.0%	-0.3%
PA - Scranton	$9,093	$9,037	$9,037	$8,962	-0.6%	-0.6%	-1.4%
IL - Hinsdale	$9,138	$9,035	$9,289	$9,092	-1.1%	1.7%	-0.5%
LA - Lake Charles	$9,141	$9,118	$8,999	$9,094	-0.2%	-1.6%	-0.5%
CA - Napa	$9,167	$9,142	$9,194	$9,259	-0.3%	0.3%	1.0%
FL - Fort Myers	$9,174	$9,110	$9,099	$9,193	-0.7%	-0.8%	0.2%
TX - San Antonio	$9,180	$9,151	$9,082	$9,118	-0.3%	-1.1%	-0.7%
TX - Wichita Falls	$9,204	$9,170	$9,240	$9,120	-0.4%	0.4%	-0.9%
AR - Texarkana	$9,220	$9,168	$9,111	$9,094	-0.6%	-1.2%	-1.4%
TX - Longview	$9,239	$9,175	$9,155	$9,185	-0.7%	-0.9%	-0.6%
RI - Providence	$9,244	$9,177	$9,450	$9,221	-0.7%	2.2%	-0.2%
AL - Tuscaloosa	$9,260	$9,252	$9,304	$9,258	-0.1%	0.5%	0.0%
CA - San Francisco	$9,278	$9,181	$9,282	$9,328	-1.0%	0.0%	0.5%
IN - Terre Haute	$9,296	$9,239	$9,236	$9,308	-0.6%	-0.6%	0.1%
PA - Wilkes-Barre	$9,321	$9,197	$9,119	$9,146	-1.3%	-2.2%	-1.9%
MD - Salisbury	$9,322	$9,307	$9,382	$9,405	-0.2%	0.6%	0.9%
TX - Lubbock	$9,327	$9,302	$9,365	$9,351	-0.3%	0.4%	0.3%
PA - Allentown	$9,343	$9,267	$9,371	$9,329	-0.8%	0.3%	-0.1%
OH - Cleveland	$9,379	$9,220	$9,309	$9,314	-1.7%	-0.7%	-0.7%
CA - Ventura	$9,388	$9,303	$9,367	$9,457	-0.9%	-0.2%	0.7%
DC - Washington	$9,399	$9,375	$9,387	$9,331	-0.3%	-0.1%	-0.7%
OH - Youngstown	$9,401	$9,231	$9,308	$9,317	-1.8%	-1.0%	-0.9%
DE - Wilmington	$9,409	$9,378	$9,277	$9,422	-0.3%	-1.4%	0.1%
MS - Jackson	$9,414	$9,384	$9,399	$9,427	-0.3%	-0.2%	0.1%
MS - Gulfport	$9,419	$9,364	$9,325	$9,321	-0.6%	-1.0%	-1.0%
MS - Meridian	$9,455	$9,366	$9,565	$9,419	-0.9%	1.2%	-0.4%
TX - Victoria	$9,479	$9,446	$9,548	$9,428	-0.4%	0.7%	-0.5%
PA - Johnstown	$9,490	$9,447	$9,487	$9,480	-0.4%	0.0%	-0.1%
IL - Evanston	$9,494	$9,474	$9,643	$9,461	-0.2%	1.6%	-0.3%
TX - Tyler	$9,527	$9,489	$9,359	$9,415	-0.4%	-1.8%	-1.2%
FL - Panama City	$9,549	$9,523	$9,484	$9,444	-0.3%	-0.7%	-1.1%
NJ - Morristown	$9,560	$9,403	$9,550	$9,406	-1.6%	-0.1%	-1.6%
IN - Gary	$9,570	$9,543	$9,368	$9,592	-0.3%	-2.1%	0.2%
FL - Jacksonville	$9,581	$9,524	$9,711	$9,496	-0.6%	1.4%	-0.9%

CT - Hartford	$9,607	$9,530	$9,519	$9,598	-0.8%	-0.9%	-0.1%
FL - Orlando	$9,607	$9,529	$9,574	$9,567	-0.8%	-0.3%	-0.4%
IL - Elgin	$9,647	$9,609	$9,701	$9,631	-0.4%	0.6%	-0.2%
IL - Melrose Park	$9,650	$9,601	$9,753	$9,607	-0.5%	1.1%	-0.5%
PA - Pittsburgh	$9,675	$9,635	$9,625	$9,611	-0.4%	-0.5%	-0.7%
MI - Ann Arbor	$9,703	$9,529	$9,705	$9,764	-1.8%	0.0%	0.6%
FL - Bradenton	$9,736	$9,287	$9,912	$9,665	-4.6%	1.8%	-0.7%
LA - Slidell	$9,760	$9,721	$9,780	$9,809	-0.4%	0.2%	0.5%
NV - Las Vegas	$9,797	$9,668	$9,795	$9,586	-1.3%	0.0%	-2.2%
OH - Elyria	$9,896	$9,612	$9,832	$9,820	-2.9%	-0.6%	-0.8%
TX - Fort Worth	$9,900	$9,807	$9,960	$9,810	-0.9%	0.6%	-0.9%
MD - Takoma Park	$9,942	$9,942	$9,955	$9,942	0.0%	0.1%	0.0%
IL - Joliet	$9,953	$9,896	$9,942	$9,986	-0.6%	-0.1%	0.3%
LA - Lafayette	$9,976	$9,960	$9,897	$9,828	-0.2%	-0.8%	-1.5%
FL - Tampa	$9,979	$9,750	$10,030	$9,872	-2.3%	0.5%	-1.1%
TX - Beaumont	$10,082	$10,056	$10,028	$9,920	-0.3%	-0.5%	-1.6%
CA - San Bernardino	$10,084	$9,925	$9,947	$9,994	-1.6%	-1.4%	-0.9%
CA - Orange County	$10,089	$9,862	$9,994	$10,021	-2.2%	-0.9%	-0.7%
FL - Clearwater	$10,113	$10,002	$10,346	$9,999	-1.1%	2.3%	-1.1%
FL - Hudson	$10,134	$10,031	$10,465	$9,960	-1.0%	3.3%	-1.7%
CA - Contra Costa County	$10,249	$10,001	$10,248	$10,276	-2.4%	0.0%	0.3%
LA - Baton Rouge	$10,286	$10,201	$10,218	$10,084	-0.8%	-0.7%	-2.0%
CT - Bridgeport	$10,316	$10,196	$10,309	$10,258	-1.2%	-0.1%	-0.6%
CA - Alameda County	$10,319	$10,240	$10,331	$10,302	-0.8%	0.1%	-0.2%
TX - Dallas	$10,325	$10,297	$10,354	$10,194	-0.3%	0.3%	-1.3%
LA - New Orleans	$10,336	$10,293	$10,204	$10,331	-0.4%	-1.3%	0.0%
CT - New Haven	$10,458	$10,415	$10,299	$10,371	-0.4%	-1.5%	-0.8%
MA - Boston	$10,459	$10,213	$10,621	$10,310	-2.4%	1.6%	-1.4%
NJ - New Brunswick	$10,464	$10,452	$10,462	$10,205	-0.1%	0.0%	-2.5%
NJ - Camden	$10,494	$10,369	$10,564	$10,235	-1.2%	0.7%	-2.5%
TX - Houston	$10,517	$10,484	$10,441	$10,269	-0.3%	-0.7%	-2.4%
MA - Worcester	$10,531	$10,403	$10,563	$10,341	-1.2%	0.3%	-1.8%
LA - Shreveport	$10,535	$10,515	$10,442	$10,254	-0.2%	-0.9%	-2.7%
LA - Alexandria	$10,567	$10,541	$10,531	$10,403	-0.3%	-0.3%	-1.6%
TX - Corpus Christi	$10,605	$10,568	$10,367	$10,574	-0.3%	-2.2%	-0.3%
FL - St. Petersburg	$10,617	$10,510	$10,721	$10,444	-1.0%	1.0%	-1.6%
IL - Blue Island	$10,631	$10,586	$10,715	$10,600	-0.4%	0.8%	-0.3%
LA - Metairie	$10,656	$10,578	$10,587	$10,523	-0.7%	-0.6%	-1.3%
NJ - Ridgewood	$10,683	$10,336	$10,516	$10,473	-3.2%	-1.6%	-2.0%
MI - Flint	$10,714	$10,551	$10,538	$10,916	-1.5%	-1.6%	1.9%
NY - White Plains	$10,730	$10,640	$10,600	$10,665	-0.8%	-1.2%	-0.6%
MI - Pontiac	$10,744	$10,625	$10,752	$10,840	-1.1%	0.1%	0.9%
PA - Philadelphia	$10,784	$10,688	$10,814	$10,690	-0.9%	0.3%	-0.9%

IN - Munster	$10,792	$10,692	$10,699	$10,766	-0.9%	-0.9%	-0.2%
NJ - Paterson	$10,970	$10,915	$10,800	$10,587	-0.5%	-1.5%	-3.5%
NJ - Hackensack	$10,993	$10,881	$10,946	$10,699	-1.0%	-0.4%	-2.7%
LA - Monroe	$11,072	$11,068	$10,887	$10,906	0.0%	-1.7%	-1.5%
MI - Royal Oak	$11,134	$11,006	$11,181	$11,170	-1.1%	0.4%	0.3%
MD - Baltimore	$11,262	$11,262	$11,256	$11,262	0.0%	-0.1%	0.0%
FL - Fort Lauderdale	$11,412	$11,337	$11,667	$11,309	-0.7%	2.2%	-0.9%
MI - Dearborn	$11,468	$10,912	$11,525	$11,440	-4.8%	0.5%	-0.2%
NJ - Newark	$11,755	$11,550	$11,832	$11,374	-1.7%	0.7%	-3.2%
NY - East Long Island	$11,800	$11,635	$11,815	$11,665	-1.4%	0.1%	-1.1%
CA - Los Angeles	$11,963	$11,759	$11,843	$11,762	-1.7%	-1.0%	-1.7%
MI - Detroit	$12,053	$11,888	$12,132	$12,066	-1.4%	0.7%	0.1%
IL - Chicago	$12,179	$12,092	$12,262	$11,937	-0.7%	0.7%	-2.0%
TX - Harlingen	$12,926	$12,855	$12,895	$12,786	-0.6%	-0.2%	-1.1%
NY - Manhattan	$13,615	$13,460	$13,454	$13,338	-1.1%	-1.2%	-2.0%
NY - Bronx	$14,173	$13,732	$13,927	$14,090	-3.1%	-1.7%	-0.6%
TX - McAllen	$14,940	$14,850	$14,774	$14,529	-0.6%	-1.1%	-2.8%
FL - Miami	$18,017	$17,872	$18,256	$17,598	-0.8%	1.3%	-2.3%

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