Trends in Medicare Payment Rates for Noninvasive Cardiac Tests and Association With Testing Location

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IMPORTANCE To control spending, the Centers for Medicare & Medicaid Services reduced Medicare fee-for-service (FFS) payments for noninvasive cardiac tests (NCTs) performed in provider-based office settings (ambulatory offices not administratively affiliated with hospitals) starting in 2005. Contemporaneously, payments for hospital-based outpatient testing increased. The association between differential payments by site and test location is unknown.

OBJECTIVES To quantify trends in differential Medicare FFS payments for NCTs performed in hospital-based and provider-based settings, determine the association between the hospital-based outpatient testing to provider-based office testing payment ratio and the proportion of hospital-based NCTs, and to examine trends in test location between Medicare FFS and 3 Medicare Advantage health maintenance organizations for which Centers for Medicare & Medicaid Services payments do not depend on testing location.

DESIGN, SETTING, AND PARTICIPANTS This observational claims-based study used Medicare FFS claims from 1999 to 2015 (5% random sample) and Medicare Advantage claims from 3 large health maintenance organizations (2005-2015) among Medicare FFS beneficiaries aged 65 years or older and a health maintenance organization control group. Statistical analysis was performed from May 1, 2017, to July 15, 2019.

EXPOSURES The weighted mean payment ratio of Medicare FFS hospital-based outpatient testing to provider-based office testing for outpatient NCTs.

MAIN OUTCOMES AND MEASURES Proportion of outpatient NCTs performed in the hospital-based setting and Medicare FFS costs.

RESULTS The data included a mean of 1.72 million patient-years annually in Medicare FFS (mean age, 75.2 years; 57.3% female in 2015) and a mean of 142,230 patient-years annually in the managed care control group (mean age, 74.8 years; 56.2% female in 2015). The Medicare payment ratio of FFS hospital-based outpatient testing to provider-based office testing increased from 1.05 in 2005 to 2.32 in 2015. The FFS hospital-based outpatient testing proportion increased from 21.1% in 2008 to 43.2% in 2015 and was correlated with the payment ratio (correlation coefficient with a 1-year lag, 0.767, P < .001). In contrast, the hospital-based outpatient testing proportion for the control group declined from 16.6% in 2008 to 15.2% in 2015 (correlation coefficient, –0.024, P = .95). The estimated extra costs owing to tests shifting to the hospital-based outpatient setting in the Medicare FFS group was $661 million in 2015, including $161 million in patient out-of-pocket costs.

CONCLUSIONS AND RELEVANCE In settings in which reimbursement depends on test location, increasing hospital-based payments correlated with greater proportions of outpatient NCTs performed in the hospital-based outpatient setting. Site-neutral payments may offer an incentive for testing to be performed in the more efficient location.

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The US Centers for Medicare & Medicaid Services (CMS) is mindful of the costs of providing care to the more than 55 million US citizens covered by Medicare. Medicare spending accounts for 20% of all US health expenditures, and spending growth consistently exceeds economic growth. The CMS’s efforts to contain costs include reducing clinician payments in the Medicare fee-for-service (FFS) program.

Noninvasive cardiac tests (NCTs), which include echocardiography and stress testing with or without imaging, have been identified as a target for reducing Medicare FFS costs, as they are frequently performed and relatively expensive. Increasing testing rates and geographical variation have raised concern about overuse of these tests, particularly in the provider-based office (PBO) setting, where the referring and testing clinicians are often the same. Starting in 2005 and accelerating in 2007, the CMS reduced PBO payments for these tests. In contrast, payments rose for outpatient tests performed in the hospital-based outpatient (HBO) setting. A prior study found a higher proportion of outpatient imaging tests performed in the HBO setting after further payment reductions for PBO testing were instituted in 2010. However, changes in setting-based payment differences for a longer period, their association with the proportion of tests performed in the HBO setting, and the estimated effect of test movement from PBO to HBO on Medicare spending and patient out-of-pocket cost have not been studied. Furthermore, trends for Medicare Advantage patients, for whom CMS payments do not depend on test location, are unknown.

Accordingly, this study examined trends in Medicare FFS payments, testing rates, and test location for outpatient NCTs between 1999 and 2015, comparing temporal trends in the HBO to PBO payment ratio, with proportion of NCTs performed in the hospital-based outpatient setting in both the Medicare FFS program and a control group of Medicare Advantage patients in 3 large health maintenance organizations, for which CMS payments do not depend on test location. Finally, the study also estimated the implications for CMS spending of the higher HBO proportion in the Medicare FFS group.

Methods

Data Sources

Data for Medicare FFS beneficiaries age 65 years or older were obtained from the National Medicare 5% random sample, which includes both Part A (hospital) and Part B (physician) claims between 1999 and 2015. Data for the managed care control group were obtained from the following 3 health maintenance organizations: Kaiser Permanente Colorado, Kaiser Permanente Northwest in Oregon, and Group Health (now Kaiser Permanente Washington) between 2005 and 2015. Race and ethnicity were reported as assigned by the CMS and the health maintenance organizations. The study was approved by the George Washington University and Northwestern University Institutional Review Boards as exempt from human participants review, including exemption from consent, because of the retrospective design using deidentified administrative claims.

NCTs Studied

We studied the following NCTs: resting transthoracic and transesophageal echocardiography (resting echocardiography); stress testing with single-photon emission computed tomography (stress SPECT); stress testing with echocardiography (stress echocardiography); and stress testing without imaging (stress electrocardiography). We measured outpatient testing rates and identified claims using Current Procedural Terminology codes (eTables 1 and 2 in the Supplement).

We obtained data on Medicare FFS payments from the CMS Physician Fee Schedule for PBO testing and from both the CMS Physician Fee Schedule and the CMS Ambulatory Payment Classification for HBO testing. We identified outpatient NCTs and test location in the Medicare carrier files.

Exposure and Outcome Variables

The primary exposure variable was the annual weighted mean ratio of HBO payments to PBO payments for the same NCTs (the HBO to PBO payment ratio). We assigned annual weights based on the number of tests of each type in a particular year. For example, in 2008, resting echocardiography comprised 56% of the NCTs performed (Table). The weighted mean therefore gives 56% weight to the payment for resting echocardiography and similarly for other tests. An overall HBO to PBO payment ratio of 1.50 indicates a weighted mean payment of 50% more for HBO testing than for PBO testing. In secondary analyses, we used dollar differences in payments instead of payment ratios and also stratified by test type. The primary outcome was the annual proportion of outpatient NCTs performed in the HBO setting (the HBO proportion). Other outcomes included testing rates and estimated costs both to Medicare and to Medicare beneficiaries.

Statistical Analysis

FFS Payment Calculations

Statistical analysis was performed from May 1, 2017, to July 15, 2019. We calculated annual FFS payment rates separately for

Key Points

Question What are the trends in Medicare payment rates for outpatient noninvasive cardiovascular tests, and are payment rates for hospital-based outpatient testing vs provider-based office testing associated with testing location?

Findings In this study using the total number of Medicare claims from 1999 to 2015 (mean of 1.72 million patient-years annually), the hospital-based outpatient testing to provider-based office testing payment ratio for noninvasive cardiac tests increased from 1.05 in 2005 to 2.32 in 2015, an increase that was associated with the subsequent proportion of hospital-based testing in Medicare fee-for-service organizations but not in a comparison group of 3 health maintenance organizations (mean of 142 230 patient-years annually).

Meaning In settings in which reimbursement depends on test location, higher hospital-based vs practice-based payments were associated with greater proportions of outpatient noninvasive cardiac tests performed in hospital-based locations.
professional and technical components (eTable 3 in the Supplement). We calculated PBO payments and HBO professional component payments using the CMS Physician Fee Schedule, which provides relative value units for each Current Procedural Terminology code. We summed the separate work, practice expense, and malpractice expense relative value units, then multiplied by the CMS conversion factor to obtain dollar amounts. For HBO technical component payments, we used the CMS Ambulatory Payment Classification. We separately measured CMS and patient out-of-pocket cost using actual payments to clinicians and hospitals in the Medicare claims files. We confirmed the consistency of payment rates from other data sources (eFigure 1 in the Supplement). We converted all payments to 2017 dollars using the consumer price index for all urban consumers.

### Tested Rates
We calculated annual testing rates in PBO and HBO per 1000 patient-years in the Medicare FFS and managed care control groups. For the managed care control group, we weighted the 3 health maintenance organizations equally. We assessed the significance of trends in rates during a specified period by regressing the rates for this period on a constant term and a year trend.

### Testing Location Trends and Correlation With Payment Levels
Trends in the HBO proportion over time were assessed with t tests for a 2-sample difference in proportions. We computed residuals from regressing the HBO to PBO payment ratio and the HBO proportion on a constant term and linear time trend and then computed the Pearson correlation coefficient between the residuals. We did so both contemporaneously (same year for each measure) and by lagging the HBO proportion by 1-year increments up to 4 years given that changes in testing location after changes in reimbursement could require contracting between physician groups and hospitals or hospital acquisition of physician groups, processes that would not occur immediately.

#### Estimated Association of Changes in Test Location With Medicare FFS Payments
We estimated additional national Medicare FFS payments owing to tests performed in the higher-paying HBO setting for 2015, the last year for which cost data were available. The estimate assumed that (1) with equal PBO and HBO payments, the ratio between the Medicare FFS group and control group HBO proportion would equal the mean observed between 2006 and 2008 (1.25), when the HBO to PBO payment ratio was close to 1.0, and (2) if the CMS reduced HBO payments to the PBO level, NCTs would move from HBOs to PBOs, with no change in overall testing rates. We identified the excess HBO proportion in the Medicare FFS group compared with the control group and attributed the difference between HBO and PBO payments for the extra HBO tests as excess Medicare FFS expenditures (eAppendix in the Supplement). We divided this additional estimated cost into CMS and patient components. We measured patient out-of-pocket payments using the Medicare 5% random sample. We calculated the sum of copayments and deductibles from the Medicare carrier files for PBO tests and the professional component of HBO tests and the outpatient files for the technical component of HBO tests.

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**Table. Demographic Characteristics of the Medicare Fee-for-Service and Medicare Advantage Populations in 2005 and 2015**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Medicare Fee-for-Service Group</th>
<th>Control Group: Medicare Advantage Patients at 3 Large HMOs</th>
</tr>
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<td>1111</td>
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<tr>
<td>Male sex, %</td>
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<td>Female sex, %</td>
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<td>Non-Hispanic black, %</td>
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<td>8.2</td>
</tr>
<tr>
<td>White, %</td>
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<td>87.0</td>
</tr>
</tbody>
</table>

Abbreviations: HMO, health maintenance organization; NCTs, noninvasive cardiac tests; SPECT, single-photon emission computed tomography.

*a Means and proportions for the managed care control group are equal-weighted means for the 3 HMO sites. Medicare data are for the national, random 5% Medicare fee-for-service sample. Medicare Advantage data are from 3 Medicare HMOs (Kaiser Permanente Colorado, Kaiser Permanente Northwest, and Group Health). 2015 Medicare Advantage data are weighted to reflect the availability of data for quarter 1 and quarter 3 but not for quarter 4 in 2015.

*b All other persons includes individuals not classified as non-Hispanic white, non-Hispanic black, or Hispanic, including individuals reporting multiple races in the managed care control group.

*c Studied NCTs are resting transthoracic and transesophageal echocardiography (resting echocardiography), stress testing with electrocardiography (stress echocardiography), stress SPECT, and stress echocardiography.
Patient Population and Overall Testing Rates

The data included a mean of 1.72 million patient-years annually in the Medicare FFS sample and 442,230 patient-years annually in the health maintenance organization control group. Mean patient age and the proportions of women declined between 2005 and 2015 in both the Medicare FFS and control group samples (mean age in Medicare FFS group: 2005, 76.1 years; and 2015, 75.2 years; mean age in control group: 2005, 75.9 years; and 2015, 74.8 years; P < .001; proportion of women in Medicare FFS group: 2005, 57.9%; and 2015, 56.2%; P < .001) (Table). The Medicare FFS sample had a higher proportion of black patients and a lower proportion of Hispanic patients than the control group plans in both time periods (proportion of black patients in Medicare FFS group: 2005, 18.3%; and 2015, 15.2%; P < .001; proportion of Hispanic patients in Medicare FFS group: 2005, 3.4%; and 2015, 4.8%; P < .001). Testing rates among the Medicare FFS group were higher than those in the managed care control group throughout the study period (218 vs 106 NCTs per 1000 patient-years in 2005 and 196 vs 101 NCTs per 1000 patient-years in 2015; P < .001 for all years). The most common tests were resting echocardiography and stress SPECT (together, 91.0% of tests in 2008); the weighted means reported are driven primarily by these tests.

Correlation Between HBO to PBO Payment Ratio and HBO Proportion

The trends in Medicare FFS payments for PBO and HBO testing resulted in an HBO to PBO payment ratio of 1.05 in 2005 and began to diverge in 2007, increasing progressively to a payment ratio of 2.32 in 2015 (Figure 3A). The Medicare FFS HBO proportion rose from a low of 21.1% in 2008 to 43.2% in 2015 (Figure 3A; P < .001). In contrast, in the managed care control group, the HBO proportion declined modestly from a high of 18.3% in 2006 to a low of 15.2% in 2015 (Figure 3A). When the Medicare FFS HBO to PBO payment ratio was close to 1, the HBO proportion was similar for the Medicare FFS group and the control group. When the payment ratio decreased early in the sample period, the Medicare FFS HBO proportion also decreased, and when the payment ratio increased later in the sample period, the HBO proportion increased.

The correlation between residuals (eTable 4 in the Supplement) was strongest with a 1-year lag in the proportion (correlation coefficient, 0.767; P < .001). We plot the HBO proportion lagged by 1 year vs the HBP to PBO payment ratio in Figure 3B. The visual correlation is apparent both early in the

Confidence Intervals and Statistical Significance

Reimbursement levels and testing rates in the control group were exact. Testing rates were precise estimates for the Medicare FFS group owing to large sample size (eg, the 2008 Medicare FFS rate was 229.02; 95% CI, 228.3-229.7). Reporting of 95% CIs, when performed, is in the eAppendix in the Supplement. We measured the statistical significance of changes and differences in rates using 2-sided tests; all reported changes and differences have P < .001 (see eAppendix in the Supplement for statistical details). We conducted all analyses in Stata, version 14.2 (StataCorp LLC).

Results

Trends in Medicare Payment Rates for Noninvasive Cardiac Tests and Association With Testing Location

Figure 1. Weighted Mean Fee-for-Service Medicare Payments for Noninvasive Cardiovascular Tests in the Hospital-Based Outpatient (HBO) and Provider-Based Office (PBO) Settings, 1999-2015

Amounts are in 2017 dollars.

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study period when the payment ratio decreased and later when the payment ratio increased. In contrast, the HBO proportion for the control group declined from 2005 to 2015, with no significant correlation between residuals ($r = -0.024; P = .95$ for a 1-year lag).

**Results by Type of Test**

For all 4 test types, the payment ratio and the HBO proportion both increased after the mid-2000s (Figure 4). The highest-volume tests—resting echocardiography and stress SPECT—also showed a declining payment ratio and HBO proportion in the early 2000s (Medicare FFS payments by individual test are shown in eFigure 2 in the Supplement; testing rates by individual test are shown in eFigure 3 in the Supplement). In secondary analyses, we found similar results using the dollar difference between HBO and PBO payment levels rather than the HBO to PBO payment ratio (eFigure 4 in the Supplement).

**Estimated Cost Implications of Testing Setting**

In 2015, the HBO proportion was 43.2% for the Medicare FFS group vs 15.2% for the managed care control group, and the Medicare FFS weighted mean NCT payment was $700 for HBO vs $302 for PBO ($398 additional per HBO test). We estimated the counterfactual for Medicare FFS HBO proportion at 19.1% using the assumptions above. There were approximately 6,915,000 NCTs performed in the Medicare FFS group in 2015 (20 times the number for the 5% random sample). An estimated 24% (ie, 43% − 19%) or 1,659,600 NCTs were performed in HBOs instead of PBOs, at an additional cost of $398 per test, for a total excess annual cost of $661 million, including additional CMS payments of $301 per test ($500 million) and out-of-pocket patient payments of $97 per test ($161 million). Time trends in FFS HBO and PBO payments and patient out-of-pocket payments are shown in eFigure 5 in the Supplement.
### Figure 4. Temporal Trends in the Hospital-Based Outpatient (HBO) to Provider-Based Office (PBO) Payment Ratio in Medicare Fee-for-Service (FFS) and the Proportion of Tests Ordered in the HBO Setting in the Medicare FFS vs Managed Care Control Group Populations by Test Type Lagged by 1 Year

[Spectrogram images showing temporal trends for different tests, labeled A, B, C, D]

SPECT indicates single-photon emission computed tomography.

### Discussion

In this analysis of 17 years of Medicare data, the number of outpatient NCTs in the Medicare FFS sector performed in the hospital setting was correlated with the HBO to PBO payment ratio. During 2006 to 2015, as the HBO to PBO payment ratio increased, the proportion of NCTs performed in the HBO setting also increased. This correlation was strongest with a 1-year lag between changes in the payment ratio and changes in test location. Rates of PBO testing decreased after 2009, a decline that was partially offset by higher HBO testing rates. In the managed care control group for which CMS payments do not depend on test setting, the proportion of tests performed in HBO settings declined modestly during the same period. The higher payment rates for hospital-based NCTs and changes in test location in the Medicare FFS group are estimated to result in substantial extra payments by both CMS and patients.

A prior study of echocardiography and myocardial perfusion imaging found a higher HBO proportion for these tests in 2010-2012 (after a well-publicized decrease in PBO payments in 2010) vs 2007-2009.8 Our study examines a longer time frame during which the HBO to PBO payment ratio first decreased and then increased, assesses the correlation between payment ratio and test location changes, includes a managed care control group, and estimates the financial outcome of tests moving from PBO to HBO.

In the early period of our study between 1999 and 2006, HBO payments began as greater than PBO payments; the amounts of both types of payments converged over time, driven by decreases in HBO payments as PBO payments remained stable. The capacity for office-based practices to capture payments both for the performance of tests and interpretation of these NCTs would create a stimulus for practices to invest in the technology to perform these tests independent of a hospital. This hypothesis is supported by a substantial increase in the absolute numbers of tests performed in the PBO setting and a corresponding decline in the HBO proportion.

The growing gap in HBO vs PBO payments after 2006 reflected the CMS’s interest in containing expenditures for PBOs, in which NCTs were perceived as potentially overused given the increases in PBO imaging rates.3-5 Our finding of lower overall testing rates in the managed care control group compared with the Medicare FFS group despite modest differences in patient demographics suggests testing in the Medicare FFS group that may not be driven by clinical need. The progres-
sive reductions in PBO payments in the Medicare FFS group, however, were not coordinated with HBO payments, which contemporaneously increased. The growing payment differential across all major types of NCTs performed among out-patients would have created incentives for clinicians and hospitals to move testing to the HBO setting. The approximately $700 mean payment for HBO tests in 2015 vs approximately $300 for PBO tests created an economic “rent” that clinicians and hospitals could capture by moving testing to HBOs. In systems in which both PBO and HBO facilities were available to perform NCTs, the payment differential would provide a strong incentive to expand HBO capacity and direct referrals to the higher-paying setting. During this period, hospitals also acquired or otherwise integrated with cardiology practices, which could facilitate test movement to the HBO setting. Rising HBO payments would increase a hospital’s ability to recruit cardiology groups, while PBO payments decreased to an extent that, in some cases, supporting independent facilities could have become financially infeasible. This latter force may have had an amplified association with NCTs performed in lower-volume practices, such as those in rural areas.

Although overall testing rates in FFS fell modestly, the principal result of the PBO payment reductions and the rising HBO to PBO payment ratio was more testing in the HBO setting over-setting lower PBO rates, leading to higher estimated Medicare FFS costs. In contrast, in the managed care control group, the HBO proportion remained low and actually declined during the same period. This comparison suggests that the increasing HBO to PBO payment ratio in the Medicare FFS group was an important causal factor in the increase in the HBO proportion in the Medicare FFS group. If the objective of reducing PBO payments for NCTs was to curb potential overuse and reduce spending, its actions were largely unsuccessful owing to the apparently unanticipated clinician response of shifting tests to the HBO setting.

The estimated financial outcome of higher relative payments for NCTs in the HBO setting for both CMS and Medicare beneficiaries is substantial. Furthermore, NCTs are a subset of the tests and procedures for which Medicare pays more in the HBO vs the PBO setting. Thus, other services may also migrate to the HBO setting in response to payment differences, resulting in additional costs for CMS and Medicare beneficiaries. Because higher Medicare FFS payments are often followed by rates set by commercial insurers, costs likely rose in this sector as well.

The Medicare Payment Advisory Committee (MedPAC), which advises Congress on payment policy, has recognized that higher HBO payments for identical services create incentives to deliver services in the HBO setting. The Medicare Payment Advisory Committee recommended aligning payments in 2014, but the issue is politically contentious, as hospitals attempt to keep their payment premium, asserting that the overhead costs of maintaining hospital facilities justify greater payments. However, economic principles do not support paying more for services that could be provided elsewhere at lower cost unless doing so results in better outcomes. The Medicare Hospital Outpatient Prospective Payment System finalized in 2018 included provisions aimed to achieve cost neutrality for some medical services. These changes have provoked strong negative responses from physician groups, hospitals, and health systems, including legal action. Meanwhile, in terms of actual payments for NCTs, there has been no sign of a reversal in site-based differences; to the contrary, the HBO to PBO payment ratio reached 2.73 in 2019. Thus, the future of site-neutral payments by the CMS remains unclear.

Limitations

This study has some limitations. First, the correlation between the changes in the HBO to PBO payment ratio and the HBO proportion is not proof of causation. However, the correlation during periods of both a decreasing and an increasing payment ratio and the lack of a similar change in the managed care control group suggest a causal link. Second, our estimate of annual extra Medicare FFS costs is predicated on a conservative assumption that reductions in HBO payments would not result in lower overall testing rates, which in turn would result in even greater Medicare savings. Third, our managed care control group of Medicare Advantage patients may not represent the larger Medicare Advantage population.

Conclusions

In settings in which reimbursement depends on test location, increasing HBO payments correlated with greater proportions of outpatient NCTs performed in the HBO setting, with higher overall costs to Medicare and patients. Site-neutral payments may offer an incentive for testing to be performed in the more efficient location.
The Case of Noninvasive Cardiac Testing—For Every Action There Is a Reaction
Joseph F. Figueroa, MD, MPH; Karen E. Joynt Maddox, MD, MPH

From 1999 to 2005, the use of noninvasive cardiac tests (NCTs), such as stress tests and echocardiography, grew by 57.1%, from 140 to 220 tests per 1000 patient-years, driven almost entirely by increased use of these tests in outpatientcardiologists’ offices.1 Concerned that this growth represented unnec-
sary overuse of testing, starting in 2005 the Centers for Medicare & Medicaid Services (CMS) reduced payments in the provider-based office (PBO) setting by half, from $600 to $300 per test on average. In this issue of JAMA Internal Medicine, Masoudi and colleagues1 investigate how this change in Medicare reimbursement rates for NCTs influenced rates of these tests being performed in hospital-based outpatient (HBO) locations vs PBO locations.

When CMS cut the PBO rate, the HBO rate stayed roughly the same. This change resulted in an increase in the HBO to PBO payment ratio from 1.05 in 2005 to 2.32 in 2015, effectively making it much more lucrative to perform the same test in a hospital-based location. Masoudi et al2 demonstrate that, after these changes, the proportion of NCTs performed in HBO locations in Medicare fee-for-service beneficiaries increased from 21.1% in 2008 to 43.2% in 2015. This increase was strongly correlated with site-specific changes in payment rates for NCTs. The authors provide further support for a possible causal link for these changes by evaluating rates of NCTs among a control Medicare Advantage population, in which payment rates did not change meaningfully over time. Masoudi et al3 found that the HBO proportion actually declined among the control population, from 18.3% in 2006 to 15.2% in 2015, and there was no correlation with payment rates.

The findings of this study are concerning and hold important lessons for policy makers. Although the reimbursement change had its intended effect, which was to slow (and in fact reverse) the growth in the use of NCTs seen in the early 2000s, the policy also contributed to 3 major unintended consequences.

The second, even more concerning, consequence is that patients’ out-of-pocket costs likely increased as well. Medi-