

Congressional Budget Office
Washington, D.C.

Methodology and Robustness Checks: Supplemental Material for
An Analysis of Private-Sector Prices for Physicians' Services

January 2018

This document details the process of constructing a study sample for analyzing private prices for physicians' services in Daria Pelech, *An Analysis of Private-Sector Prices for Physicians' Services*, Working Paper 2018-01 (Congressional Budget Office, January 2018), www.cbo.gov/publication/53441. It also outlines the steps for estimating the prices the Medicare fee-for-service (FFS) program pays physicians and the robustness checks we undertook to ensure an accurate comparison of private and Medicare FFS prices.

Sample Selection

To analyze prices for physicians' services, we selected a sample of claim-line observations (specific, itemized services shown on a claim) that met three basic criteria: They involved services that had been provided by physicians (rather than by nonphysician professionals), their prices were likely to be representative of average prices paid by insurers, and their prices could reasonably be compared with prices paid in Medicare's fee-for-service (FFS) program. To build that sample, we did the following:

1. Created a data set that included all claim-line observations occurring in 2014 from the physician file provided by the Health Care Cost Institute (HCCI).
2. Limited the data to services that had been provided by physicians, rather than by nonphysician professionals, such as nurses, chiropractors, or dentists.
3. Excluded claim-lines for pharmaceuticals, home health care, durable medical equipment, ambulance services, and laboratory services.
4. Restricted claim-lines to services delivered in physicians' offices, hospital inpatient departments, hospital outpatient departments, and ambulatory surgical centers (ASCs).
5. Excluded certain types of providers (pediatricians and anesthesiologists) to simplify the comparison between private prices and Medicare FFS prices.¹
6. Excluded claim-lines for which the data indicated that the HCCI insurer was a secondary payer.
7. Dropped observations provided by "low-volume" providers, which we defined as providers that billed fewer than 50 claim-lines in the 2014 physician data.² Providers were identified using national provider identifiers (NPIs).
8. Dropped claim-lines with missing current procedural terminology (CPT) codes or missing (NPIs).
9. Focused on metropolitan areas (those with a valid metropolitan statistical area, or MSA, code) and excluded claims from Puerto Rico and the other U.S. territories. This last step was taken to ensure that we had sufficient statistical power to compare prices across and within areas.

Table A-1 summarizes the steps we used to select the sample, shows the number of claim-line observations included after each step, and shows the percentage of the sample excluded after each step.

¹ We excluded pediatricians because the population under 18 was not the focus of this study and anesthesiologists because they have a complicated billing structure in Medicare FFS.

² That restriction reduced the number of providers in our data set by roughly 30 percent but had a small effect on the number of claim-lines. Overall, only 1.7 percent of claim-lines were excluded by this step.

Selection of Medicare Advantage and Commercial Samples

We constructed two samples from the data set described above—one for the commercially insured population and one for the Medicare Advantage population. For the commercial sample, we did the following:

1. Included claim-lines for enrollees between the ages of 18 and 64 for which there were valid age and gender data.
2. Included claim-lines from beneficiaries in commercial insurance policies (rather than in Medicare Advantage).
3. Limited the sample to beneficiaries in large- or small-group policies (excluding individual market and unclassified policies).
4. Excluded beneficiaries who were enrolled in both a commercial policy and a Medicare Advantage policy during the year.
5. Focused on claims from enrollees in health maintenance organizations (HMOs), preferred provider organizations (PPOs), exclusive provider organizations (EPOs), or point of service (POS) plans. This final step excluded indemnity plans, short-term plans, and unclassified plans. We excluded those observations because insurers may be more likely to pay physicians based on charges rather than negotiated prices in those plan types.

Table A-2 lists those steps and summarizes the number of observations included after each step of sample selection. Roughly 63 percent of the 415 million claim-lines selected in the initial sample were for patients between the ages of 18 and 64. Other sample restrictions had relatively small effects on the size of the commercial sample. Restricting the sample to commercial insurance claims and to large- and small-group plans reduced the size of the subsample of 18- to 64-year-old patients by about 6 percent each. Excluding data for people who were covered by both Medicare Advantage and commercial policies during the year and limiting the data to HMO, EPO, PPO, or POS plans reduced the size of the subsample by less than half a percentage point each.

To define the Medicare Advantage sample we took the following analogous steps:

1. Included claim-lines from enrollees age 65 years or older with valid age and gender data.
2. Limited the sample to beneficiaries who were in group or individual Medicare Advantage plans.
3. Excluded beneficiaries who were enrolled in both a commercial policy and a Medicare Advantage policy during the year.
4. Focused on claims from HMO, PPO, EPO, or POS plans. In the Medicare Advantage population, that step excluded private fee-for-service plans. (There were no indemnity plans, unclassified, or short-term plans in the Medicare Advantage population.) We excluded those observations because under current law, some private fee-for-service plans can pay exactly Medicare prices.

Roughly 30 percent of our initial sample of claim-lines were provided to patients who were ages 65 or older. (The 7 percent of claim-lines that were in neither subsample were provided to enrollees under age 18 or Medicare Advantage enrollees who were under 65.) Of those observations, 74 percent were for patients in Medicare Advantage plans. Excluding beneficiaries who were enrolled in both Medicare Advantage and commercial policies during the year reduced the sample by less than 1 percent; limiting the Medicare Advantage sample to observations from HMO, EPO, PPO, and POS plans reduced that sample by 2.5 percent (where excluded observations were from private-fee-for-service plans).

Selection of Procedure Codes

After selecting the sample for analysis, we chose a subset of services to analyze, as identified by CPT code. We focused on services that occurred frequently, that were relatively expensive, and that offered a fairly straightforward price comparison between private insurance and Medicare FFS.

For the commercial sample, we focused on services that occurred at least 50,000 times in that sample and that, on average, cost at least \$450. Seventeen services met those criteria, and of that set, we chose 11 to analyze: Mohs micrographic surgery, image-guided breast biopsy, knee arthroscopy, colonoscopy with tumor removal, gall bladder surgery, cataract removal, brain magnetic resonance imaging (MRI), abdominal MRI, intensity modulated radiation therapy (IMRT), positron emission tomography/computed tomography (PET/CT), and coronary angiography (see Table A-3).

We chose not to analyze four CPT codes for obstetric and neonatal services and two CPT codes for sleep studies (see Table A-4) because obstetric and neonatal services are rarely provided to the Medicare population and because sleep study codes potentially cover a heterogeneous bundle of services. We also excluded a fifth service—high-intensity emergency room evaluation and management (E&M)—from the main analysis. Although that code occurred frequently in the commercial sample, it occurred primarily in emergency departments in Medicare Advantage and thus appeared only rarely in that sample. For supplementary analysis of in- and out-of-network prices, we added emergency departments as a setting of service and analyzed emergency room E&M services.

The HCCI Medicare Advantage population was smaller than the commercial population and average prices were lower. Hence, for that subsample, we focused on services that occurred more than 20,000 times in the population and that, on average, cost more than \$300. Eleven codes fit those criteria, of which five (Mohs micrographic surgery, colonoscopy, cataract surgery, IMRT and PET/CT scans) had already been selected from our criteria in the commercial population. We excluded three codes that were clinically similar to those already selected: One code was for an additional stage of Mohs micrographic surgery, a second was a different code for cataract

surgery, and the third was for physician planning for IMRT. That left three additional services to add to the 11 selected above.

To augment the list of services, we chose five additional services from those that occurred most frequently in both populations: moderately complex and complex office visits for an established patient (99213, 99214), moderately complex office visits for a new patient (99203), moderately complex subsequent hospital care, and routine EKG conducted in an office with at least 12 leads. Those services did not meet our previous selection criteria because of their lower average prices. Collectively, however, they accounted for a large proportion of services and spending in the sample.

Cleaning the Data

Our measure of private prices included the total amount paid by the insurer and total cost sharing paid by the patient in the form of copayments, coinsurance, and deductibles for each observation, divided by the units of service provided on each claim-line. Before calculating final prices, we took the following steps to reduce anomalies in the data and simplify the calculation of Medicare prices:

1. Aggregated all claim-lines for the same patient, provider, date, procedure code, and procedural modifier to account for price adjustments made on a claim.
2. Excluded claim-lines with payments of \$0 or less.
3. Excluded claim-lines on which the number of units provided on the claim was less than 1, greater than 5, or a noninteger value.
4. Excluded claim-lines on which the only payment was the patient copayment, rather than an insurer payment or a patient deductible (such claims are more likely to be capitated).
5. Standardized bilateral billing patterns to match Medicare's billing patterns.
6. Excluded a subset of observations with certain procedural modifiers (described below).
7. Excluded any procedural modifier that occurred for less than 1 percent of each claim in each service.
8. Trimmed outliers by excluding observations below the 1st percentile or above the 99th percentile of private-to-Medicare price ratios in each sample (commercial and Medicare Advantage).

Most steps had little impact on the sample, affecting less than 1 percent of claim-lines for any code in any population. The steps that affected a larger proportion of the sample or that otherwise warrant further explanation are discussed below and summarized in Table A-5 and Table A-6.

Aggregating Claim-Lines

We aggregated claim-lines for the same patient, date, provider, procedural code, and code modifier so that the total price paid by the insurer and the patient reflected all price adjustments

made on a claim. We did this because we sometimes observed claims where a claim-line with a positive payment was paired with a claim-line for the same patient, provider, procedure, and date and an offsetting negative amount. Such patterns suggest that sometimes prices were adjusted over multiple lines.

For most services, aggregating claim-lines in that fashion had relatively small effects on sample sizes (see Column 3 in Table A-5 and Column 3 in Table A-6). However, for three services—Mohs micrographic surgery, stent placement, and cardiac catheterization—aggregation changed sample sizes by 5 percent to 13 percent in the commercial sample and by 14 percent to 17 percent in the Medicare Advantage sample. Those changes reflect the fact that those three services tended to have more negative, offsetting charges than other studied services. For all three procedures, between 1 percent and 10 percent of claim-lines were provided on the same claim as a negative charge, compared with less than 1 percent for most other services.

Aggregating multiple procedures does not affect average prices. However, it might affect estimated Medicare FFS prices – particularly because adjustments for multiple procedures were applied after the claim-lines were aggregated. To test whether aggregating claim-lines substantially changed estimated Medicare prices, we tested whether excluding claim-lines with multiple units affected the estimated ratios of private to Medicare prices. We found that those ratios changed by at most 3 percent for any service, leading us to conclude that error caused by aggregating multiple procedures is small.

Aggregating Bilateral Services

Billing patterns for bilateral services (services that are performed once each on opposite sides of the body) were standardized so that we could apply Medicare FFS’s bilateral pricing rules. Medicare requires that providers bill bilateral services on a single claim-line, and Medicare payments for those services are then increased by 50 percent. In contrast, private payers recognize a range of billing patterns for bilateral services, including billing two claim-lines for the same service. To apply Medicare’s pricing rules’ consistently, we aggregated bilateral claims that were billed on multiple lines and summed their commercial payments. Aggregation of claim-lines for bilateral services affected less than 1 percent of the sample for any service.

Excluding Procedural Modifiers

In calculating Medicare prices, we accounted for a range of procedural modifiers that affect payment and excluded claim-lines with modifiers for which the private billing patterns were not comparable to Medicare FFS. Specifically, we excluded observations with the procedural modifiers GC, Q6, and 59, and we included only modifier 26 for PET/CT scans. Modifier GC indicates a claim for a service provided under the direction of a teaching physician, and modifier Q6 indicates that the service was provided by a locum tenens physician (a physician who works in place of the regular physician when that provider is absent). We excluded those observations

because Medicare rules for paying teaching physicians and locum tenens physicians vary across services and settings. Modifier 59 marks services that are usually paid for as part of a larger service bundle, but that the physician indicates should be billed separately in that instance. Although Medicare pays for such services in full, private payers often discount them significantly. Thus, their prices may not be comparable to Medicare FFS prices.

In the commercial sample, excluding claim-lines with those three procedural modifiers reduced the sample size by more than 2 percent for only 4 services—Mohs micrographic surgery, knee arthroscopy, hysteroscopy, and EKG. For those services, the vast majority of excluded claim-lines had modifier 59. In the Medicare Advantage sample, excluding lines with specific clinical modifiers reduced the sample size by more than 2 percent for 10 services. For 5 of those services—Mohs micrographic surgery, knee arthroscopy, colonoscopy, stent placement, and EKG—the majority of excluded claim-lines had modifier 59. For the others—breast biopsy, gall bladder surgery, hysteroscopy, subsequent hospital care, and IMRT—excluded observations predominantly had claim-lines with modifier GC or Q6.

For PET/CT scans, we included only claim-lines with modifier 26, which indicates the professional component of a service, because the technical component of this service (modifier TC) is priced by individual Medicare administrative contractors, and prices vary across those contractors.

Calculating Medicare FFS Prices

To compare private prices with those paid by Medicare FFS, we used the Medicare fee schedule to calculate the amount that Medicare FFS would have paid for each claim-line observed in our data. To accurately capture what Medicare FFS would have paid for a particular service, we followed Medicare’s rules in calculating base prices and then applied four of Medicare’s payment adjustments: assistant at surgery rules, global payment adjustments, bilateral adjustments, and multiple procedure payment adjustments. We took the following steps:

1. Calculated the base relative value unit (RVU) for each claim-line. RVUs differ based on whether a service is provided in an office or a facility and whether a physician provides professional services, technical services, or both.
2. Multiplied the RVU by Medicare’s geographic pricing cost index to reflect variation in input costs across areas.
3. Multiplied the RVU by \$35.82, the conversion factor used to set Medicare’s FFS payment rates in 2014.³

³ See Centers for Medicare & Medicaid Services, Office of the Actuary, Sustainable Growth Rates & Conversion Factors, “Final 2015 SGR: Estimated Sustainable Growth Rate and Conversion Factor for Medicare Payments to Physicians in 2015” (November 2014), <https://go.usa.gov/xnggk> (PDF, 253 KB).

4. Adjusted prices to reflect the 2 percent reduction in Medicare’s FFS physician payments required by budget sequestration. Because sequestration rules exclude patient cost sharing, we assumed that patients paid the standard 20 percent coinsurance and, accordingly, reduced prices by 80 percent of 2 percent (1.6 percent).
5. Adjusted for assistant-at-surgery rules, which specify that Medicare FFS will pay only 16 percent of the standard Medicare price when a service is provided by a physician who assists at surgery.
6. Reduced prices by the amount specified on the fee schedule for claims that indicated that a physician provided only a portion of a global surgical package.⁴
7. Increased payments for bilateral procedures to account for the fact that Medicare’s pays for such procedures at 1.5 times the regular rate.
8. Applied multiple procedure payment adjustments as described below. To be consistent with Medicare pricing rules, we applied steps 5–7 before applying the multiple procedure payment reductions.

Multiple Procedure Payment Reductions

To accurately reflect what Medicare pays for a service, we applied Medicare’s multiple procedure payment reductions to the calculated Medicare FFS prices. For certain procedures, Medicare reduces payments if a physician performs multiple procedures for the same patient in one day. Specifically, Medicare ranks the claim-lines on a claim by RVU, pays the item with the highest RVU in full, and reduces payments on lines with lower-valued RVUs by an amount that varies across services. We applied those adjustments to accurately estimate Medicare FFS prices for the services in our sample; absent that adjustment, we would have overestimated Medicare FFS prices for many services and underestimated the ratios of private-to-Medicare prices.

Table A-7 and Table A-8 summarize the effects of applying multiple procedure payment adjustments to the 13 services subject to those rules. For several of those services, more than a third of observations were provided on claims with other services and were therefore potentially subject to multiple procedure payment rules (see Column 2 in Table A-7 and Column 2 in Table A-8). For instance, 90 percent of micrographic surgeries in the commercial sample were provided with at least one other service.

Column 3 in Table A-7 and Column 3 in Table A-8 show the ratios of private to Medicare FFS prices for observations provided alone. Those observations were unaffected by multiple procedure payment adjustments and therefore serve as a useful comparison for observations

⁴ In the 2014 Medicare fee schedule, some surgical services are grouped into global bundles for which Medicare pays more for a main surgical service and does not pay separately for pre- or postoperative services. However, when physicians indicate they provided only pre- and intraoperative care or only postoperative care (as denoted by procedural modifiers 54 or 55) Medicare reduces the price of the service by an amount specified in the fee schedule. For claim-lines with those modifiers, our calculated Medicare FFS price reflects those downward adjustments.

affected by those adjustments. Column 4 in those tables shows price ratios for observations provided with other services, before any adjustments. Before adjustment, those price ratios were generally lower than for claim-lines provided alone. For instance, in the commercial population, prices for knee arthroscopy and cardiac catheterization when provided with other services were nearly 39 percent and 30 percent lower, respectively, than prices for those same services provided alone.

Column 5 in those tables shows the average ratios of private prices to Medicare FFS prices for claim-lines provided alongside other services, after applying multiple procedure payment adjustments. For all but three services in each population (gall bladder surgery, brain MRI, and abdominal MRI in the commercial sample; colonoscopy, hip replacement, and knee replacement in the Medicare Advantage sample), applying multiple procedure payment adjustments reduced the absolute difference in price ratios between claim-lines provided alone and claim-lines provided alongside other services. Thus, billing patterns were generally more consistent within a service after adjustments.

Columns 6 and 7 in both Table A-7 and Table A-8 summarize the effects of applying multiple procedure payment rules on the average ratios of private to Medicare FFS prices in the whole sample. For all services except micrographic surgery, knee arthroscopy, and cardiac catheterization, applying multiple procedure payment adjustments changed the average ratio of private to Medicare FFS prices by less than 0.1. The largest change of any price ratio was for knee arthroscopy in the commercial population, where multiple procedure payment adjustments increased the ratio of commercial to Medicare FFS prices by roughly 29 percent (from 1.6 to 2.1).

Although multiple procedure payment adjustments are important for accurately reflecting Medicare FFS prices, large changes in the ratios of private to Medicare FFS prices may suggest that some insurers in our data applied multiple procedure payment adjustments differently than Medicare FFS—or did not apply them at all. Variations in the application of those rules could explain some of the price variation in our sample and also may provide one explanation for why Medicare FFS prices are lower than commercial prices for certain services.

Robustness

We performed a range of robustness checks to ensure that private and Medicare FFS prices were comparable and that analyzing the ratios of private to Medicare FFS prices did not lead us to overstate variation in those prices. Two of those checks are discussed in detail below.

Analysis of Coefficient of Variation

Throughout this analysis, we report price variation using the ratios of private to Medicare FFS prices. A concern with this approach is that, if private payers adjust prices differently than

Medicare FFS, dividing private prices by Medicare FFS might increase variation in prices, rather than reduce it.

To test whether dividing private prices by Medicare FFS prices increased variation, we compared the coefficients of variation for private prices with the coefficients of variation for the ratios of private to Medicare FFS prices (see Table A-9 and Table A-10). After taking the steps described above, we calculated coefficients of variation so that the samples would be identical for both comparisons.

Dividing commercial prices by Medicare FFS prices did not increase coefficients of variation for most services. For some services, variation decreased substantially. For instance, variation in prices for brain MRIs decreased by roughly 40 percent after dividing by Medicare prices. For other services (IMRT, PET/CT), variation in prices and price ratios was virtually the same. In the commercial population, variation increased for only two services, and those increases were relatively small: 6 percent for gall bladder surgery and 2 percent for stent placement.

Dividing Medicare Advantage prices by Medicare FFS prices also generally decreased variation, and that variation decreased by more than in the commercial sample. For some services, such as MRI and hip replacement, coefficients of variation for price ratios were two or three times smaller than coefficients of variation for prices. Dividing Medicare Advantage prices by Medicare FFS prices increased the coefficients of variation for only one service—subsequent hospital care—and the coefficients of variation for that service increased only by 3 percent.

Those results suggest that Medicare Advantage prices reflect Medicare FFS price adjustments more closely than commercial prices do, and that describing price variation in terms of the ratios of private to Medicare FFS prices is generally a reasonable approach in both the commercial and Medicare Advantage populations.

Facility Fees

Medicare FFS pays different prices for services provided in offices and facilities (hospitals and ambulatory surgery centers). Medicare pays physicians more when a service is provided in an office than it does when the service is provided in a facility, based on the assumption that a physician's office must cover the cost of inputs such as staff and supplies. For services performed in facilities, Medicare FFS pays physicians a lower fee and then pays an additional, separate fee to the facility in which the service is provided. For instance, in 2014, Medicare's national average rate for an office visit for an established patient (99214) was \$107.83. If the same service was provided in a hospital outpatient department, Medicare would pay the doctor \$79.17 at the national average rate and pay the facility a separate fee of \$92.53 (for a total of \$171.70).⁵

⁵ In 2014, Medicare also paid facility rates for services provided in physicians' offices that were owned by hospitals.

Our analysis includes only the fees paid to physicians, not to facilities, and, in calculating Medicare FFS prices, we assumed that private payers follow Medicare's model in paying separate fees to physicians and facilities. If that assumption is incorrect, however, and private insurers pay one combined fee for physician and facility services, then we would underestimate Medicare FFS prices and overestimate the ratios of private to Medicare FFS prices. For instance, suppose that an insurer pays the national average Medicare FFS price for services in facilities, but pays that price as a lump sum. That insurer would pay a physician in a facility $\$79.17 + \$92.53 = \$171.70$, and, using our methodology, we would estimate that Medicare pays that doctor only the outpatient physician fee of $\$79.16$. As a result, our estimated ratio of private to Medicare FFS would be twice as large as it would be if we had included the facility payment in the calculation of the Medicare FFS prices ($171.69/79.16 = 2.2$ rather than $171.69/171.69 = 1.0$).

To test whether excluding facility fees biased the comparison of private and Medicare FFS prices, we tested whether price ratios were affected if we excluded facility-based observations for which we could not find a matching facility fee. (Those are the observations whose price ratios might be affected by our assumptions.) Specifically, we matched physicians' claims from outpatient facilities (hospital outpatient departments or ASCs) to claims in the outpatient database based on patient ID, CPT code, and date of service (plus or minus 1 day), and then compared price ratios with and without unmatched claims.

Most services had a small proportion of observations that occurred in a facility and were unmatched; however, this was not the case for all services (see Column 2 and Column 3 in Table A-11 and Table A-12). For instance, 98 percent of knee arthroscopies in the Medicare Advantage sample occurred in an outpatient facility (Column 2, Table A-12), and nearly a third of those claims had no match in the outpatient file (Column 3, Table A-12).

However, despite the significant number of unmatched observations, excluding those observations had almost no effect on average ratios of private prices to Medicare FFS prices in either sample. Excluding unmatched observations changed estimated price ratios by 0.05 or less for all services in both samples. (Columns 4 and 5 in both Table A-11 and Table A-12 show the mean ratios of private prices to Medicare FFS prices, with and without unmatched observations, and Column 6 in those tables summarizes the difference.) Based on those results, we concluded that the exclusion of facility fees from our analysis did not significantly bias the comparison of private and Medicare FFS prices.

Tables

Abbreviations Used in the Tables

ASC = ambulatory surgery center
CPT = current procedural terminology
CT = computed tomography
EKG = electrocardiogram
E&M = evaluation and management
EPO = exclusive provider organization
FFS = fee for service
HMO = health maintenance organization
IMRT = intensity-modulated radiation therapy
MRI = magnetic resonance imaging
MSA = metropolitan statistical area
N = number
NPI = national provider identifier
PET = positron emission tomography
PPO = preferred provider organization
POS = point of service (plan)

Table A-1. Initial Steps in Selecting Observations from HCCI Physician Data

	1	2	3	4	5	6
Step		Number of Claim-Line Observations	Number of Unique Patients	Number of Unique Providers (NPIs)	Number of Unique MSAs	Percentage of Observations Excluded in This Step
1	Started with physician file for 2014	891,455,768	38,757,204	1,539,221	389	
2	Excluded services provided by nonphysicians (such as nurses, chiropractors, and dentists)*	773,048,237	37,622,093	1,233,947	389	13.3
3	Excluded claim-lines for pharmaceuticals, home health care, durable medical equipment, ambulance services, and laboratory services	617,350,067	37,400,175	1,229,685	389	17.5
4	Limited to services delivered in physician offices, hospital inpatient and outpatient departments, and ambulatory surgical centers	547,787,570	36,506,550	1,156,562	389	7.8
5	Excluded pediatricians and anesthesiologists	484,069,676	33,341,793	1,059,884	389	7.1
6	Dropped secondary payer claims	463,318,505	32,858,391	1,041,762	389	2.3
7	Dropped claims for NPIs that provide fewer than 50 claim-lines in a year	448,023,605	32,358,224	723,353	389	1.7
8	Dropped missing CPT codes and claims for physicians with invalid NPIs	447,753,482	32,356,438	723,279	389	0.0
9	Dropped non-MSAs and U.S. Territories	415,637,464	30,885,323	669,331	381	3.6

* Excluded nonphysician specialties include chiropractors, dentists and dental technicians, orthodontists, prosthodontists, periodontists, registered nurses, social workers, speech therapists, community support specialists, and home health aides.

Table A-2. Selection of Commercial and Medicare Advantage Observations From Initial Sample

	1	2	3	4	5
Step		Number of Claim-Line Observations	Number of Unique Patients	Number of Unique Providers (NPIs)	Percentage of Observations Excluded in This Step
Commercial Sample					
1	Restricted to patients ages 18-64 and patients with valid gender and age data	261,610,108	21,085,795	630,428	
2	Restricted to commercial insurance (excluded Medicare Advantage)	247,174,823	20,454,169	619,349	5.5
3	Restricted to large and small-group plans (excluding individual market)	230,406,831	18,840,225	606,388	6.4
4	Excluded beneficiaries who were enrolled in both a commercial policy and a Medicare Advantage policy during the year.	230,320,130	18,833,560	606,368	0.0
5	Kept only patients in EPO, HMO, PPO, or POS plans (excluded unclassified and indemnity plans)	229,480,669	18,777,707	605,640	0.3
Medicare Advantage Sample					
1	Kept patients ages 65 or older and patients with valid gender and age data	126,183,773	5,844,084	536,150	
2	Restricted to Medicare Advantage plans (excluding commercially insured)	93,387,694	4,033,719	470,574	26.0
3	Excluded beneficiaries who were enrolled in both a commercial policy and a Medicare Advantage policy during the year.	93,073,787	4,015,334	470,261	0.2
4	Kept only patients in EPO, HMO, PPO, or POS plans (excludes private-fee-for-service plans)	89,962,101	3,863,904	468,206	2.5

Roughly 63 percent of the 415 million claim-lines selected in the initial sample were provided to patients between the ages of 18 and 64. Roughly 30 percent of the initial sample of claim-lines was provided to patients age 65 or older. Both samples include 381 MSAs.

Table A-3. CPT Codes Included in Main Analysis

1	2	3	4	5
Code	Service	Met Commercial Criteria	Met Medicare Advantage Criteria	Occurred in the Top 10 Most Frequent Codes
17311	Mohs micrographic surgery	X	X	
19083	Image-guided breast biopsy	X		
27447	Total knee arthroplasty (knee replacement)		X	
27130	Total hip arthroplasty (hip replacement)		X	
29881	Knee arthroscopy	X		
45385	Colonoscopy with removal of tumor w/snare	X	X	
47562	Gall bladder removal	X		
58558	Hysteroscopy, surgical, with biopsy or polypectomy	X		
66984	Cataract removal with intraocular lens insertion	X	X	
70553	Brain MRI, with and without contrast.	X		
74183	Abdominal MRI, with and without contrast	X		
77418	IMRT	X	X	
78815	Tumor imaging, PET with concurrently acquired CT	X	X	
92928	Stent placement with coronary angioplasty		X	
93458	Coronary angiography with catheter placement	X		
99203	Intermediate office visit, new patient			X
99213	Intermediate office visit, established patient			X
99214	Complex office visit, established patient			X
93000	EKG, 12 leads, interpretation and report			X
99232	Subsequent hospital care, intermediate intensity			X

CPT codes met the initial inclusion criteria in the commercial sample if they occurred more than 50,000 times and cost an average of \$450 or more. Codes met the inclusion criteria in the Medicare Advantage sample if they occurred more than 20,000 times and cost an average of \$300 or more.

Table A-4. CPT Codes Excluded From Main Analysis

1	2	3	4	5
Code	Service	Met Commercial Criteria	Met Medicare Advantage Criteria	Reason for Exclusion
59400	Postpartum obstetrics	X		Population not represented in Medicare
59510	Routine obstetrics related to antepartum care	X		Population not represented in Medicare
95810	Sleep study	X		Heterogeneous services
95811	Sleep study	X		Heterogeneous services
99469	Subsequent inpatient neonatal crucial care	X		Population not represented in Medicare
99472	Subsequent inpatient pediatric and neonatal critical care	X		Population not represented in Medicare
99285	Emergency department E&M visit, high intensity	X		Insufficient sample in Medicare Advantage
17312	Additional stages, Mohs micrographic surgery		X	Similar to 17311
77263	IMRT planning		X	Similar to 77418
66982	Cataract surgery		X	Similar to 66984

Table A-5. Change in Commercial Sample Size Attributable to Data Cleaning

1	2	3	4	5	6	7
		Percentage Decrease in Claim-Lines				
Service	N, Initial Sample	Due to Aggregation	After Dropping Capitated Payments	After Dropping Modifiers	After Trimming Outliers	Overall Percentage Decrease in Observations
Mohs Micrographic Surgery	55,551	5.2	0.0	2.6	2.0	10
Breast Biopsy	24,999	2.1	0.1	1.1	2.0	5
Hip Replacement	26,978	3.0	0.0	0.1	2.0	5
Knee Replacement	40,863	4.8	0.0	0.2	2.0	7
Knee Arthroscopy	60,599	3.8	0.1	3.2	2.0	9
Colonoscopy	198,725	3.0	0.0	1.4	1.8	6
Gall Bladder Surgery	56,348	2.3	0.1	1.3	2.0	6
Hysteroscopy	52,466	2.0	0.1	3.3	1.9	7
Cataract Surgery	79,738	1.5	0.2	0.2	2.0	4
Brain MRI	218,369	1.8	0.2	0.5	2.0	4
Abdominal MRI	51,884	1.2	0.1	0.7	1.9	4
IMRT	32,867	3.8	0.0	1.3	1.3	6
PET/CT Scan	135,947	1.2	0.1	0.0	1.9	3
Stent Placement	23,454	13.2	0.0	1.8	2.0	17
EKG	2,690,278	1.4	1.0	4.6	2.0	9
Cardiac Catheterization	64,400	4.7	0.1	0.6	2.0	7
New Patient Visit	4,372,235	0.7	0.5	0.5	2.0	4
Established Patient Visit (99213)	24,396,829	0.6	2.2	0.4	2.0	5
Established Patient Visit (99214)	18,123,564	0.6	1.0	0.3	2.0	4
Subsequent Hospital Care	2,042,380	1.1	0.2	1.7	2.0	5

Table summarizes overall change in sample size attributable to four data-cleaning steps: aggregating claim-lines for the same patient–date–provider–modifier combination, excluding potentially capitated observations for which the insurer paid nothing and the patient made only a copayment, dropping selected procedural modifiers, and trimming observations above the 99th and below the 1st percentiles. (For some services, fewer than 2 percent of observations were excluded in the final step because multiple observations had prices equal to those at the 1st and 99th percentiles.) Column 7 shows the overall change in sample size resulting from all data-cleaning steps. Steps that affected less than 0.5 percent of observations for any one service were not summarized in this table.

Table A-6. Change in Medicare Advantage Sample Size Due to Data Cleaning Steps

1	2	3	4	5	6	7
		Percentage Decrease in Claim-Lines				
Service	N, Initial Sample	Due to Aggregation	After Dropping Capitated Payments	After Dropping Modifiers	After Trimming Outliers	Overall Percentage Decrease in Observations
Mohs Micrographic Surgery	83,316	14.3	0.4	6.7	2.0	22
Breast Biopsy	7,540	2.3	0.2	2.5	1.9	7
Hip Replacement	20,137	1.7	0.0	0.4	2.0	4
Knee Replacement	39,473	1.9	0.0	0.5	2.0	5
Knee Arthroscopy	6,306	1.1	0.0	4.4	1.9	7
Colonoscopy	101,091	2.4	0.0	4.4	1.9	9
Gall Bladder Surgery	12,343	1.1	0.0	3.4	2.0	6
Hysteroscopy	4,354	4.3	0.1	4.3	1.9	10
Cataract Surgery	227,898	1.5	0.1	2.0	2.0	5
Brain MRI	82,991	0.9	0.3	1.0	1.7	4
Abdominal MRI	19,337	0.6	0.2	0.7	1.7	3
IMRT	32,649	2.7	0.8	2.4	1.2	7
PET/CT Scan	186,305	0.5	0.0	0.0	2.0	2
Stent Placement	31,966	17.3	0.0	3.4	2.0	22
EKG	1,328,991	1.6	1.9	9.8	1.6	14
Cardiac Catheterization	70,879	16.8	0.0	0.9	2.0	19
New Patient Visit	1,031,605	1.6	0.8	1.5	2.0	6
Established Patient Visit (99213)	8,602,001	1.0	2.3	0.9	2.0	6
Established Patient Visit (99214)	8,853,197	0.9	1.5	0.7	1.7	5
Subsequent Hospital Care	3,541,840	0.7	0.1	3.6	2.0	6

Table summarizes overall change in sample size attributable to four data-cleaning steps: aggregating claim-lines for the same patient–date–provider–modifier combination, excluding potentially capitated observations for which the insurer paid nothing and the patient made only a copayment, dropping selected procedural modifiers, and trimming observations above the 99th and below the 1st percentiles. (For some services, fewer than 2 percent of observations were excluded in the final step because multiple observations had prices equal to those at the 1st and 99th percentiles.) Column 7 shows the overall change in sample size resulting from all data-cleaning steps. Steps that affected less than 0.5 percent of observations for any one service were not summarized in this table.

Table A-7. Effect of Multiple Procedure Payment Reductions on Ratios of Commercial to Medicare FFS Prices

1	2	3	4	5	6	7
Average Ratio of Commercial to Medicare FFS Prices						
Service	Percentage of Claim-Lines Provided With Other Services	For Claim-Lines Provided Alone	For Claim-Lines Provided With Other Services, Before Adjustment	For Claim-Lines Provided With Other Services, After Adjustment	Whole Sample, Before Adjustment	Whole Sample, After Adjustment
Mohs Micrographic Surgery	90	1.2	1.1	1.2	1.1	1.2
Breast Biopsy	43	2.0	1.9	1.9	2.0	2.0
Hip Replacement	11	1.8	1.7	1.9	1.8	1.8
Knee Replacement	17	1.8	1.6	1.8	1.8	1.8
Knee Arthroscopy	36	1.9	1.2	2.4	1.6	2.1
Colonoscopy	47	1.8	1.7	1.8	1.7	1.8
Gall Bladder Surgery	23	1.8	1.8	1.9	1.8	1.8
Hysteroscopy	29	1.7	1.4	1.8	1.6	1.7
Cataract Surgery	8	1.2	1.2	1.3	1.2	1.3
Brain MRI	44	2.2	2.4	2.6	2.3	2.4
Abdominal MRI	47	2.1	2.2	2.2	2.1	2.1
Stent placement	83	1.5	1.4	1.5	1.4	1.5
Cardiac Catheterization	49	1.5	1.1	1.5	1.3	1.5

Column 2 summarizes the percentage of claim-lines that were provided with other services on the same claim and were therefore potentially affected by multiple procedure payment adjustments. Columns 3, 4, and 5 compare the ratios of private to Medicare FFS prices for claim-lines provided alone (and therefore unaffected by multiple procedure payment adjustments), and for claim-lines provided alongside other services, before and after applying the multiple procedure payment adjustment to the Medicare FFS prices. Columns 7 and 8 compare average prices for the whole sample before and after applying those adjustments.

Because of rounding, the average ratios of commercial to Medicare FFS prices for some services do not appear different before and after adjustments.

Table A-8. Effect of Multiple Procedure Payment Reductions on Ratios of Medicare Advantage to Medicare FFS Prices

1	2	3	4	5	6	7
		Average Ratios of Medicare Advantage to Medicare FFS Prices				
Service	Percentage of Claim-Lines Provided With Other Services	For Claim-Lines Provided Alone	For Claim-Lines Provided With Other Services, Before Adjustment	For Claim-Lines Provided With Other Services, After Adjustment	Whole Sample, Before Adjustment	Whole Sample, After Adjustment
Mohs Micrographic Surgery	91	0.9	0.8	1.0	0.8	1.0
Breast Biopsy	37	1.1	1.0	1.0	1.0	1.0
Hip Replacement	8	1.0	1.0	1.0	1.0	1.0
Knee Replacement	10	1.0	1.0	1.0	1.0	1.0
Knee Arthroscopy	19	1.0	0.7	1.3	1.0	1.1
Colonoscopy	46	1.0	1.0	1.0	1.0	1.0
Gall Bladder Surgery	27	1.0	0.9	1.0	1.0	1.0
Hysteroscopy	13	1.0	0.9	1.0	1.0	1.0
Cataract Surgery	8	1.0	0.9	1.0	1.0	1.0
Brain MRI	31	1.0	1.0	1.0	1.0	1.0
Abdominal MRI	31	1.0	1.0	1.0	1.0	1.0
Stent placement	83	1.0	0.9	0.9	0.9	0.9
Cardiac Catheterization	49	1.0	0.8	1.1	0.9	1.0

Column 2 summarizes the percentage of claim-lines that were provided with other services on the same claim and were therefore potentially affected by multiple procedure payment adjustments. Columns 3, 4, and 5 compare the ratios of private to Medicare FFS prices for claim-lines provided alone (and therefore unaffected by multiple procedure payment adjustments), and for claim-lines provided alongside other services, before and after applying the multiple procedure payment adjustment to the Medicare FFS prices. Columns 7 and 8 compare average prices for the whole sample before and after applying those adjustments.

Because of rounding, the average ratios of commercial to Medicare FFS prices for some services do not appear different before and after adjustment.

Table A-9. Comparison of Coefficients of Variation Between Commercial Prices and Price Ratios

1	2	3	4
Service	Coefficient of Variation, Unit Prices	Coefficient of Variation, Ratios of Private to Medicare FFS Prices	Difference in Coefficients of Variation (Percent)
Mohs Micrographic Surgery	46.0	40.7	13
Breast Biopsy	83.0	76.2	9
Hip Replacement	89.4	68.7	30
Knee Replacement	71.4	51.6	38
Knee Arthroscopy	70.1	62.7	12
Colonoscopy	54.2	52.7	3
Gall Bladder Surgery	93.2	98.6	-5
Hysteroscopy	79.3	66.8	19
Cataract Surgery	42.6	42.2	1
Brain MRI	102.2	59.6	72
Abdominal MRI	105.2	52.8	99
IMRT	62.7	62.7	0
PET/CT Scan	51.4	51.3	0
Stent Placement	47.9	48.9	-2
EKG	43.9	42.4	3
Cardiac Catheterization	67.3	54.9	23
New Patient Visit	33.5	33.4	0
Established Patient Visit (99213)	34.8	34.3	1
Established Patient Visit (99214)	35.3	35.2	0
Subsequent Hospital Care	40.0	39.7	1

Coefficients of variation were calculated by dividing the standard deviations of prices (or price ratios) by mean prices (or price ratios) for each service.

Table A-10. Comparison of Coefficients of Variation Between Medicare Advantage Prices and Price Ratios

1	2	3	4
Service	Coefficient of Variation, Unit Prices	Coefficient of Variation, Ratios of Private to Medicare FFS Prices	Difference in Coefficients of Variation (Percent)
Mohs Micrographic Surgery	29.0	23.5	24
Breast Biopsy	71.1	36.3	96
Hip Replacement	46.2	14.0	229
Knee Replacement	46.2	14.6	217
Knee Arthroscopy	33.3	31.3	6
Colonoscopy	22.9	17.5	31
Gall Bladder Surgery	32.4	8.2	295
Hysteroscopy	24.4	21.2	15
Cataract Surgery	20.2	15.7	28
Brain MRI	82.6	23.8	248
Abdominal MRI	94.6	22.9	313
IMRT	22.5	21.3	6
PET/CT Scan	10.1	9.4	7
Stent Placement	20.4	19.9	3
EKG	16.4	14.6	13
Cardiac Catheterization	36.5	26.5	38
New Patient Visit	11.9	10.4	14
Established Patient Visit (99213)	12.8	11.4	13
Established Patient Visit (99214)	12.7	11.7	9
Subsequent Hospital Care	8.2	8.4	-3

Coefficients of variation were calculated by dividing the standard deviations of prices (or price ratios) by mean prices (or price ratios) for each service.

Table A-11. Effect of Excluding Unmatched Outpatient Observations on Ratios of Commercial to Medicare FFS Prices

1	2	3	4	5	6
			Mean Ratios of Commercial to Medicare FFS Prices		
Service	Observations Occurring in Outpatient Facilities (Percent)	Unmatched Outpatient Observations (Percent)	Whole Sample	Excluding Unmatched Observations	Difference, Columns 4 and 5
Mohs Micrographic Surgery	3	0	1.19	1.19	0.00
Breast Biopsy	69	8	1.95	1.94	0.01
Hip Replacement	4	2	1.82	1.81	0.00
Knee Replacement	3	2	1.77	1.77	0.00
Knee Arthroscopy	99	13	2.09	2.03	0.05
Colonoscopy	93	13	1.77	1.73	0.04
Gall Bladder Surgery	76	14	1.81	1.81	0.00
Hysteroscopy	76	14	1.68	1.69	-0.01
Cataract Surgery	98	16	1.25	1.22	0.03
Brain MRI	46	6	2.39	2.40	-0.01
Abdominal MRI	51	5	2.12	2.12	0.00
IMRT	0	0	2.02	2.02	0.00
PET/CT Scan	85	11	2.18	2.17	0.01
Stent Placement	50	36	1.47	1.48	-0.01
EKG	0	0	1.67	1.67	0.00
Cardiac Catheterization	53	13	1.54	1.55	-0.01
New Patient Visit	2	1	1.14	1.13	0.01
Established Patient Visit (99213)	1	1	1.11	1.10	0.00
Established Patient Visit (99214)	1	1	1.12	1.11	0.01
Subsequent Hospital Care	0	0	1.22	1.22	0.00

“Outpatient facility” refers to a hospital outpatient department or an ASC. Observations were matched to the records in the outpatient file, based on patient ID, CPT code, and date of service (± 1 day).

Table A-12. Effect of Excluding Unmatched Outpatient Observations on Ratios of Medicare Advantage to Medicare FFS Prices

			Mean Ratios of Medicare Advantage to Medicare FFS Prices		
1	2	3	4	5	6
			Mean Ratios of Medicare Advantage to Medicare FFS Prices		
Service	Observations Occurring in Outpatient Facilities (Percent)	Unmatched Outpatient Observations (Percent)	Whole Sample	Excluding Unmatched Observations	Difference, Columns 4 and 5
Mohs Micrographic Surgery	5	2	0.96	0.96	0.00
Breast Biopsy	75	23	1.05	1.05	0.00
Hip Replacement	1	1	1.00	1.00	0.00
Knee Replacement	1	1	1.01	1.01	0.00
Knee Arthroscopy	98	31	1.08	1.05	0.03
Colonoscopy	91	27	1.01	1.00	0.01
Gall Bladder Surgery	59	21	0.98	0.98	0.00
Hysteroscopy	87	28	1.01	0.98	0.02
Cataract Surgery	99	34	0.98	0.94	0.03
Brain MRI	45	14	1.02	1.02	0.00
Abdominal MRI	51	14	1.01	1.01	0.00
IMRT	0	0	0.93	0.93	0.00
PET/CT Scan	84	22	1.00	0.99	0.00
Stent Placement	50	44	0.92	0.92	0.00
EKG	0	0	0.99	0.99	0.00
Cardiac Catheterization	52	18	1.04	1.05	0.00
New Patient Visit	5	5	0.96	0.96	0.00
Established Patient Visit (99213)	6	6	0.96	0.96	0.00
Established Patient Visit (99214)	6	6	0.96	0.96	0.00
Subsequent Hospital Care	0	0	0.97	0.97	0.00

“Outpatient facility” refers to a hospital outpatient department or an ASC. Observations were matched to the records in the outpatient file, based on patient ID, CPT code, and date of service (± 1 day).