

Appendix Table 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 non-physicians (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

Table summarizes the percentage of claim-lines, patients, providers, and MSAs included in each step of study sample selection. Column 6 summarizes the percentage change in the number of observations from the previous step.

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

CPT=current procedural terminology; MSA=metropolitan statistical areas; NPI= national provider identifier.

Appendix Table 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 (excluded 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 (excluded 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 (excluded 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 18-64 years old. Roughly 30 percent of the initial sample of claim-lines was provided to patients age 65 or older. Both samples include 381 MSAs.

EPO=exclusive provider organization; HMO=health maintenance organization; MA=Medicare Advantage; MSA=metropolitan statistical areas; NPI= national provider identifier; POS=point of service plans; PPO=preferred provider organization.

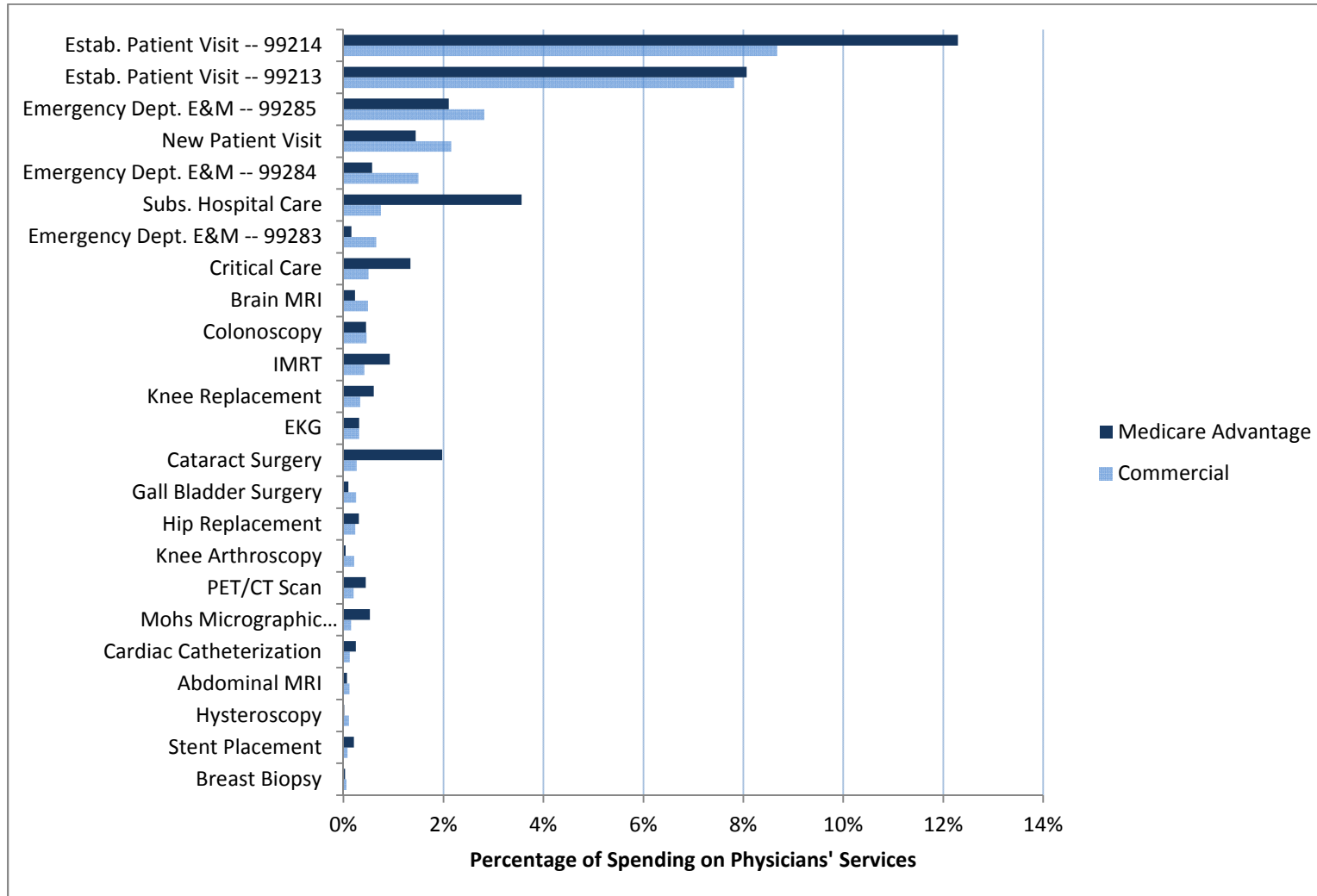
Appendix Table 3. Physician Services Included in Analysis and Descriptive Statistics

CPT Code	Service	Most Common Provider Specialty	Most Common Setting
Surgical Services			
17311	Mohs micrographic surgery	Dermatology	Physician office
19083	Image-guided breast biopsy	Radiology	Hospital outpatient dept. or ASC
27447	Total knee arthroplasty (knee replacement)	Orthopedics	Hospital inpatient dept.
27130	Total hip arthroplasty (hip replacement)	Orthopedics	Hospital inpatient dept.
29881	Knee arthroscopy and surgery	Orthopedics	Hospital outpatient dept. or ASC
45385	Colonoscopy with tumor or lesion removal	Gastroenterology	Hospital outpatient dept. or ASC
47562	Laparoscopic cholecystectomy (gallbladder surgery)	General surgery	Hospital outpatient dept. or ASC
58558	Surgical hysteroscopy with biopsy or polypectomy	Obstetrics and gynecology	Hospital outpatient dept. or ASC
66984	Cataract removal with intraocular lens insertion	Ophthalmology	Hospital outpatient dept. or ASC
Radiologic Services			
70553	Brain MRI, with and without contrast	Radiology	Hospital outpatient dept. or ASC
74183	Abdominal MRI, with and without contrast	Radiology	Hospital outpatient dept. or ASC
77418	IMRT	Therapeutic radiology	Physician office
78815	Tumor imaging, PET with concurrently acquired CT*	Radiology	Hospital outpatient dept. or ASC
Medical Services			
92928	Percutaneous transcatheter placement of intracoronary stent(s), with coronary angioplasty when performed (stent placement)	Cardiology	Hospital outpatient dept. or ASC (commercial), hospital inpatient department (Medicare Advantage)
93000	EKG, 12 leads, interpretation and report, office-based	Internal medicine (commercial), cardiology (Medicare Advantage)	Physician office
93458	Catheter placement for coronary artery(s) for coronary angiography, with left heart catheterization	Cardiology	Hospital outpatient dept. or ASC
99203	New patient office visit, low to moderate complexity	Family practice (commercial), orthopedics (Medicare Advantage)	Physician office
99213	Established patient office visit, low to moderate complexity	Family practice	Physician office
99214	Established patient office visit, moderate to high complexity	Family practice	Physician office
99232	Subsequent hospital care, intermediate intensity	Internal medicine	Hospital inpatient dept.

The table summarizes the services studied in this analysis, the top specialty providing each service, and top setting for each service. Unless otherwise noted, the most common provider specialty and most common setting are the same for the commercial and MA population.

*PET/CT scans include only the professional component of this code, as the technical component is priced by individual Medicare carriers in the Medicare FFS program.

Figure 1. The Percentage of Physicians' Spending Accounted for by Each Service



The figure summarizes the percentage of spending of physicians' services in the HCCI data that is accounted for by each service in each population (commercial or MA).

Variation in Physician Prices across MSAs

We analyzed price variation across MSAs by calculating the average ratio of private to Medicare FFS prices for each service in each MSA in both populations.¹ The average ratios of commercial to Medicare FFS prices varied substantially from one MSA to another; the average ratios of Medicare Advantage to Medicare FFS prices varied much less. For example, the average commercial price for hip replacements in the MSA at the 10th percentile was 24 percent higher than Medicare FFS, while the average price in the MSA at the 90th percentile was 2.7 times higher than Medicare FFS. As a result, price ratios varied more than twofold across MSAs. We observed similar variation for all 20 services in the commercial population. Average commercial price ratios in the 90th-percentile MSA were 50 percent higher than the average ratios in the 10th-percentile MSA for all services, and twice as high for 10 of the 20 services (Figure 2). In contrast, the average ratios of MA prices to Medicare FFS prices varied much less across MSAs. For example, the average MA price for hip replacements in the 10th-percentile MSA was 3 percent lower than Medicare FFS and 6 percent higher in the 90th-percentile MSA. Thus, there was only a 9 percent difference between the most and least expensive areas in MA prices for hip replacements, compared with the more than twofold difference in commercial prices. For all services, the average ratio of MA to Medicare FFS prices in the 90th-percentile MSA was at most 24 percent higher than the price ratio in the 10th-percentile MSA.

Variation in Prices Across Physicians Within MSAs

To describe how prices varied among physicians within MSAs, we calculated the median ratio of private to Medicare FFS prices for each service and each physician within an MSA.² (We summarized physician-level prices using medians because many doctors provided a small number of each service and averages could be sensitive to outliers.)

There was limited variation in median price ratios among physicians within MSAs in MA; in contrast, commercial price ratios varied substantially. For instance, for brain MRIs in Chicago in the commercial sample, the physician in the 10th percentile of price ratios was paid 25 percent more than Medicare FFS, while the physician at the 90th percentile was paid more than four times the Medicare FFS price (Appendix Table 4). In contrast, for brain MRIs in Chicago in MA, the physician at the 10th percentile of price ratios was paid 9 percent less than Medicare FFS, and the physician at the 90th percentile was paid exactly the Medicare FFS price (Appendix Table 5). Thus, there was only a 10 percent difference between the 90th and 10th percentile physicians in Chicago in MA, compared to a threefold difference between commercial physicians.

To systematically characterize price variation across physicians within MSAs, we calculated the percentage of MSAs for which price ratios for the 90th-percentile physician were at least 50 percent higher than price ratios for 10th-percentile physician. In MA, fewer than half of all MSAs had such variation (Figure 3). The service with the most variation was breast biopsies, for which the 90th percentile physician was at least 50 percent more expensive than the 10th-

¹ To ensure that averages were not influenced by a small number of observations, we included only MSAs for which there were more than 25 observations from at least five providers for this portion of analysis.

² To reduce the probability that variation within MSAs was driven by outliers, we restricted the sample for that analysis to physicians who provided at least five observations in an MSA for each population and service. We then restricted analysis to MSAs and services with at least five physicians and 50 observations.

percentile physician in 45 percent of MSAs. For all other services in MA, we observed such variation in less than a third of MSAs.³

In contrast, more than half of all MSAs had a 50 percent difference between providers in the 10th and 90th percentile in the commercial sample. For cataract surgery—the service that varied the least across providers—the 90th percentile provider was 50 percent more expensive than the 10th percentile provider in 53 percent of MSAs. For brain MRIs—the service that varied the most—providers in the 90th percentile were 50 percent more expensive than those in the 10th percentile in 87 percent of MSAs.

Analysis of Coefficient of Variation

Throughout this analysis, we report price variation using the ratios of private to Medicare FFS prices. The advantage of this approach is that Medicare FFS prices are adjusted for a range of considerations (including variation in input costs across areas, the type of provider administering the service, or whether a physician provides multiple related services in a day), and thus, variation in prices due to those factors should be reduced. However, a concern with this approach is that, if private payers apply different adjustment to prices 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 to the coefficients of variation for the ratios of private to Medicare FFS prices (see Appendix Table 6 and Appendix Table 7).

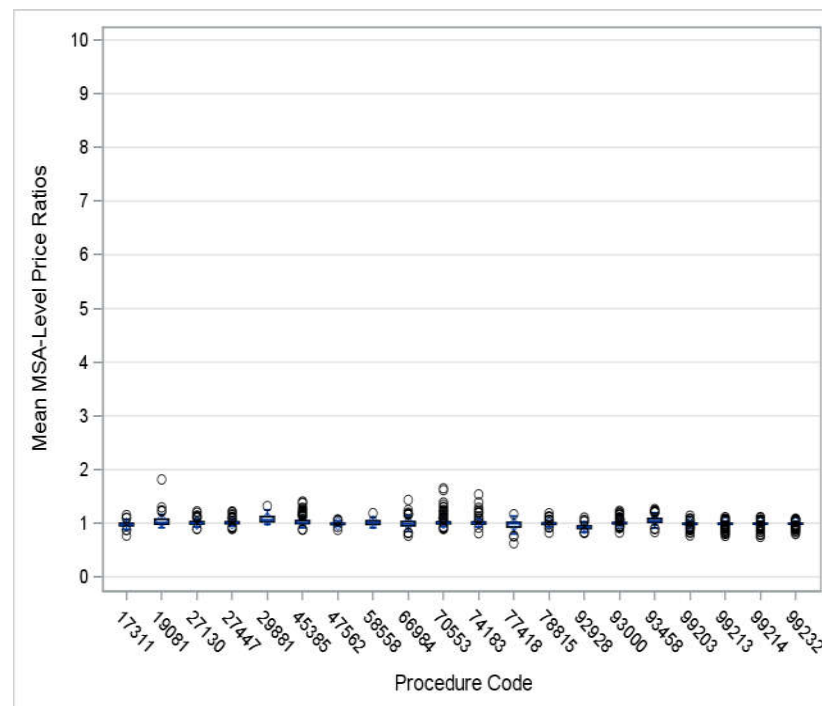
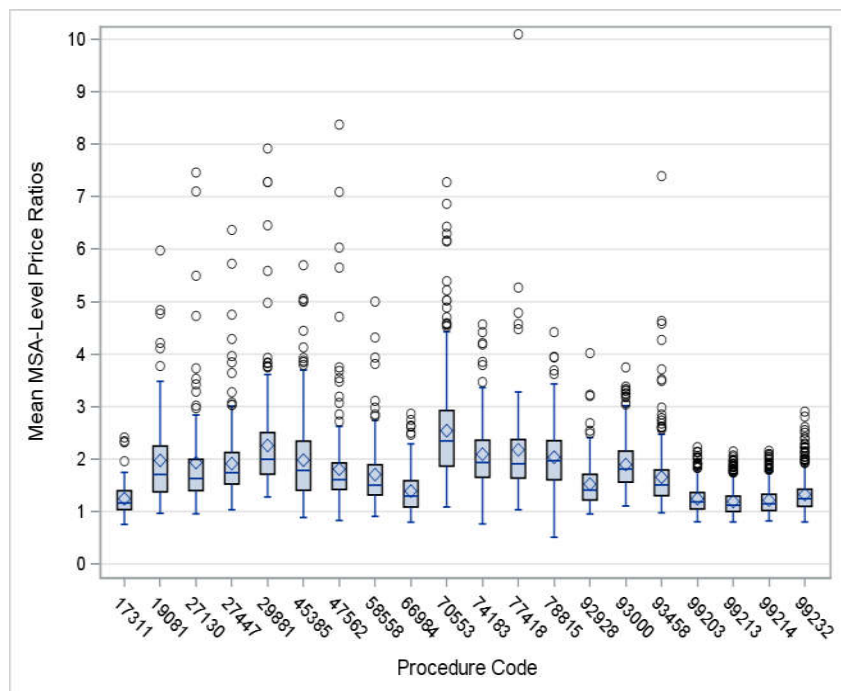
Dividing commercial prices by Medicare FFS prices did not increase coefficients of variation for most services. For some services, variation decreased substantially; for instance, variation in prices for brain MRIs decreased by roughly 40 percent. For other services (IMRT, PET/CT), variation in prices 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 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.

³ Knee arthroscopy and hysteroscopy were omitted from this portion of analysis for MA because fewer than 5 MSAs met our sample restrictions.

Figure 2. Variation Across MSAs in the Average Ratios of Private Prices to Medicare FFS Prices
Commercial Medicare Advantage



Procedure codes			
17311 = Mohs Micrographic Surgery	45385 = Colonoscopy	74183 = Abdominal MRI	93458 = Cardiac Catheterization
19081 = Breast Biopsy	47562 = Gall Bladder Surgery	77418 = IMRT	99203 = New Patient Office Visit
27130 = Hip Replacement	58558 = Hysteroscopy	78815 = PET/CT scan	99213 = Estab. Patient Office Visit
27447 = Knee Replacement	66984 = Cataract Surgery	92928 = Stent Placement	99214 = Estab. Patient Office Visit
29881 = Knee Arthroscopy	70553 = Brain MRI	93000 = EKG	99232 = Subsequent Hospital Care

Data were limited to all MSAs with at least 25 claim-lines and at least five distinct providers for each service in each population. The edges of each box are the 25th and 75th percentiles, respectively; the middle line is the median MSA; the mean is marked by a diamond. The upper and lower fences end at 1.5 times the interquartile range above and below the 25th and 75th percentiles. Outliers outside those ranges are indicated by dots. Average prices include both in- and out-of-network observations.

Appendix Table 4. Variation in Ratios of Commercial Prices to Medicare FFS Prices Across Providers Within Select Metropolitan Areas

	Commercial Prices Relative to FFS Prices	Chicago-Naperville-Elgin, IL-IN-WI	Cincinnati, OH-KY-IN	Dallas-Fort Worth-Arlington, TX	Miami-Fort Lauderdale-West Palm Beach, FL	New York-Newark-Jersey City, NY-NJ-PA
Colonoscopy	Number of Providers	313	87	254	225	801
	10th Percentile	1.07	0.98	1.17	0.71	0.86
	90th Percentile	2.14	1.70	2.69	1.49	2.40
	Ratio of 90th to 10th Percentiles	2.01	1.73	2.30	2.11	2.79
Cataract Surgery	Number of Providers	145	46	133	82	283
	10th Percentile	0.96	0.94	1.08	0.64	0.81
	90th Percentile	1.60	1.42	1.43	1.19	1.88
	Ratio of 90th to 10th Percentiles	1.66	1.52	1.33	1.87	2.33
Brain MRI	Number of Providers	347	60	270	172	553
	10th Percentile	1.25	1.64	1.28	0.97	0.82
	90th Percentile	4.09	2.58	3.97	2.40	3.63
	Ratio of 90th to 10th Percentiles	3.27	1.57	3.11	2.47	4.45
Established Patient Visit	Number of Providers	11,053	3,086	6,755	5,925	25,780
	10th Percentile	0.84	0.72	0.93	0.58	0.64
	90th Percentile	1.57	1.38	1.55	1.31	1.67
	Ratio of 90th to 10th Percentiles	1.87	1.92	1.66	2.27	2.59

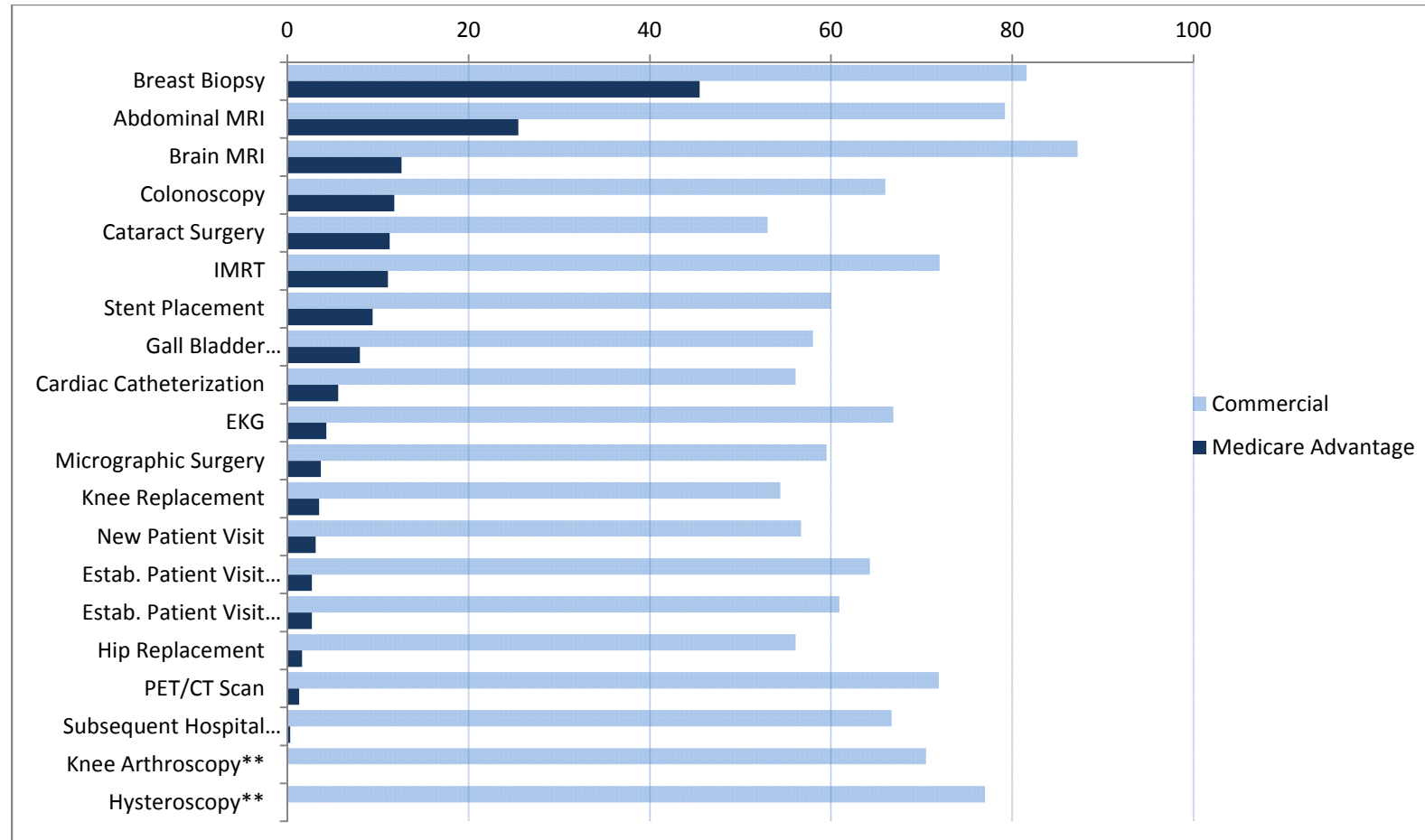
Table summarizes median, provider-level price ratios within five MSAs, selected for having the most providers in one of the two populations. Analysis excludes providers with fewer than 5 claims and includes only MSAs with at least 50 claim-lines and at least 5 distinct providers for each service in each population. Average prices include both in- and out-of-network observations.

Appendix Table 5. Variation in Ratios of Medicare Advantage to Medicare FFS Prices Across Providers Within Select Metropolitan Areas

	Medicare Advantage Prices Relative to FFS Prices	Chicago-Naperville- Elgin, IL-IN-WI	Cincinnati, OH-KY-IN	Dallas-Fort Worth-Arlington, TX	Miami-Fort Lauderdale-West Palm Beach, FL	New York-Newark- Jersey City, NY-NJ-PA
Colonoscopy	Number of Providers	166	81	129	108	358
	10th Percentile	0.90	0.94	1.00	0.75	0.63
	90th Percentile	1.03	1.00	1.76	1.00	1.00
	Ratio of 90th to 10th Percentiles	1.14	1.06	1.77	1.34	1.59
Cataract Surgery	Number of Providers	231	54	136	127	491
	10th Percentile	0.80	0.94	1.00	0.65	0.74
	90th Percentile	1.01	1.00	1.05	1.00	1.00
	Ratio of 90th to 10th Percentiles	1.26	1.06	1.05	1.54	1.35
Brain MRIs	Number of Providers	134	48	90	93	154
	10th Percentile	0.91	1.00	0.85	0.58	0.80
	90th Percentile	1.00	1.10	1.03	1.01	1.15
	Ratio of 90th to 10th Percentiles	1.10	1.10	1.22	1.74	1.43
Established Patient Visit	Number of Providers	6,980	2,501	4,244	3,614	15,641
	10th Percentile	1.00	0.91	1.00	0.70	0.55
	90th Percentile	1.01	1.01	1.06	1.01	1.01
	Ratio of 90th to 10th Percentiles	1.01	1.11	1.06	1.44	1.83

Table summarizes median, provider-level price ratios within five MSAs, selected for having the most providers in one of the two populations. Analysis excludes providers with fewer than 5 claims and includes only MSAs with at least 50 claim-lines and at least 5 distinct providers for each service in each population. Average prices include both in- and out-of-network observations.

Figure 3. Percentage of MSAs in Which the Ratio of Private to Medicare FFS Prices is at Least 50 Percent Greater for the 90th Percentile Provider Than the 10th Percentile Provider



Analysis excludes providers with fewer than five claims and includes only MSAs with at least 50 claim-lines and at least five distinct providers for each service in each population. Average prices include both in- and out-of-network observations.

** Knee arthroscopies and hysteroscopy were omitted from this portion of analysis for Medicare Advantage because there were fewer than five MSAs that met the sample restrictions in Medicare Advantage.

Appendix Table 6. Comparison of Coefficients of Variation Between Medicare Advantage Prices and Price Ratios

Procedural Code	Service	Coefficient of Variation, Unit Prices	Coefficient of Variation, Ratios of Private to Medicare FFS Prices	Percentage Difference in Coefficients of Variation (%)
17311	Mohs Micrographic Surgery	29.0	23.5	-19
19081	Breast Biopsy	71.1	36.3	-49
27130	Hip Replacement	46.2	14.0	-70
27447	Knee Replacement	46.2	14.6	-68
29881	Knee Arthroscopy	33.3	31.3	-6
45385	Colonoscopy	22.9	17.5	-24
47562	Gall Bladder Surgery	32.4	8.2	-75
58558	Hysteroscopy	24.4	21.2	-13
66984	Cataract Surgery	20.2	15.7	-22
70553	Brain MRI	82.6	23.8	-71
74183	Abdominal MRI	94.6	22.9	-76
77418	IMRT	22.5	21.3	-6
78815	PET/CT Scan	10.1	9.4	-7
92928	Stent Placement	20.4	19.9	-3
93000	EKG	16.4	14.6	-11
93458	Cardiac Catheterization	36.5	26.5	-27
99203	New Patient Visit	11.9	10.4	-13
99213	Estab. Patient Visit	12.8	11.4	-11
99214	Estab. Patient Visit	12.7	11.7	-8
99232	Subsequent Hospital Care	8.2	8.4	3

Table summarizes the coefficients of variation for private prices, coefficients of variation for the ratios of private to Medicare FFS prices, and the percentage difference in the coefficients of variation.

Appendix Table 7. Comparison of Coefficients of Variation Between Commercial Prices and Price Ratios

Procedural Code	Service	Coefficient of Variation, Unit Prices	Coefficient of Variation, Ratios of Private to Medicare FFS Prices	Percentage Difference in Coefficient of Variation (%)
17311	Mohs Micrographic Surgery	46.0	40.7	-12
19081	Breast Biopsy	83.0	76.2	-8
27130	Hip Replacement	89.4	68.7	-23
27447	Knee Replacement	71.4	51.6	-28
29881	Knee Arthroscopy	70.1	62.7	-11
45385	Colonoscopy	54.2	52.7	-3
47562	Gall Bladder Surgery	93.2	98.6	6
58558	Hysteroscopy	79.3	66.8	-16
66984	Cataract Surgery	42.6	42.2	-1
70553	Brain MRI	102.2	59.6	-42
74183	Abdominal MRI	105.2	52.8	-50
77418	IMRT	62.7	62.7	0
78815	PET/CT Scan	51.4	51.3	0
92928	Stent Placement	47.9	48.9	2
93000	EKG	43.9	42.4	-3
93458	Cardiac Catheterization	67.3	54.9	-18
99203	New Patient Visit	33.5	33.4	0
99213	Estab. Patient Visit	34.8	34.3	-1
99214	Estab. Patient Visit	35.3	35.2	0
99232	Subsequent Hospital Care	40.0	39.7	-1

Table summarizes the coefficients of variation for private prices, coefficients of variation for the ratios of private to Medicare FFS prices, and the percentage difference in the coefficients of variation.