What Are the Potential Savings From Steering Patients to Lower-Priced Providers? A Static Analysis

Sunita M. Desai, PhD; Laura A. Hatfield, PhD; Andrew L. Hicks, MS; Michael E. Chernew, PhD; Ateev Mehrotra, MD, MPH; and Anna D. Sinaiko, PhD, MPP

ABSTRACT

OBJECTIVES: Healthcare payers are increasingly using price transparency and benefit design to encourage patients to choose lower-priced providers. We quantify potential savings from shifting patients to lower-priced providers. If there is limited price variation or if higher-priced providers command little market share, savings could be minimal.

STUDY DESIGN: Using 2013-2014 commercial claims for 697,381 enrollees in California, we characterized within-market price variation and the relationship between providers' market shares and relative prices for 3 nonemergent, shoppable outpatient services: laboratory tests, imaging services, and durable medical equipment (DME). In a stylized policy simulation that holds provider price and utilization constant, we computed potential savings if patients who visited providers with prices above the median price shifted to the median-priced provider in their geographic market for the same service.

METHODS: Observational analyses.

RESULTS: Of the service categories examined, laboratory tests had greatest within-market price variation (median coefficient of variation of 100% vs 87% for imaging services and 43% for DME). Roughly half of services (53%, 47%, and 54% for laboratory tests, imaging services, and DME, respectively) were billed by providers with prices above their market median. Shifting these patients to the median-priced provider in their markets could save 42%, 45%, and 15% of spending on laboratory tests, imaging services, and DME, respectively, together representing savings of 11% of total outpatient spending and 7% of the sum of inpatient and outpatient spending.

CONCLUSIONS: Steering patients from higher- to lower-priced providers within geographic markets in targeted service categories could generate substantial healthcare savings.

Am J Manag Care. 2019;25(7):e204-e210

Prices of healthcare vary substantially, even among providers within the same geographic area,[1-4] and price is weakly correlated with quality.[5] Therefore, shifting patients to lower-priced providers could yield savings without sacrificing quality. Motivated by this potential, health plans have focused on raising the salience of and exposure to prices for patients through, for example, price transparency initiatives,[6] high-deductible health plans, and other benefit designs.[7] Motivated by this ongoing policy interest,[8,9] we quantify the potential savings from shifting patients from higher- to lower-priced providers in their market.

Prior work estimated that switching patients from higher-priced branded drugs to available generics could save 11% of national drug expenditures.[10] We examine 3 services (laboratory tests, imaging services, and durable medical equipment [DME]) that, like drugs, are good candidates for shifting to lower-priced options. They are often used in nonemergent scenarios and do not require patients to switch primary care physicians. Moreover, most patients do not believe that price differences reflect quality differences in healthcare.[11]

Potential savings depend on the extent of price variation across providers in a market and the share of patients receiving care from higher-priced providers. As an example, if prices vary widely but few patients receive care from higher-priced providers, shifting this small fraction of patients away from these providers may not meaningfully reduce spending. Potential savings would be minimal even if a large share of patients receive care from the higher-priced providers, but the price difference between the higher- and lower-priced providers is small.

We characterize price variation within markets and describe the relationship between providers' market shares and their relative prices in the market. To estimate potential savings from shifting to lower-priced providers, we simulate savings on laboratory tests, imaging services, and DME if commercially insured patients visiting higher-priced providers instead received care from the median-priced provider in their market for the same service. We estimate partial equilibrium or static effects. In other words, our analysis holds other factors constant and does not incorporate potential

responses in provider prices or patient utilization that might be expected over the longer term if a large number of patients in a market were steered toward lower-cost providers. Our analysis illuminates the extent of price variation, the share of spending attributable to high-priced providers in markets, and how that share varies by services and markets.

TAKEAWAY POINTS

- Steering patients to lower-priced providers could generate substantial savings in laboratory and imaging services and, to a lesser extent, in durable medical equipment.
- Potential savings from steering patients to lower-priced providers will be greater for services with higher within-market price variation and for services in which high-priced providers command greater market share.
- In a simulation that holds provider prices and utilization constant, we find that steering patients to lower-priced providers could result in substantial decreases in outpatient spending.

METHODS

Study Population and Data

Anthem Blue Cross provided deidentified medical claims and enrollment data for California enrollees in preferred provider organization health plans with deductibles ranging from $250 to $750 between January 1, 2013, and December 31, 2014. To ensure that we observed all spending, we excluded enrollees during any quarters in which they were not continuously enrolled and enrollees with supplemental coverage from another source.

Study Variables

We focused on 3 service categories of outpatient medical services: laboratory tests, imaging, and DME (**eAppendix Table 1** [eAppendix available at **ajmc.com**]). Each Current Procedural Terminology (CPT) code for a test, image, or equipment is referred to as a "service."

We calculated spending in each service category and for all outpatient care by enrollee and quarter. Quarters began on January 1, April 1, July 1, and October 1 of each year.

The price for a given service was defined as the sum of payments to the provider from the insurer and enrollee (deductible, co-payment, and coinsurance). Professional and facility fees for the same service performed in a hospital outpatient department (HOPD) were summed to a single price. Moreover, for a given beneficiary, payments from multiple claims for the same CPT code and service date were summed. We defined a single price for each provider–service market as the median of the price paid to the provider for that service in a calendar year. In sensitivity analyses, we defined provider prices using the mean and modal prices. To reduce the influence of outliers, we winsorized prices at the 99th percentile of each service by year before computing the provider's price.[12]

Markets were defined as 3-digit zip codes; any provider serving enrollees who resided in a given 3-digit zip code was considered a provider in that market. Therefore, providers may have appeared more than once if they served patients in multiple 3-digit zip codes. In a sensitivity analysis, we defined smaller markets using 5-digit zip codes.

Analysis

Within-market price variation. We calculated 2 measures of price variation—coefficient of variation (CV) and interquartile ratio (IQR)—for each market–service combination. The CV is the SD divided by the mean price multiplied by 100, which provides a unitless measure of price dispersion. The IQR is the quotient of the 75th percentile price divided by the 25th percentile price. These measures are weighted by the volume of the service and market. For each service category, we report the median CV and IQR across all market–service combinations.

Market share analysis. For each service, a provider's market share in that year was defined as the percentage of claims in a market billed by that provider. We assigned provider–service combinations to price deciles within their markets, which were designated by the patient's 3-digit zip code of residence (eg, the lowest-priced providers are in the bottom decile; the providers with prices in the top 10% of the distribution are in the top decile). We report the share of claims billed by providers in each decile by service category.

Potential savings from shifting patients to lower-priced providers in their market. We analyzed the potential savings from switching patients from higher- to lower-priced providers and report results in 2 ways. Our main results report the estimated savings that accrue if all patients who received services from higher-than-median-priced providers instead received care at the provider with the median price in their market. We also simulated the savings from switching patients who received services from the highest-priced providers to successively lower-priced providers in small increments. Specifically, we report savings from switching patients from providers above the 95th percentile to the price at the 95th percentile, then from above the 90th percentile to the 90th percentile, continuing in 5% increments down to the lowest price in the market.

We present potential savings from these simulations in aggregate, as well as the distribution of savings across markets and services. For each service category, we report the 10 markets and services with the most and least estimated savings, as well as savings stratified by Northern, Central, and Southern California. Prior work has highlighted the high prices of care provided in HOPDs.[13] To examine the contributions to potential savings from price variation within each setting (eg, shifting patients from higher- to lower-priced HOPDs and from higher- to lower-priced freestanding clinics), we simulated potential savings separately in HOPDs and freestanding providers. In secondary analyses, we also examined the potential savings from shifting patients visiting high-priced (above-median) HOPD providers to the median-priced provider in their market to capture potential savings from efforts that focused on steering patients away from expensive HOPD providers. Whether a service

TABLE 1. Characteristics of the Sample Population (N = 697,381)[14]

Characteristic	% of Population[a]
Gender	
Male	49
Female	51
Age group in years	
0-5	5
6-17	10
18-24	18
25-34	17
35-44	18
45-54	18
55-64	14
Years enrolled in plan at start of study period	
>0-1	18
>1-2	30
>2-3	20
>3	34
Charlson Comorbidity Index score[b]	
0	82
1	12
≥2	6

[a]Percentages may not sum to 100 due to rounding.

[b]The Charlson Comorbidity Index is a weighted count of 22 medical diagnoses in the past year. Diagnoses are given weights of 1, 2, 3, or 6 based on their association with subsequent 1-year mortality. The score can range from 0 to 43.[14]

was rendered in a HOPD or freestanding clinic was determined by the place of service designation on each claim.

We conducted several sensitivity analyses. As noted previously, we defined smaller markets using 5-digit zip code, and we defined providers' prices by the mean and modal allowed amount. We also repeated the analyses excluding laboratory tests, imaging services, and DME received on days when enrollees had other outpatient medical care. In these situations, clinicians who are part of health systems may have directed patients to receive the service in their facility, leaving little opportunity for the patient to choose a lower-priced provider.

RESULTS

Our sample included 697,381 enrollees living in 60 three-digit zip codes (markets) across California (**Table 1**[14]). The average market had 28 laboratory test providers, 32 imaging providers, and 6 DME providers. Average quarterly outpatient and total nonpharmacy (inpatient and outpatient) spending was $778 and $1150, respectively. Laboratory tests, imaging, and DME constituted 10%, 14%, and 3%, respectively, of overall outpatient spending.

Within-Market Price Variation

Price dispersion relative to the mean within markets was greatest for laboratory tests (CV = 100%) and imaging (CV = 87%) and lower for DME (CV = 41%) (**Table 2**). The median ratio between the 75th and 25th percentile prices in a market was 2 for laboratory tests, 2 for imaging services, and 1 for DME claims. The extent of price dispersion varied across both services and markets (**eAppendix Figure**).

Market Share Analysis

Providers with above-median prices had 47%, 53%, and 54% of market share in laboratory tests, imaging, and DME, respectively (**Figure 1**). Providers with the highest prices had the most market share in imaging (11% of market share for providers in the top decile), followed by laboratory tests (6%) and DME (3%).

Potential Savings From Shifting Patients to Lower-Priced Providers in Their Market

Mean (SD) quarterly spending for laboratory tests per enrollee was $76 ($705) (Table 2). Simulated spending after shifting enrollees to pay the median price was $44 per enrollee per quarter, or 42% savings. For imaging services, mean (SD) spending was $107 ($668) per enrollee; if enrollees at providers above the median instead paid the median price, spending would have been $59 per enrollee, or 45% savings. Mean (SD) DME spending was $20 ($426) per enrollee, and simulations moving enrollees who paid above the median price to the median price would result in spending of $17 per enrollee, implying savings of 15%.

Potential savings were not the same across all geographic markets. Across geographic markets, the potential savings from shifting patients to the median-priced providers ranged from 31% to 55% for laboratory services, 27% to 58% for imaging, and 3% to 23% for DME (**Figure 2**; **eAppendix Table 2**). For all 3 service categories, estimated savings were higher by 1 to 4 percentage points in Northern versus Southern California (**eAppendix Table 3**).

Stratifying by site of service revealed that spending and potential for savings are significantly greater in the HOPD setting compared with freestanding providers. If we assume that patients would stay within the chosen setting, then for laboratory services, shifting patients visiting HOPD providers with above-median prices to the median HOPD price would generate about 64% savings compared with 26% savings among freestanding providers. For imaging services, potential savings were 62% in the HOPD setting compared with 19% among freestanding providers. Potential for savings in DME received in the HOPD setting were 20% compared with 10% in the freestanding office setting. Instead, patients could switch across settings. In simulations, shifting patients visiting providers with above-median prices in the HOPD setting to the median-priced provider in the market, regardless of whether HOPD or freestanding facility, would yield savings of 32%, 38%, and 6% in laboratory tests, imaging, and DME, respectively.

A second set of simulations analyzed the savings from shifting patients to lower-priced providers in smaller increments (**Figure 3**). Steeper slopes indicate that greater potential savings can come from moving a small number of enrollees from the highest-priced providers. Potential savings increased most steeply for imaging

services followed by laboratory tests, driven by high within-market price variation in these service categories. Despite the substantially higher market share for DME providers with above-median prices, the savings from shifting patients to successively lower prices grow slowly relative to laboratory tests and imaging, due to more modest within-market price variation in DME. An extreme scenario, shifting all patients who receive care at providers above the 5th percentile to 5th percentile price in the market, would generate savings of 68% in laboratory tests, 78% in imaging services, and 38% in DME.

Results From Sensitivity Analyses

Altering the market definition from 3- to 5-digit zip code reduced the savings, but they remained substantial at 35% for laboratory tests, 38% for imaging services, and 7% for DME (eAppendix). Excluding laboratory and imaging claims billed on the same day as other outpatient services modestly reduced potential savings for those services to 37% for both. Changing the definition of a provider's price from median to mean or mode had virtually no effect on estimated savings.

TABLE 2. Price Variation and Simulated Savings From Switching All Patients Paying Above-Median Prices to the Median Market Price: Laboratory Tests, Imaging, and DME[a]

	Overall	Stratified by Place of Service	
		HOPD[b]	Non-HOPD[b]
Laboratory Tests			
Price variation measures			
Median CV per service per market, %	100	45	37
Median IQR per service per market	2	2	1
Actual and simulated spending			
Actual mean spending per enrollee per quarter, $	76	491	35
Simulated mean spending per enrollee per quarter, $[c]	44	175	26
Simulated mean savings per enrollee per quarter, %	42	64	26
Imaging			
Price variation measures			
Median CV per service per market, %	87	56	51
Median IQR per service per market	2	2	1
Actual and simulated spending			
Actual mean spending per enrollee per quarter, $	107	1123	42
Simulated mean spending per enrollee per quarter, $[c]	59	424	34
Simulated mean savings per enrollee per quarter, %	45	62	19
DME			
Price variation measures			
Median CV per service per market, %	43	86	40
Median IQR per service per market	1	3	1
Actual and simulated spending			
Actual mean spending per enrollee per quarter, $	20	1260	10
Simulated mean spending per enrollee per quarter, $[c]	17	1003	9
Simulated mean savings per enrollee per quarter, %	15	20	10

CPT indicates Current Procedural Terminology; CV, coefficient of variation; DME, durable medical equipment; HOPD, hospital outpatient department; IQR, interquartile ratio.

[a]Service categories are laboratory tests, imaging, and DME. Services are individual procedures or DME, identified by CPT code.

[b]The sample in the HOPD and non-HOPD analyses includes enrollees with at least some spending in that service category and place of service.

[c]Simulated spending indicates quarterly enrollee services if all patients who visited providers with prices above the market median price paid the median price in their market instead.

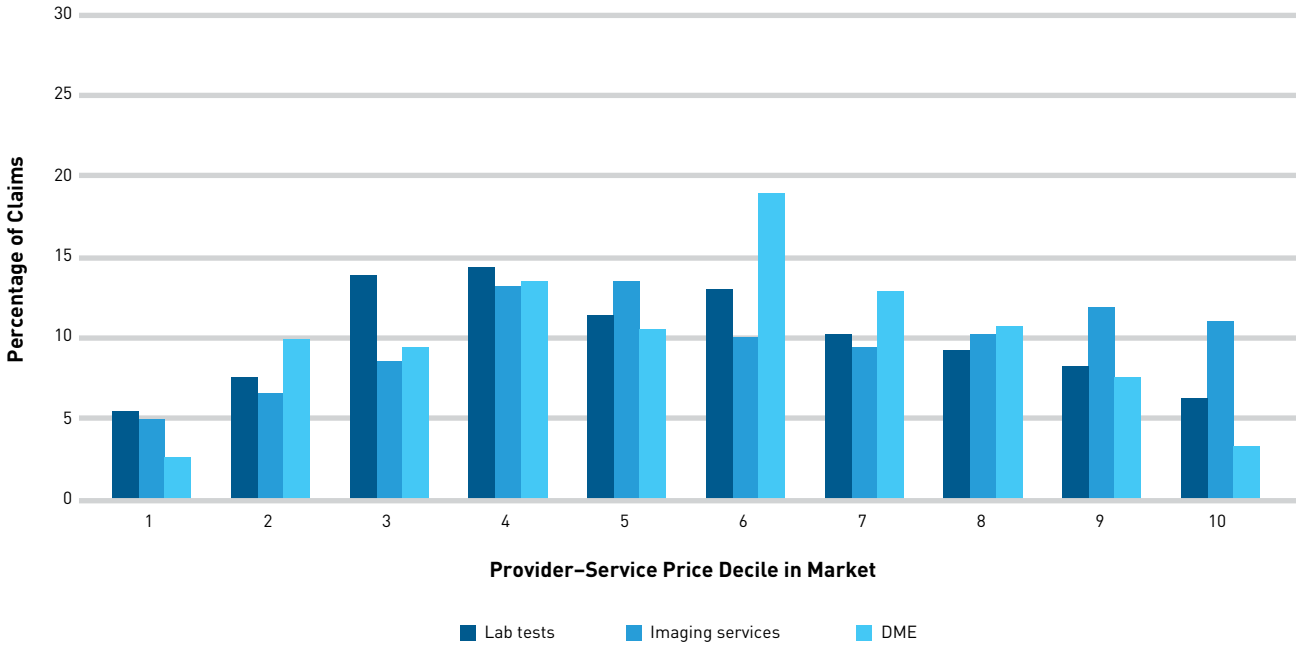
DISCUSSION

There is widespread interest in decreasing healthcare spending by encouraging patients to choose providers with lower prices. We find that if patients who visited a higher-priced provider switched to a median-priced provider in their market, savings would be 42% in laboratory tests, 45% in imaging services, and 15% in DME. These significant potential savings in imaging and laboratory tests can be explained by both wider within-market price variation and high market share among high-priced providers. The cumulative potential savings from all 3 service categories are equivalent to 11% of total outpatient spending and 7% of total medical spending. California Public Employees' Retirement System alone could save $15.3 million quarterly from shifting patients to the median-priced providers for these 3 service categories. For context, the $332 in annual savings per patient is much larger than prior estimates of $45 in savings from switching from branded drugs to generics. However, it is important to acknowledge that the 2 estimates are not directly comparable because they are based on different samples and different time periods.[10]

Although these results imply significant opportunities for savings if payers can steer patients to lower-cost providers, the most effective way to do so remains unclear. Inducing patients to switch to lower-priced providers may be difficult because of patient loyalty to their providers[15] and because often patients themselves do not benefit financially from switching to lower-priced providers (eg, once above the deductible).[16] Offering patients price transparency tools has, to date, had limited impact in steering patients.[9,17,18] On the other hand, alternative benefit designs such as reference-based pricing and tiered provider networks, where patients face much larger out-of-pocket costs if they choose higher-priced providers, have shown early success in shifting patients to lower-priced providers.[15,19-22]

We focused on laboratory tests, imaging, and DME because choosing a lower-priced provider for these services does not require switching physicians; still, a physician's recommendation for a laboratory or imaging center may strongly influence the patient's choice of provider.[23] Physicians often recommend that patients get

FIGURE 1. Percent of Claims by Within-Market Price Decile for Laboratory Tests, Imaging Services, and DME[a]



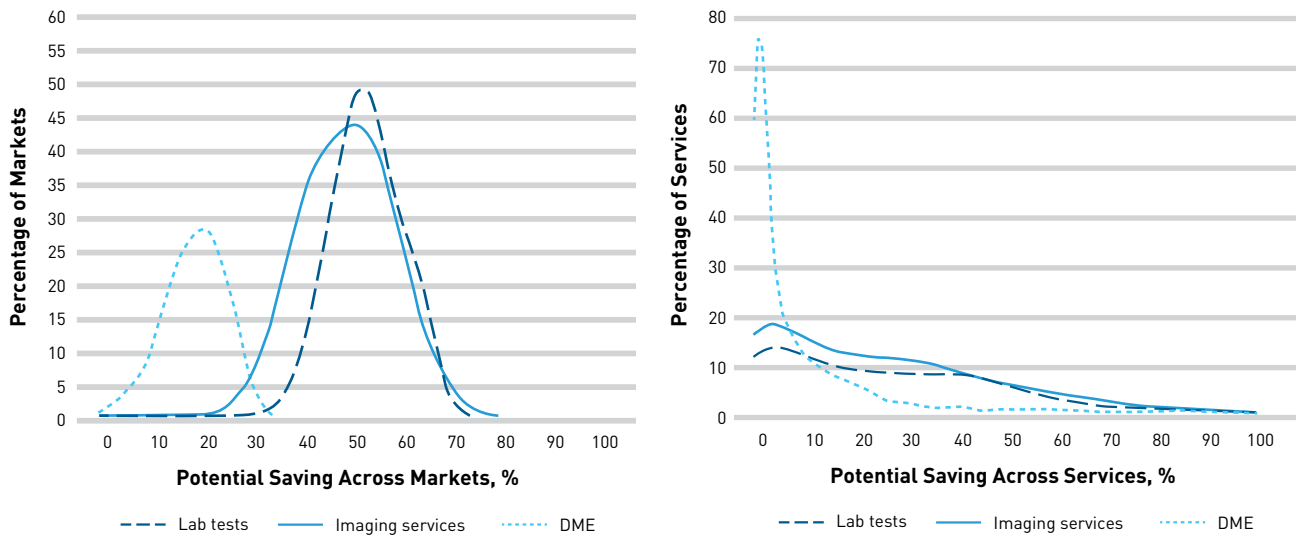
DME indicates durable medical equipment.

[a]This graph presents the relationship between provider market share and provider price in their market. Providers are assigned to price deciles based on their price relative to other providers in the same market for each service (eg, the lowest-priced providers are in the bottom decile; the providers with prices in the top 10% of the distribution are in the top decile). The figure plots the proportion of service category claims received from providers in each decile.

FIGURE 2. Variation in Potential Savings[a]

A. Variation in Potential Savings Across 60 Markets in California

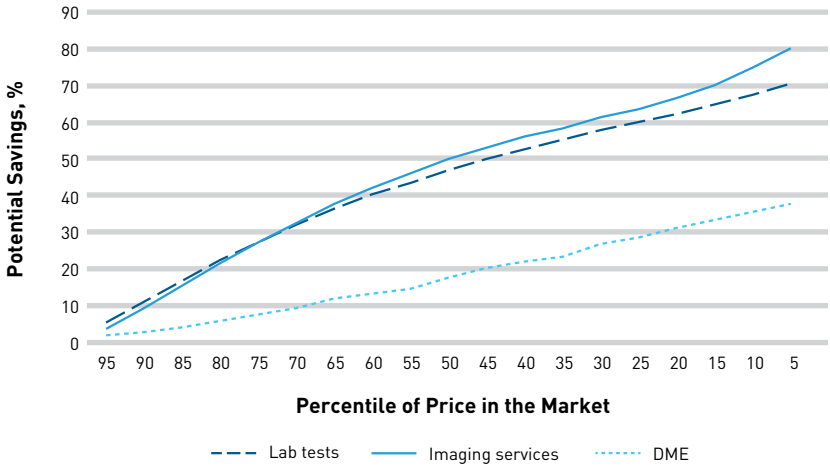
B. Variation in Potential Savings Across Services (CPT codes) Within Each Service Category



CPT indicates Current Procedural Technology; DME, durable medical equipment.

[a]These graphs present the smoothed distribution of potential savings from shifting patients who visit providers with prices above the median price in their geographic market to providers with prices at the median by geographic market (A) and service (B) for each service category.

FIGURE 3. Savings From Shifting Patients Receiving Services From Higher-Priced Providers to Lower-Priced Providers in Their Market in 5-Percentile Increments[a]



DME indicates durable medical equipment.

[a]This graph presents the simulated savings from shifting patients receiving services from high-priced providers to lower-priced providers in their market, in increments of 5 percentile points. For example, the first point represents the potential savings generated if patients receiving care from providers with prices above the 95th percentile in their geographic market shifted to the provider with a price at the 95th percentile; the second point represents the potential savings generated if patients receiving care from providers with prices above the 90th percentile in their geographic market shifted to the provider with a price at the 90th percentile; and so on.

Moreover, specific market conditions could affect both the potential for savings from successfully steering patients to lower-cost providers and the ability of a payer to actually steer patients. Although the differences were not large, potential savings are higher in Northern compared with Southern California. This may reflect the fact that Northern Californian markets are less competitive, and, on average, less competitive markets have higher prices. Although less competitive markets may have greater opportunities for savings, influencing patient behavior may be more difficult in these markets. The dominant providers in these markets may have the means to more effectively retain their patient base through measures such as advertising. Moreover, longer-term effects of steering patients away from dominant providers in less competitive markets could also differ. For example, although our analyses hold price constant, providers in less competitive markets may wield their market power by threatening to leave the payer's network or demanding higher prices in response to payer efforts to shift patients away from them.

tests within the same health system in part because the results are more easily accessible in electronic health records or because they have financial incentives to do so. If, for these reasons or others, patient "stickiness" to physicians extends to choice of laboratory, imaging, and DME providers, then strategies to lower prices, rather than inducing patients to switch providers, may be more effective in achieving savings. Top-down strategies, such as all-payer rate setting, would also reduce price variation.

Policies that promote competition in the healthcare delivery system, such as stricter antitrust enforcement, may limit the ability of increasingly large health systems to negotiate higher prices, which puts downward pressure on prices for healthcare services.[24] Relatedly, curbing alleged anticompetitive practices by large systems, such as the inclusion of antisteering clauses in payer contracts, may also be effective.[25] The presence of these contracting arrangements inhibits ability to reduce healthcare spending through consumer-directed strategies. Our results suggest that a majority of the potential savings would come from steering patients away from the hospital-based providers. For example, 32% of the 45% in overall estimated savings in imaging would come from simply shifting patients visiting an above-median hospital-based provider to the median-priced provider. In laboratory tests and imaging, focusing on patients visiting above-median hospital-based providers would account for 71% and 40% of overall estimated savings, respectively. However, due to the competitive power wielded by hospital systems, as discussed, steering patients away from these providers may be most difficult.

Limitations

This analysis has several limitations. First, it is limited to enrollees of a single insurer in a single type of plan, and savings are conditional on the network and range of provider prices in this sample. Wide variation in negotiated prices for individual insurers has been observed in other US regions,[26,27] but changes in market structure since 2014 may have altered the extent of price variation and distribution of market share. By looking at a large insurer, we might expect less variation in prices than if we examined results from a smaller insurer with less market power. In contrast, studying an insurer with a broad network will yield savings greater than if the insurer had a small network (although narrowing the network may be one way to capture the savings).

Second, we assume that 3-digit zip codes are markets. Although sensitivity tests that defined smaller markets using 5-digit zip codes also demonstrated potential savings, in reality, markets may be bigger or smaller and are likely to differ based on the service and the burden on patients from travel. Future work should evaluate other geographies and commercial insurers.

Third, providers may be misclassified as freestanding or hospital owned if our method, which is based on the place of service codes in the claims, does not produce accurate designations. However, if the misclassification is not systematically related to the provider's relative price in the market, noise due to such misclassification should not bias the results.

Fourth, our analysis does not consider that price variation and greater market share of higher-priced providers could be justified by variation in provider quality or in patients' perceptions of quality.

If providers who charge higher prices provide higher quality of care, then savings from shifting patients to lower-cost providers could be offset by reduced patient satisfaction or worse health outcomes. However, past work suggests that higher-priced providers do not necessarily generate better health outcomes compared with lower-priced providers.[5] Also, variation in quality may be less of a concern in laboratory tests, imaging, and DME than in physician services.

Finally, our simulation does not consider potential long-term, general equilibrium effects of shifting a large volume of services to lower-priced providers or of higher-priced providers substantially reducing their prices. If lower-priced providers increase their share of patients and increase their prices in response, our simulated savings would be overestimates. If, instead, price competition due to enrollee shifting leads to further price decreases, our simulated savings would underestimate savings. Longer-term effects of changes in market share or other downward pressure on healthcare prices are important topics for further research.

CONCLUSIONS

For 3 sets of clinical services (laboratory testing, imaging, and DME), we observe both significant price variation and substantial market share among high-priced providers. If patients were to switch away from the highest-price providers, our analyses suggest savings of roughly 11% of total outpatient spending. These findings suggest that efforts to steer patients to providers where they pay lower prices or to negotiate lower provider prices could substantially reduce healthcare spending. ■

Author Affiliations: NYU School of Medicine (SMD), New York, NY; Harvard Medical School (SMD, LAH, ALH, MEC, AM), Boston, MA; Beth Israel Deaconess Medical Center (AM), Boston, MA; Harvard T.H. Chan School of Public Health (ADS), Boston, MA.

Source of Funding: This work was supported by a grant from California Public Employee and Retirement System to Harvard. Dr Desai was also supported by the Marshall J. Seidman Center for Studies in Health Economics and Health Care Policy at Harvard Medical School.

Author Disclosures: Dr Mehrotra is employed by Harvard, which, as a large employer, is working to address high prices; he has received grants from the Arnold Foundation and the Donaghue Foundation and has attended meetings of AcademyHealth and the Society of General Internal Medicine. The remaining authors report no relationship or financial interest with any entity that would pose a conflict of interest with the subject matter of this article.

Authorship Information: Concept and design (SMD, LAH, MEC, AM, ADS); acquisition of data (SMD, AM); analysis and interpretation of data (SMD, LAH, ALH, MEC, ADS); drafting of the manuscript (SMD); critical revision of the manuscript for important intellectual content (SMD, LAH, ALH, MEC, AM, ADS); statistical analysis (SMD, ALH); provision of patients or study materials (SMD); and supervision (SMD).

Address Correspondence to: Sunita M. Desai, PhD, Department of Population Health, NYU School of Medicine, 227 E 30th St, New York, NY 10016. Email: sunita.desai@nyu.edu.

REFERENCES

1. White C, Reschovsky JD, Bond AM. Understanding differences between high- and low-price hospitals: implications for efforts to rein in costs. *Health Aff (Millwood)*. 2014;33(2):324-331. doi: 10.1377/hlthaff.2013.0747.
2. Chernew ME, Sabik LM, Chandra A, Gibson TB, Newhouse JP. Geographic correlation between large-firm commercial spending and Medicare spending. *Am J Manag Care*. 2010;16(2):131-138.
3. Alpert A, Duggan M, Hellerstein JK. Perverse reverse price competition: average wholesale prices and Medicaid pharmaceutical spending. *J Public Econ*. 2013;108:44-62. doi: 10.1016/j.jpubeco.2013.08.010.
4. Aliferis L. Variation in prices for common medical tests and procedures. *JAMA Intern Med*. 2015;175(1):11-12. doi: 10.1001/jamainternmed.2014.6793.
5. Hussey PS, Wertheimer S, Mehrotra A. The association between health care quality and cost: a systematic review. *Ann Intern Med*. 2013;158(1):27-34. doi: 10.7326/0003-4819-158-1-201301010-00006.
6. de Brantes F, Delbanco S. Report card on state price transparency laws – July 2016. Catalyst for Payment Reform website. catalyze.org/wp-content/uploads/woocommerce_uploads/2017/04/2016-Report-Card-on-State-Price-Transparency-Laws.pdf. Published July 2016. Accessed January 15, 2019.
7. 2016 Employer Health Benefits Survey. Kaiser Family Foundation website. kff.org/report-section/ehbs-2016-summary-of-findings. Published September 14, 2016. Accessed May 20, 2017.
8. Robinson JC, Whaley C, Brown TT. Association of reference pricing for diagnostic laboratory testing with changes in patient choices, prices, and total spending for diagnostic tests. *JAMA Intern Med*. 2016;176(9):1353-1359. doi: 10.1001/jamainternmed.2016.2492.
9. Sinaiko AD, Joynt KE, Rosenthal MB. Association between viewing health care price information and choice of health care facility. *JAMA Intern Med*. 2016;176(12):1868-1870. doi: 10.1001/jamainternmed.2016.6622.
10. Haas JS, Phillips KA, Gerstenberger EP, Seger AC. Potential savings from substituting generic drugs for brand-name drugs: Medical Expenditure Panel Survey, 1997-2000. *Ann Intern Med*. 2017;142(11):891-897. doi: 10.7326/0003-4819-142-11-200506070-00006.
11. Phillips KA, Schleifer D, Hagelskamp C. Most Americans do not believe that there is an association between health care prices and quality of care. *Health Aff (Millwood)*. 2016;35(4):647-653. doi: 10.1377/hlthaff.2015.1334.
12. Ghosh D, Vogt A. Outliers: an evaluation of methodologies. *JSM Proceedings*, Survey Research Methods Section. 2012;3455-3460.
13. Neprash HT, Chernew ME, Hicks AL, Gibson T, McWilliams JM. Association of financial integration between physicians and hospitals with commercial health care prices. *JAMA Intern Med*. 2015;175(12):1932-1939. doi: 10.1001/jamainternmed.2015.4610.
14. Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: development and validation. *J Chronic Dis*. 1987;40(5):373-383.
15. Sinaiko AD, Rosenthal MB. The impact of tiered physician networks on patient choices. *Health Serv Res*. 2014;49(4):1348-1363. doi: 10.1111/1475-6773.12165.
16. Volpp KG. Price transparency: not a panacea for high health care costs. *JAMA*. 2016;315(7):1842-1843. doi: 10.1001/jama.2016.4325.
17. Desai S, Hatfield LA, Hicks AL, Chernew ME, Mehrotra A. Association between availability of a price transparency tool and outpatient spending. *JAMA*. 2016;315(17):1874-1881. doi: 10.1001/jama.2016.4288.
18. Whaley C, Schneider Chafen J, Pinkard S, et al. Association between availability of health service prices and payments for these services. *JAMA*. 2014;312(16):1670-1676. doi: 10.1001/jama.2014.13373.
19. Robinson JC, Whaley C, Brown TT. Reference pricing, consumer cost-sharing, and insurer spending for advanced imaging tests. *Med Care*. 2016;54(12):1050-1055. doi: 10.1097/MLR.0000000000000605.
20. Robinson JC, Brown TT, Whaley C, Finlayson E. Association of reference payment for colonoscopy with consumer choices, insurer spending, and procedural complications. *JAMA Intern Med*. 2015;175(11):1783-1789. doi: 10.1001/jamainternmed.2015.4588.
21. Whaley C, Brown T, Robinson J. Consumer responses to price transparency alone versus price transparency combined with reference pricing. *Am J Health Econ*. 2019;5(2):227-249. doi: 10.1162/ajhe_a_00118.
22. Whaley C, Brown TT, Robinson JC. Using data to lower costs: California's reference-based payment experience and implications for other states. Berkeley Center for Health Technology website. bcht.berkeley.edu/sites/default/files/using_data_to_lower_costs_ca_reference-based_payment_other_states_10.18_.pdf. Published 2016. Accessed January 15, 2019.
23. Mehrotra A, Huckfeldt PJ, Haviland AM, Gascue L, Sood N. Patients who choose primary care physicians based on low office visit price can realize broader savings. *Health Aff (Millwood)*. 2016;35(12):2319-2326. doi: 10.1377/hlthaff.2016.0408.
24. Gaynor M, Mostashari F, Ginsburg PB. Making health care markets work: competition policy for health care. *JAMA*. 2017;317(13):1313-1314. doi: 10.1001/jama.2017.1173.
25. *California v Sutter Health*, CGC-18-565398 (Cal 2018). oag.ca.gov/system/files/attachments/press_releases/Sutter%20Complaint.pdf. Accessed January 15, 2019.
26. Office of the Attorney General of Massachusetts. Examination of health care cost trends and cost drivers pursuant to G.L. c. 12, § 11N: report for annual public hearing under G.L. c 6D, § 8. Commonwealth of Massachusetts website. mass.gov/files/documents/2018/05/04/cost-containment-5-report.pdf. Published September 18, 2015. Accessed January 15, 2019.
27. Cooper Z, Craig SV, Gaynor M, Van Reenen J. The price ain't right? hospital prices and health spending on the privately insured. *Q J Econ*. 2018;134(1):51-107. doi: 10.1093/qje/qjy020.

Visit **ajmc.com/link/4071** to download PDF and eAppendix

eAppendix to
What are the potential savings from steering patients to lower-priced providers? A static analysis

eAppendix Table 1. Top 25 services (CPT) in laboratory testing, imaging, and DME

	CPT Code	Description
Laboratory Tests		
1	36415	COLLECTION OF VENOUS BLOOD BY VENIPUNCTURE
2	85025	BLOOD COUNT; COMPLETE (CBC), AUTOMATED (HGB, HCT, RBC, WBC AND PLATELET COUNT) AND AUTOMATED DIFFERENTIAL WBC COUNT
3	80053	COMPREHENSIVE METABOLIC PANEL
4	80061	LIPID PANEL
5	84443	THYROID STIMULATING HORMONE (TSH)
6	82306	CALCIFEDIOL (25-OH VITAMIN D-3)
7	83036	HEMOGLOBIN; GLYCATED
8	88305	LVL IV-SX PATHOLOGY,GROSS&MICROSCOPIC X ABORT-SPON/MISSED ART,BX BN MARRW, BX BN XOSTOSIS BRAIN/MENINGES,OTH THAN,TUMR RESCT BRST,BX,NO REQ MIC
9	80050	GENERAL HEALTH PANEL
10	81001	URINALYSIS, BY DIP STICK/TABLET REAGENT FOR BILIRUBIN, GLUCOSE, HEMOGLOBIN, KETONES, LEUKOCYTES, NITRITE, PH, PROTEIN, SPEC GRAV, UROBILINOGEN,
11	84439	THYROXINE; FREE
12	81002	URINALYSIS, BY DIP STICK OR TABLET REAGENT FOR BILIRUBIN, GLUCOSE, HEMOGLOBIN, KETONES, LEUKOCYTES, NITRITE, PH, PROTEIN, SPEC GRAVITY, UROBILI
13	88175	CYTOPATHOLOGY, CERVICAL/VAGINAL (ANY REPORTING SYSTEM), COLLECTED PRESERVATIVE FLUID, AUTOMATED THIN LAYER PREPARATION; WITH SCREENING AUTOMATE
14	81003	URINALYSIS, BY DIP STICK OR TABLET REAGENT FOR BILIRUBIN, GLUCOSE, HEMOGLOBIN, KETONES, LEUKOCYTES, NITRITE, PH, PROTEIN, SPEC GRAVITY, UROBILI
15	99000	HANDLING AND/OR CONVEYANCE OF SPECIMEN FOR TRANSFER FROM THE PHYSICIAN'S OFFICE TO A LABORATORY
16	87086	CULTURE, BACTERIAL; QUANTITATIVE COLONY COUNT, URINE
17	80048	BASIC METABOLIC PANEL
18	85610	PROTHROMBIN TIME;
19	85027	BLOOD COUNT; COMPLETE (CBC), AUTOMATED (HGB, HCT, RBC, WBC AND PLATELET COUNT)

20	87491	INFECTIOUS AGENT DETECT BY DNA/RNA; CHLAMYDIA T, AMP PROBE
21	84153	PROSTATE SPECIFIC ANTIGEN (PSA)
22	87591	INFECTIOUS AGENT DETECT BY DNA/RNA; NEISSERIA G, AMP PROBE
23	81000	URINALYSIS, BY DIP STICK OR TABLET REAGENT FOR BILIRUBIN, GLUCOSE, HEMOGLOBIN, KETONES, LEUKOCYTES, NITRITE, PH, PROTEIN, SPEC GRAVITY, UROBILI
24	84550	URIC ACID; BLOOD
25	82607	CYANOCOBALAMIN (VITAMIN B-12);
Imaging Services:		
1	77052	COMPUTER-AIDED DETECTION (COMPUTER ALGORITHM ANALYSIS OF DIGITAL IMAGE DATA FOR LESION DETECTION) WITH FURTHER REVIEW FOR INTERPRETATION; SCREENING MAMMOGRAPHY
2	G0202	SCREENING MAMMOGRAPHY, PRODUCING DIRECT DIGITAL IMAGE, BILATERAL, ALL VIEWS
3	71020	RADIOLOGIC EXAMINATION, CHEST, TWO VIEWS, FRONTAL AND LATERAL;
4	71010	RADIOLOGIC EXAMINATION, CHEST; SINGLE VIEW, FRONTAL
5	76830	ULTRASOUND, TRANSVAGINAL
6	73630	RADIOLOGIC EXAMINATION, FOOT; COMPLETE, MINIMUM OF THREE VIEWS
7	76856	ULTRASOUND, PELVIC (NONOBSTETRIC), B-SCAN AND/OR REAL TIME WITH IMAGE DOCUMENTATION; COMPLETE
8	93306	ECHOCARDIOGRAPHY, TRANSTHORACIC, REAL-TIME WITH IMAGE DOCUMENTATION (2D), INCLUDES M-MODE RECORDING, WHEN PERFORMED, COMPLETE, WITH SPECTRAL DOPPLER ECHOCARDIOGRAPHY, AND WITH COLOR FLOW DOPPLER ECHOCARDIOGRAPHY
9	76700	ULTRASOUND, ABDOMINAL, B-SCAN AND/OR REAL TIME WITH IMAGE DOCUMENTATION; COMPLETE
10	76645	ULTRASOUND, BREAST(S) (UNILATERAL OR BILATERAL), B-SCAN AND/OR REAL TIME WITH IMAGE DOCUMENTATION
11	Q9967	LOW OSMOLAR CONTRAST MATERIAL, 300-399 MG/ML IODINE CONCENTRATION, PER ML. CONTAINS ALL TEXT OF PROCEDURE OR MODIFIER LONG DESCRIPTIONS.
12	77051	COMPUTER-AIDED DETECTION (COMPUTER ALGORITHM ANALYSIS OF DIGITAL IMAGE DATA FOR LESION DETECTION) WITH FURTHER PHYSICIAN REVIEW FOR INTERPRETATION, WITH OR WITHOUT DIGITIZATION OF

		FILM RADIOGRAPHIC IMAGES; DIAGNOSTIC MAMMOGRAPHY
13	73610	RADIOLOGIC EXAMINATION, ANKLE; COMPLETE, MINIMUM OF THREE VIEWS
14	73030	RADIOLOGIC EXAMINATION, SHOULDER; COMPLETE, MINIMUM OF TWO VIEWS
15	70450	COMPUTED TOMOGRAPHY, HEAD OR BRAIN; WITHOUT CONTRAST MATERIAL
16	74177	CT ABDOMEN & PELVIS WITH CONTRAST
17	73721	MAGNETIC RESONANCE (EG, PROTON) IMAGING, ANY JOINT OF LOWER EXTREMITY; WITHOUT CONTRAST MATERIAL
18	76942	ULTRASONIC GUIDANCE FOR NEEDLE PLACEMENT (EG, BIOPSY, ASPIRATION, INJECTION, LOCALIZATION DEVICE), IMAGING SUPERVISION AND INTERPRETATION
19	77057	SCREENING MAMMOGRAPHY, BILATERAL (2-VIEW FILM STUDY OF EACH BREAST)
20	77080	HIP, SPINE OR CENTRAL DEXA (DUAL ENERGY X-RAY ABSORPTIOMETRY)
21	73110	RADIOLOGIC EXAMINATION, WRIST; COMPLETE, MINIMUM OF THREE VIEWS
22	73562	RADIOLOGIC EXAMINATION, KNEE; THREE VIEWS
23	72100	RADIOLOGIC EXAMINATION, SPINE, LUMBOSACRAL; TWO OR THREE VIEWS
24	73130	RADIOLOGIC EXAMINATION, HAND; MINIMUM OF THREE VIEWS
25	76536	ULTRASOUND, SOFT TISSUES OF HEAD AND NECK (EG, THYROID, PARATHYROID, PAROTID), B-SCAN AND/OR REAL TIME WITH IMAGE DOCUMENTATION
Durable Medical Equipment:		
1	E0601	CONTINUOUS AIRWAY PRESSURE (CPAP) DEVICE
2	A7038	FILTER, DISPOSABLE, USED WITH POSITIVE AIRWAY PRESSURE DEVICE
3	A7035	HEADGEAR USED WITH POSITIVE AIRWAY PRESSURE DEVICE
4	A7034	NASAL INTERFACE (MASK OR CANNULA TYPE) USED WITH POSITIVE AIRWAY PRESSURE DEVICE, WITH OR WITHOUT HEAD STRAP
5	L3000	FOOT INSERT, REMOVABLE, MOLDED TO PATIENT MODEL, "UCB" TYPE, BERKELEY SHELL, EACH
6	A7037	TUBING USED WITH POSITIVE AIRWAY PRESSURE DEVICE

7	E1390	OXYGEN CONCENTRATOR, CAPABLE OF DELIVERING 85 PERCENT OR GREATER OXYGEN CONCENTRATION AT THE PRESCRIBED FLOW RATE
8	E0562	HUMIDIFIER, HEATED, USED WITH POSITIVE AIRWAY PRESSURE DEVICE
9	A4556	ELECTRODES (E.G., APNEA MONITOR), PER PAIR
10	A4649	SURGICAL SUPPLY; MISCELLANEOUS
11	A7033	REPLACEMENT PILLOWS FOR NASAL APPLICATION DEVICE, PAIR
12	A7032	REPLACEMENT CUSHION FOR NASAL APPLICATION DEVICE, EACH
13	A4630	REPLACEMENT BATTERIES FOR MEDICALLY NECESSARY TRANSCUTANEOUS ELECTRICAL NERVE STIMULATOR (TENS) OWNED BY PATIENT
14	A4604	REPLACEMENT BATTERIES, MEDICALLY NECESSARY, TRANSCUTANEOUS ELECTRICAL STIMULATOR, OWNED BY PATIENT
15	A7039	FILTER, NON DISPOSABLE, USED WITH POSITIVE AIRWAY PRESSURE DEVICE
16	A4230	INFUSION SET FOR EXTERNAL INSULIN PUMP, NON NEEDLE CANNULA TYPE
17	A4232	SYRINGE WITH NEEDLE FOR EXTERNAL INSULIN PUMP, STERILE, 3CC
18	L3908	WRIST-HAND ORTHOSIS (WHO), WRIST EXTENSION CONTROL COCK-UP, NON MOLDED, PREFABRICATED, INCLUDES FITTING AND ADJUSTMENT
19	A7031	FACE MASK INTERFACE, REPLACEMENT FOR FULL FACE MASK, EACH
20	A4580	CAST SUPPLIES (E.G. PLASTER)
21	A7030	FULL FACE MASK USED WITH POSITIVE AIRWAY PRESSURE DEVICE, EACH
22	L4360	PNEUMATIC ANKLE FOOT ORTHOSIS, WITH OR WITHOUT JOINTS, PREFABRICATED, INCLUDES FITTING AND ADJUSTMENT
23	E0431	PORTABLE GASEOUS OXYGEN SYSTEM, RENTAL; INCLUDES PORTABLE CONTAINER, REGULATOR, FLOWMETER, HUMIDIFIER, CANNULA OR MASK, AND TUBING
24	L3020	FOOT INSERT, REMOVABLE, MOLDED TO PATIENT MODEL, LONGITUDINAL/ METATARSAL SUPPORT, EACH
25	E0114	CRUTCHES UNDERARM, OTHER THAN WOOD, ADJUSTABLE OR FIXED, PAIR, WITH PADS, TIPS AND HANDGRIPS

Note: This table presents the 25 most frequent CPT codes and code descriptions in each service category from the claims data used in the analysis.

eAppendix Table 2. Ten markets with the most and least potential savings in each service category

	Range of potential savings in top ten markets	Range of potential savings in bottom ten markets
Labs	47% - 55% savings	31% - 38% savings
Imaging	50% - 58% savings	27% - 35% savings
DME	20% - 23% savings	3% - 10% savings

eAppendix Table 3. Average savings by region

	North	Central	South
Labs	46%	46%	42%
Imaging	46%	47%	44%
DME	19%	18%	18%

The sample population for this analysis includes one very large employer (CalPERS). To test whether observed price variation is the same or different for enrollees of an employer with large market power, we stratified the analyses by CalPERS plan membership. Results (in Appendix Table 3 below) show that both CalPERS and non-CalPERS enrollees had similar potential savings across each service category, indicating one population does not drive main results.

eAppendix Table 4. Potential savings from shifting patients to the median-priced provider in their geographic market: Sensitivity analyses

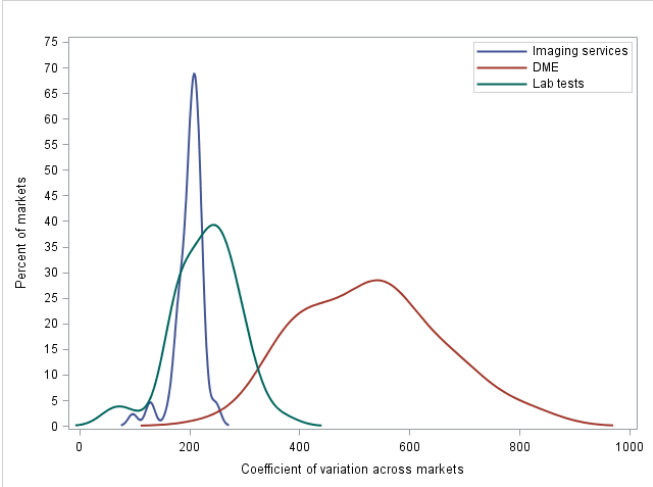
	CalPERS enrollees	Non-CalPERS enrollees	Designating 5-digit zip codes as markets	Limit to claims with no other outpatient care on the same day	Provider negotiated price based on mean allowed amount	Provider negotiated price based on modal allowed amount
Labs						
Actual Mean Spending per Enrollee per Quarter, $	75	77	76	57	76	76
Simulated Mean Spending per Enrollee per Quarter, $	43	44	50	36	44	43
Simulated Mean Savings per Enrollee per Quarter, %	**42**	**43**	**35**	**37**	**43**	**44**
Imaging						
Actual Mean Spending per Enrollee per Quarter, $	119	101	107	66	107	107
Simulated Mean Spending per Enrollee per Quarter, $	64	56	67	41	59	58
Simulated Mean Savings per Enrollee per Quarter, %	**47**	**45**	**38**	**37**	**45**	**46**
Durable Medical Equipment						
Actual Mean Spending per Enrollee per Quarter, $	22	20	20	12	20	20
Simulated Mean Spending per Enrollee per Quarter, $	18	16	19	10	17	17
Simulated Mean Savings per Enrollee per Quarter, %	**15**	**18**	**7**	**15**	**17**	**17**

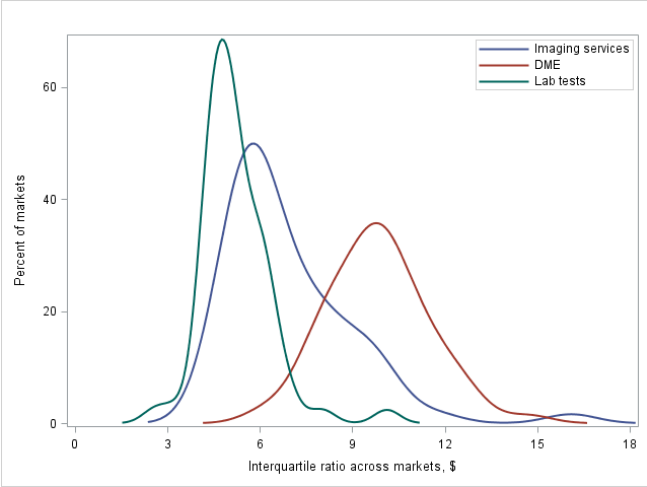
eAppendix Figure. Distribution of coefficient of variation and interquartile ratio across markets and services (without weighting by volume)

Coefficient of variation

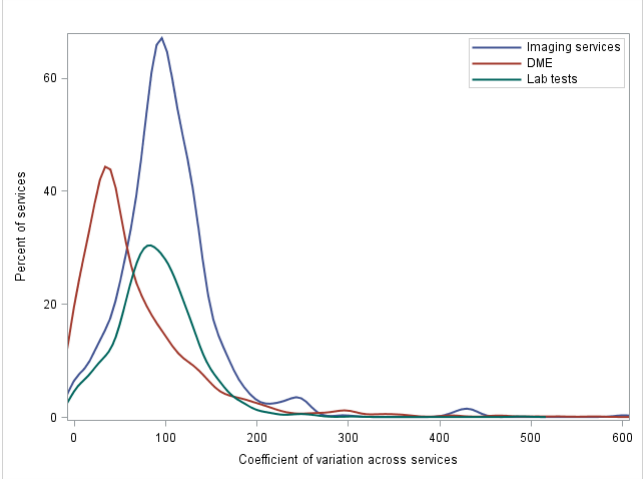
Interquartile ratio

Distribution across markets





Distribution across services



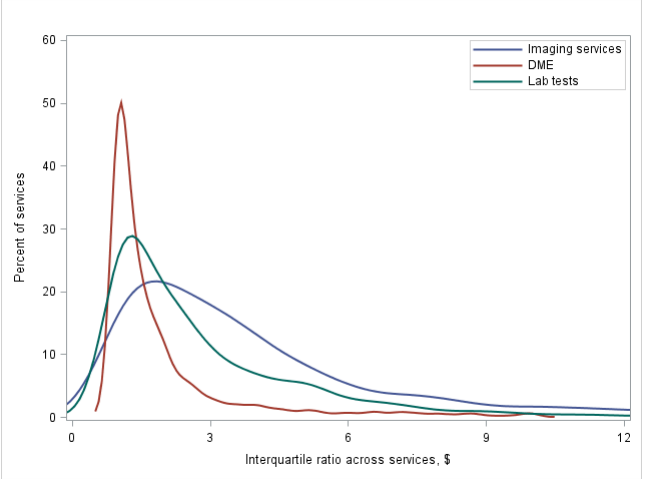


Figure Legend. This figure presents the distribution of coefficient of variation and interquartile ratio (IQR) across services and markets in each service category. Coefficient variation (CV) is the ratio of the standard deviation to the mean multiplied by 100, and IQR is the quotient of the 75th percentile price in a market divided by the 25th percentile prices. The CV and IQR are calculated for each service–market combination and are averaged across all services and markets in each service category. Measures were not weighted by volume in the histograms.