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Marketwide Price Transparency Suggests Significant Opportunities For Value-Based Purchasing

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ABSTRACT The extent of price variation across a local market has important implications for value-based purchasing. Using a new data set containing health care prices for nearly every insurer-provider-service triad across a large local market, we comprehensively examined variation in fee-for-service paid commercial prices in Massachusetts for 291 predominantly outpatient medical services. Prices varied considerably across hospital service areas. Prices for medical services at acute hospitals were, on average, 76 percent higher than at all other providers. The service categories with the widest price variation were ambulance/transportation services, physical/occupational therapy, and laboratory/pathology testing. In this market, simulations suggested that steering patients toward lower-price providers or setting price ceilings could generate potential savings of 9.0–12.8 percent. Marketwide price information at the insurer-provider-service level could help target policy interventions to reduce health care spending.

Health care price variation within the United States is attracting increasing attention from state and federal policy makers.^{1,2} But not all price variation is the same. Variation in health care prices across the country can be wide,³ but it is not a meaningful market signal for patients or local payers whose choice of providers is restricted to those in their local areas.

Variation in health care prices within local areas can also be wide, and this has different policy implications because providers within local areas are close enough to each other that patients could realistically choose and travel between them. For example, a Government Accountability Office report found that the estimated total cost of laparoscopic gallbladder surgery for patients with the same commercial insurer ranged from \$3,281 to \$40,626 across providers in Denver, Colorado, in July 2014.¹ Moreover, the prices paid for a service at one provider vary

across commercial insurers.^{4,5}

Local health care price variation is not fully explained by differences in quality^{2,6} but instead is the result of insurers' and providers' holding positions of varying strength during price negotiations.^{6–8} Because of this, there are opportunities to reduce spending without any loss in value.

Growing awareness of health care price differences within local markets has led to calls for policies that “steer” patients to lower-cost options and put pressure on providers to make price concessions.^{1,2,9} Policy interventions include price transparency tools, benefit designs such as reference-based pricing and tiered or narrow networks,¹⁰ and value-based purchasing.¹¹ Some states have also considered explicit regulation of health care prices through legislation that would determine the amounts that health care providers must accept as payment for medical services.¹²

As part of an initiative to rein in health care spending and improve value, Massachusetts has

begun to make data available on actual prices negotiated between insurers and providers. Although paid prices must be observable if they are to meaningfully influence behavior, paid prices are almost never made available to the public.¹³ Only New Hampshire publishes actual insurer prices paid to providers, including both physicians and facilities: Information for approximately 125 medical services appears on a state-run website.

To this end, the Center for Health Information and Analysis (a Massachusetts state agency) created a unique data set that contains prices by procedure, insurer, and provider for 291 predominantly outpatient medical services. This provides the first opportunity to examine marketwide commercial health care price variation for procedure-provider-insurer triads across nearly all insurers and providers within a large local market. These data also allow the examination of price variation by category of service and as a share of spending. In contrast, most existing evidence on price variation within local areas is based on data from a few large insurers or purchasers in a market.^{3,5,6}

Understanding price variation using marketwide data has important implications for insurers that contract with providers, regulators that evaluate antitrust concerns, employer purchasers that select insurance carriers for employee health plans, and physicians in risk-based payment contracts who decide where to refer patients. In this article we evaluate the extent of price variation for outpatient services across Massachusetts and discuss the implications of our findings for potential savings and for policies targeted at reducing prices.

Study Data And Methods

DATA We obtained access to a data set that contained median fee-for-service prices paid by eight large commercial insurers to nearly every health care provider for 291 medical services in Massachusetts during 2015. The data set was derived from the Massachusetts All-Payer Claims Database by the Center for Health Information and Analysis; the data set underlies the state's web-based price transparency tools for consumers.¹⁴ *Price* is the total allowed amount of payment received by the provider for a medical service (identified by *Current Procedural Terminology* code), including the amount paid by the plan member and the insurer. This is also known as the total allowed amount.

All but two of the services included in the data were exclusively outpatient; the exceptions were two obstetric services—vaginal delivery and cesarean section—for which inpatient and out-

patient services were bundled. The Center for Health Information and Analysis selected these services because the number of encounters at the provider-insurer-service level was large enough that prices could be accurately and reliably estimated.

Each service was associated with a single primary provider that billed for the service. A billing provider could be a facility, medical group, medical lab, individual clinician, or some other entity—such as an ambulance service company. For services such as radiology that included both facility fees and professional fees, both types of fees were bundled into one price and attributed to the facility or group that was the primary billing provider. Office visits that occurred in an outpatient hospital setting but were billed by a physician group included the physician fee only. They were not bundled with facility fees because there was insufficient information on the claim to match the facility fee and the visits reliably. Obstetric maternity bundles included the professional fee only. (Additional details on price data are in section 1.1 of the online appendix.)¹⁵

The eight insurers in the data set covered 75.4 percent of the commercially insured population in Massachusetts in 2015.¹⁶ The insurers not included were predominantly small insurers or national insurers whose data quality could not be sufficiently validated. Spending on the encounters underlying the price data represented approximately 5.5 percent of 2015 health care spending in Massachusetts and approximately 40.0 percent of outpatient spending for the eight insurers. (Details on spending calculations are in section 1.4 of the appendix.)¹⁵

For every provider-insurer-service triad, the data also included the volume of services provided, the service category (such as ambulance services and behavioral health services), and the provider type.¹⁴

SUMMARY PRICE MEASURES The insurer-provider-service price was reported directly in the data. We also constructed two summary price measures. The first was the implied price for each provider.¹⁷ This measure allowed us to compare price differences across providers without requiring that all providers deliver the same basket of services. This was helpful, given that we aimed to characterize the magnitude and heterogeneity of price variation for different types of medical services—including some that are less common and provided by fewer providers or only in certain regions within the state.

The implied price is the amount paid for all services rendered by the provider using actual provider-insurer-service paid prices, divided by a hypothetical amount that would have been paid for the same quantity of services had they been

paid for according to state-level average prices. An implied price of 1 indicates that the price is equivalent to the average statewide price. An implied price greater than 1 indicates that the price is higher than average. For example, an implied price of 1.25 indicates that, on average, the price per service is 25 percent higher than the statewide average price.

Second, we calculated an implied price at the hospital service area (HSA) level. HSAs are geographic areas in which residents primarily use the hospitals located within the area; providers were mapped to HSAs using five-digit ZIP codes.¹⁸ The HSA-level implied price was constructed similarly to the provider-level implied price but included all services provided within the HSA.

Prices paid to providers in the Boston area are higher than prices in the rest of the state in part because of higher costs of labor, maintaining a practice (for example, renting office space and buying supplies), and malpractice insurance. To purge prices of differences due to these geographic differences in input costs, we adjusted all prices and summary price measures using the Medicare Geographic Practice Cost Index. This enabled us to compare prices across all regions in the state. (See section 1.3 of the appendix for more details.)¹⁵

ANALYSES OF PRICE VARIATION Prior research has found that prices vary across geographic regions, as a result of factors other than input costs.^{3,19} To test for similar patterns within Massachusetts and map high- versus low-spending areas, we report the average implied price across all HSAs in the state.

Prices at acute hospitals have been found to be higher than those for the same service in other settings.²⁰ We quantified this price difference and tested whether its magnitude varied across service categories. To do so, we calculated the ratio of the average price per service when it was provided by an acute hospital to the average price for the same service in all other settings, and we report the average and interquartile range of this ratio by service category. The price for a service at an acute hospital is the mean of prices for encounters that were billed by the hospital as provider. Prices for services billed by hospital outpatient departments or by physicians in those departments, both of which excluded associated facility fees, were included in the “other settings” category.

We also characterized price variation using the coefficient of variation, which was calculated as the standard deviation of price divided by the mean. The coefficient of variation describes the dispersion of prices around the mean, with a higher ratio indicating greater dispersion. We

Work to understand the implications of price variation within local areas is just beginning.

used it because doing so allowed us to compare variation between services with different mean prices. Service-category price variation was calculated as the unweighted average coefficient of variation of services in the category; overall price variation was calculated as the average coefficient of variation of all services in the data. To look across providers, we first calculated a provider’s mean price per service—that is, the average price paid to the provider across insurers for a particular service. We then calculated the coefficient of variation for that service across providers, and we report the mean service coefficient of variation by service category. Our analysis of variation in prices paid across insurers was similar, but we used the insurer’s mean price per service instead of the provider’s mean price per service.

IMPLICATIONS FOR SPENDING Our final analyses examined the relationships between price variation, market share, and spending across providers. We focused this analysis on the three service categories with the largest coefficients of variation in the state: ambulance/transportation services, laboratory/pathology testing, and physical/occupational therapy.

We sorted providers that offered these services into deciles by implied price. We calculated the market share of the service category held by providers in each decile, which was the sum of the market shares per service, weighted by the share of spending on that service across the state. This approach put more weight on the share of services that were frequently provided and involved higher spending, and less weight on the share of services that were rarely provided and involved lower spending. We also report the proportion of the service-category revenue earned by each provider decile. (Additional details are in section 1.7 of the appendix.)¹⁵

We conducted two policy simulations to quantify the effects of two relatively aggressive policies aimed at reducing price variation. A “price steering” simulation reallocated all services delivered by high-price providers, which we de-

defined as providers with a service price above the seventy-fifth percentile within the insurer and HSA, to lower-price providers within the same insurer and HSA. We restricted the steering of services to providers within the HSA and insurer network to maintain a reasonable travel distance for patients to a new provider and to simulate insurers' network constraints. Steered services were reallocated proportionately to the distribution of the market shares across lower-price providers, so the low-price provider with the most market share got the most reallocated services. In this simulation, services delivered by fewer than five providers within an HSA-insurer pair were not steered and instead were left unchanged.

In a second simulation, using a "price ceiling," we assessed how spending would change if providers with prices above the seventy-fifth percentile of the statewide price distribution were paid the seventy-fifth-percentile price. We set the hypothetical price ceiling based on the statewide distribution of prices, as opposed to using within-HSA price distributions as in the "price steering" simulation, to simulate a state-level policy.

SENSITIVITY ANALYSIS Although Massachusetts is a relatively small state, residents, particularly those living in the Boston hospital referral region, may be very unlikely to travel across the state for care. To examine whether similar patterns exist within smaller areas across which patients could more feasibly travel, we also examined price variation within the hospital referral region for Boston.

LIMITATIONS Our analyses had several limitations. First, the study data came only from Massachusetts. These data provide a substantially complete picture of prices in this market, giving a novel look at comprehensive market-level price variation, and this analysis followed a large literature that carefully characterized local markets when national data were imperfect or unavailable.^{21,22} However, analyses from other US markets will be important to understand the degree to which price variation in other states is similar to that in Massachusetts.

Second, the simulations reported here evaluated changes only if patients were steered or price ceilings imposed, which in economic terms is a partial equilibrium analysis. We did not examine the impact of potential provider responses, such as changes in prices or quantities of care delivered, to the steering or price ceiling policies we examined.

Third, we did not have data to report on price variation for other types of care, such as inpatient services.

Fourth, we did not have information on quality that would have allowed us to examine to what

extent the prices we observed were explained by quality differences or how the policies we simulated might affect the quality of care.

Fifth, there were also differences in the availability of high-intensity services, such as those provided in intensive care units, across providers that are a function of site of care. We did not have data to determine the extent to which price differences reflected provider-level differences in the intensity of care.

Study Results

ANALYSES OF PRICE VARIATION Exhibit 1 presents the variation across hospital service areas in Massachusetts. On the mainland, the HSA implied price ranged from 0.69 to 1.17. Higher prices were generally found in the eastern part of the state, particularly in the areas surrounding Boston, and on the borders with Connecticut and Rhode Island to the south. The highest prices were observed on the islands of Nantucket (1.39) and Martha's Vineyard (1.59). Relative to the lowest-price HSAs in Massachusetts, the prices paid in the highest-price mainland HSA were 70 percent higher (for example, 1.17 versus 0.69), and the prices paid in the islands were 100–129 percent higher.

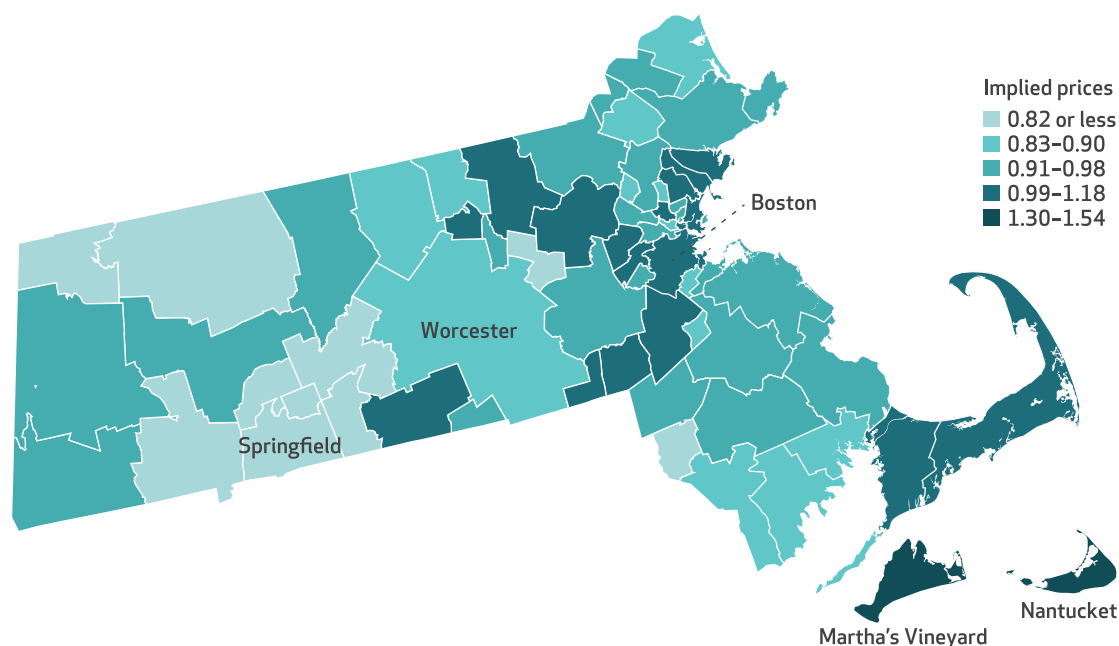
The mean coefficient of variation across all provider-insurer prices was 0.50 (exhibit 2). Not surprisingly, the coefficient of variation for prices across providers (0.42) was greater than it was for insurers (0.30). The greatest price variation occurred for ambulance/transportation services (average coefficient of variation: 0.79), physical/occupational therapy (average coefficient of variation: 0.70), and laboratory/pathology testing (average coefficient of variation: 0.64). Services in these three categories accounted for 3.0 percent, 3.7 percent, and 8.4 percent of total spending in our data set, respectively.

Prices paid for outpatient services delivered at acute hospitals were 76 percent higher than prices paid for the same services received in other settings, but there was considerable variation across service categories (exhibit 3). Physical/occupational therapy and laboratory/pathology testing had average acute hospital prices that were 199 percent higher and 100 percent higher, respectively, than prices for the same services in other settings. The exception to this pattern was office visits: On average, prices for office visits at acute hospitals were slightly lower than prices for the visits in other settings.

IMPLICATIONS FOR SPENDING For two of the three service categories with the widest price variation, laboratory/pathology testing and physical/occupational therapy, providers in

EXHIBIT 1

Variation in implied prices across Massachusetts hospital service areas (HSAs), 2015



SOURCE Authors' analysis of data from the Center for Health Information and Analysis. **NOTES** Implied prices are explained in the text. For HSAs that cross state borders, calculations were made using only the subset of ZIP codes in that HSA in Massachusetts.

the highest price decile had large market shares (41.1 percent and 16.9 percent, respectively) (exhibit 4). The large market share in combination with being paid the highest prices resulted in the highest price decile of these providers

receiving a very high proportion of total category spending (57.3 percent and 33.4 percent, respectively). The highest price decile of ambulance/transportation service providers had a 10.3 percent market share. The highest price decile of

EXHIBIT 2

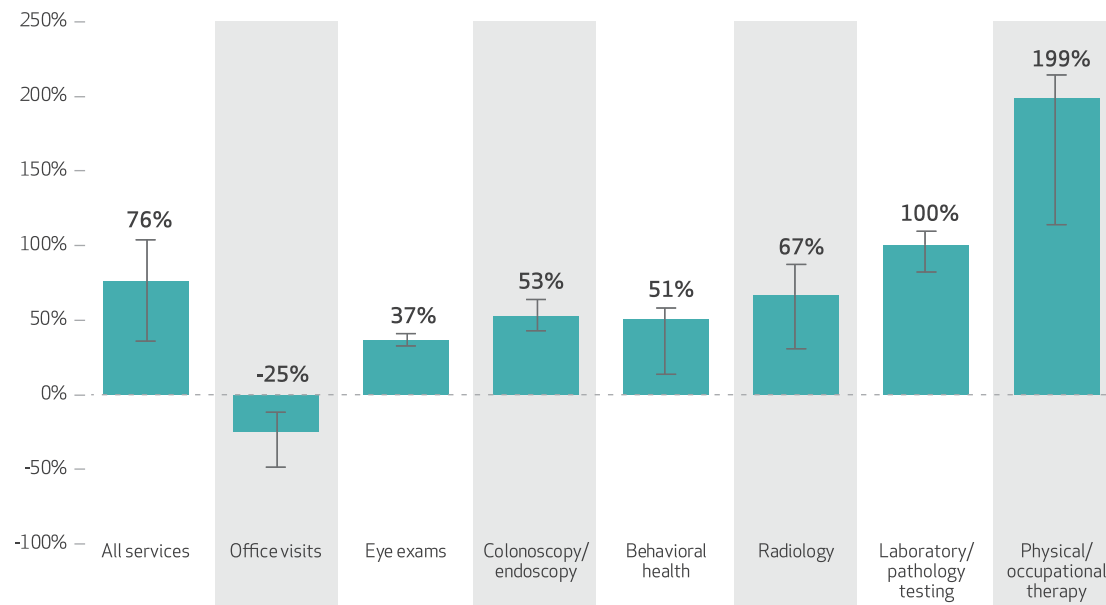
Total spending, mean service price, and price variation by service category, across providers and insurers in Massachusetts, 2015

Service	No. of CPT codes	Total spending (\$)	Across provider-insurer combinations		Across providers		Across insurers	
			Mean price (\$)	Mean CV	No.	Mean CV	No.	Mean CV
All	291	3,061,294,213	177.68	0.50	12,549	0.42	8	0.30
Ambulance/transportation	7	91,402,809	654.15	0.79	255	0.75	8	0.34
Behavioral health	22	200,043,469	88.62	0.35	7,146	0.32	8	0.16
Colonoscopy/endoscopy	12	240,608,922	2,097.17	0.31	91	0.29	8	0.24
Emergency department visits	5	202,651,922	537.63	0.49	67	0.32	8	0.32
Eye exams	4	82,982,024	154.49	0.50	714	0.31	8	0.28
Laboratory/pathology testing	86	256,020,132	26.86	0.64	713	0.54	8	0.34
Maternity	2	42,027,721	4,132.35	0.24	99	0.20	4	0.16
Office visits	28	1,240,858,596	164.81	0.38	4,034	0.29	8	0.26
Physical/occupational therapy	17	113,832,069	42.96	0.70	1,392	0.69	8	0.96
Radiology	108	590,866,549	471.11	0.42	518	0.34	8	0.22

SOURCE Authors' analysis of data from the Center for Health Information and Analysis. **NOTES** We calculated the mean provider price per service across insurers and then calculated the coefficient of variation (CV; explained in the text) for each service. We also calculated the mean insurer price per service across providers and then calculated the CV for each service. Maternity service prices were reported for provider-insurer combinations with at least eleven observations (only four insurers in our data had sufficient volume to meet this threshold). CPT is *Current Procedural Terminology*.

EXHIBIT 3

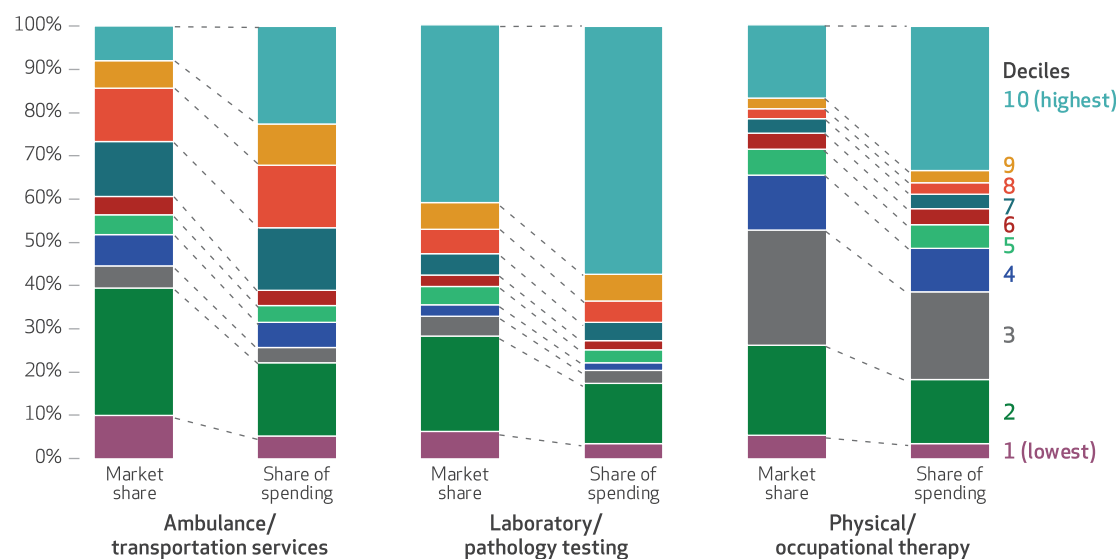
Differences between acute hospitals and other providers in average negotiated prices paid by commercial health plans in Massachusetts, by service category, 2015



SOURCE Authors' analysis of data from the Center for Health Information and Analysis. **NOTES** Prices for acute hospitals include all prices for outpatient services billed with the hospital listed as the provider. Prices for other providers include claims billed by hospital outpatient departments, excluding the associated facility fee. Claims for emergency department and maternity services were excluded because these services are provided almost exclusively at acute hospitals. Claims for ambulance services were excluded because the vast majority of providers billing for these services are not hospitals. The error bars indicate interquartile ranges.

EXHIBIT 4

Market share and share of spending, by category of service and decile of provider prices in Massachusetts, 2015



SOURCE Authors' analysis of data from the Center for Health Information and Analysis. **NOTES** Providers were sorted into deciles based on the average implied price for the category of services. Implied prices are explained in the text. Service-level market shares were weighted by the share of market spending on the service relative to other services in the service category.

these providers received 22.6 percent of the spending in that category.

The “steering” simulation suggested that a policy that steered patients from providers with high prices to providers with lower prices in the same HSA and insurer network could save up to 12.8 percent of spending, with the highest proportion of savings from office visits, radiology services, and laboratory/pathology testing. The “price ceiling” simulation, with price ceilings set at the seventy-fifth percentile, resulted in 9.0 percent lower spending, with the greatest savings in the same three services. The simulation results are in appendix exhibit 1.¹⁵

SENSITIVITY ANALYSES When we considered only providers located within the Boston hospital referral region, we found that the average coefficient of variation in prices across all services was 0.50, while the coefficients of variation across providers and insurers were 0.41 and 0.35, respectively. These are very similar in magnitude to the coefficients of variation in price observed across the state. Results from all other analyses when restricted to providers in the Boston hospital referral region were also similar to results from analyses for the whole state (data not shown).

Discussion

An analysis of paid health care prices for insurer-provider-service triads across Massachusetts revealed extensive variation in health care prices for outpatient services that were not attributable to geographic variation in the cost of doing business. Prices in the urban areas surrounding Boston (where large acute hospitals are most concentrated) and on the two islands off the coast (where there are fewer providers and geographic isolation) had the highest prices. Lower prices were paid in neighboring HSAs. We found the widest variation in prices across ambulance/transportation services, physical/occupational therapy, and laboratory/pathology testing. In general, prices for services provided by acute hospitals were higher than prices for services in other settings. The acute hospital category included services for which the hospital was the primary provider and did not include services provided in hospital outpatient departments—those services, without associated facility fees, were included in the “other settings” category. Accounting for facility fees would have narrowed the variation in prices between acute hospitals and hospital outpatient departments, but not that between acute hospitals and any other settings.

Providers in the highest price decile received very large proportions of category spending.

Our findings suggest that meaningful savings are available from policies to reduce price variation.

This result is in part a mathematical one, due to their higher relative prices. However, for labs and physical or occupational therapy providers, this result is also due to higher volumes, as these higher-price providers, on average, have higher market shares than lower-price providers do.

Work to understand the implications of price variation within local areas is just beginning. For example, further investigation of lower average prices for office visits in acute hospitals revealed that only a small proportion of office visits had an acute hospital as the billing provider (these visits accounted for 8 percent of office visit spending), and the most common visit was of short duration. Thus, while our analyses and simulations took account of the specific *Current Procedural Terminology* code billed, the data also suggest that office visits billed by hospitals may play a different role than office visits billed by physician practices.

Overall, previous research has found that quality differences explain little price variation.⁵ While many of the services for which we documented substantial price variation would appear to be relatively commodified, such as lab tests, there may be some in which quality differences across providers are more important. In addition, there are differences in the availability of services, such as those provided in an intensive care unit, across providers. Having access to such services during a procedure, particularly for high-risk patients, could make paying higher prices for care at those providers worth it. Thus, steering or regulatory policies should optimize value instead of simply minimizing costs and should take quality differences into account.

Policy Implications

Our findings suggest that meaningful savings are available from policies to reduce price variation. The simulations suggested greater potential savings from steering than from price ceilings—because steering would reallocate services to providers with prices along the price

distribution, whereas price ceilings would increase the number of providers paid the seventy-fifth-percentile price. Of course, achieving savings from steering would depend on being able to successfully steer patients to low-price providers. Simply providing price information directly to people through price transparency tools has not led to changes in behavior.¹⁰ New products and interventions are required to improve value in health care choices. The development of these tools and new incentive programs requires investment, and our findings can be used to assess the maximum returns from such efforts.

Interventions such as reference-based pricing and tiered or narrow networks have shown promise.^{23–26} Under reference-based pricing benefit design, the insurer sets a maximum reimbursement that it will pay for a service, and patients who choose a provider with a higher price must pay the full difference between the provider's price and the insurer's maximum. Tiered and narrow networks are forms of managed care network design in which the insurer sorts providers into tiers based on price and quality. The insurer assesses higher cost sharing—or, in the case of narrow networks, may provide no coverage at all—when patients choose providers in the highest price tier.

Both of these interventions are well suited to services that are nonemergency and generally not complex, such as physical/occupational therapy and laboratory testing. However, if steering is onerous for some services because the geographic distribution of services is not comprehensive, it could be disruptive to patient care. Steering could also be infeasible in some cases, such as for ambulance services. Then im-

posing price ceilings may be preferable.

Although the aim of transparency in health care prices is to provide missing price information to improve the functioning of health care markets, the publication of paid prices could have adverse consequences. An oft-mentioned concern is that providers' response to increased price transparency could lead to patients' paying higher prices—for example, if providers raise their prices to equal the highest in the market.²⁷

The release of information on commercial paid prices is unlikely to create additional market power for providers so that they could command higher prices from insurers. More concerning is that widespread transparency of prices could lead to alignment of price negotiation strategies by providers or, at worst, to outright collusion.²⁸ Thus, wider release of commercial health care price data should be accompanied by analysis and oversight to monitor the provider response—especially in markets with fewer large providers, where anticompetitive behavior is more feasible.

Conclusion

While preliminary, our findings provide a road map for ways that consumers and purchasers can save money not only through choice of providers but also through choice of insurers. Other stakeholders can capitalize on these data, too. Referring physicians in risk contracts can leverage price variation to reduce spending. Marketwide price transparency data could also shed light on competition and inform antitrust enforcement. Marketwide price transparency is an important tool in the effort to increase the value of health care spending. ■

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