Hospital system market share and commercial prices: a cross-sectional approach using price transparency data

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Abstract

Background The goal of this study is to estimate the association between hospital system market share and negotiated prices.

Hospital system consolidation has led to many highly concentrated markets where systems can leverage their market share to negotiate higher commercial prices. Recently, the Centers for Medicare & Medicaid Services, under its Transparency in Coverage initiative, required health insurers to release all negotiated commercial prices, providing, for the first time, publicly available, nationally representative data on commercial rates. We utilize this newly available data on negotiated prices of healthcare services to show that a hospital with 10% higher market share charges 880-1,180 more per admission.

Study design We used commercial price data for national networks of three large, national insurers and performed a linear regression based on more than 1.3 million negotiated rates across 1,784 hospitals to estimate the association between a hospital's system-level market share and commercial negotiated rates, adjusting for service (DRG), health system, and area level time-invariant characteristics.

Results We find that a one percentage point increase in hospital system market share is associated with an $88 to $118 higher negotiated rate per admission. All else equal, a hospital that is part of a system with a 10-percentage point higher market share can expect from $880 to $1,180 more per admission relative to a hospital with lower system market share (5.4% to 6.2% of the median price).

Conclusion These findings confirm that higher hospital system market share is strongly associated with higher commercial negotiated prices and should aid policymakers and decisionmakers in assessing the impact of various policy options aimed at reducing provider consolidation in the healthcare market.

Trial registration Not applicable.

Keywords Hospital, Health insurance, Commercial rates, Market share, Negotiated rates, Price transparency

What is known on this topic

High concentration in healthcare markets as a result of increasing consolidation between providers has been linked to increasing healthcare costs. Existing literature has relied on using allowed charges in commercial claims data as proxy for prices due to lack of reliable data on prices until now.

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What this study adds

Utilizes newly available data on negotiated prices of healthcare services to show that a hospital with 10% higher market share charges 880-1,180 more per admission.

Relationship between provider market share and higher negotiated prices should inform debate about policies and actions regarding consolidation in the healthcare system.

Background

Healthcare markets in the United States have witnessed increasing consolidation among hospital systems and physician groups in the last three decades. This consolidation has led to highly concentrated healthcare provider markets [1–12]. In turn, this has been found to increase commercial healthcare prices [4, 5, 13–19]. In studies investigating the link between market concentration and prices, one major drawback has been the paucity of reliable data on prices, or the rates negotiated between the providers and insurers. Instead, much of the existing literature has relied on using allowed charges in commercial claims data as proxy for prices. For example, in a recent study, Cooper and colleagues conducted a large claims-based analysis with actual paid amounts and found that consolidation led to price increases of 6% [14]. In this paper, we contribute to this literature by directly using prices or negotiated rates for healthcare services between three of the largest national insurers and hospitals across the United States. Our findings demonstrate that a hospital systems' bargaining power, as measured by its market share, is associated with significantly higher reimbursement rates. In doing so, we demonstrate the utility of the recently available data on prices, thanks to the Price Transparency rules, for health economics and policy research.

A major challenge with assessing the relationship between market share and pricing has been a lack of data on commercial prices. Commercial data has long been protected by confidentiality agreements, masked with price discrimination and confounded by the disconnect between billed charges and negotiated amounts that insurers [20–22] pay. Seeking to make prices transparent, President Trump issued an Executive Order in 2019 requiring both hospitals and insurance companies to make negotiated commercial rates public. The first rule included in the Executive Order, referred to as Hospital Price Transparency, required providers to release information on prices for a standard set of services beginning year 2021.The second rule required payers to release the data in a standardized format beginning July 2022; this is referred to as Transparency in Coverage [23, 24]. These two rules, for the first time, made commercial negotiated prices available for researchers at the national level.

Naturally, there has been significant interest in using these two datasets on negotiated rates – the first one made available by the providers (Hospital Price Transparency) and the second one made available by payers (Transparency in Coverage). The former, Hospital Price Transparency, which puts the onus upon hospitals to post prices, has been the primary focus of researchers due to ease of access. For example, LoSasso, Toczydlowski, and Yang [25] use the prices posted by the hospitals to show that insurance companies use their market share to their advantage and negotiate a lower rate in markets where they face less competition. However, a limitation of using the Hospital Price Transparency data is that hospital compliance rates with the rule have been low and this raises potential selection bias issues [26].

In this paper, we use the prices disclosed by the insurance companies as part of the Transparency in Coverage rule and build on the growing Price Transparency literature as well as previous work studying provider market share and prices in healthcare.

We believe we are the first to utilize this data to demonstrate how health systems use their bargaining power to extract higher rates from insurance companies. In doing so, we partially avoid the selection issues in the prices disclosed by the hospitals and draw on a larger pool of hospitals to offer precise estimates of the magnitude to which higher market share of a hospital system is associated with higher commercial negotiated prices.

Methods

Data

This study combines data from multiple sources. We define national health insurers as those that have more than 500,000 commercial lives and operate in at least 15 states - six insurers fit this criteria based on data from the National Association of Insurance Commissioners (NAIC) [27].

The Transparency in Coverage data includes information on all commercial plans (mostly with employers) that insurers cover with links to networks with negotiated rates. Different insurance plans may utilize the same network and they may operate across multiple networks. For example, a health insurance plan might provide coverage in one network for traditional medical services and a separate network for behavioral health services. For each insurer, we sought to identify the broad national network that was commonly used by many of the plans for medical care. At the time of data collection during the third quarter of 2022, of the six national insurers,

two did not have national data, but instead released data from a variety of state-level subsidiaries, so they were excluded. A third insurer had a national network but did not provide NPI or TIN data that consistently matched to hospitals (only eight hospitals matched to one of their national provider identifiers [NPIs] or tax identification numbers [TINs] in the entire country), so it was excluded. For the three insurers we used, their most common national network represented 54.6%, 48.9% and 32.5% of all their reported plans, respectively. Additional information on the data collection process is available in the Appendix.

The price data from the payers' websites consist of large, machine-readable files containing negotiated rates for thousands of billing codes with hundreds of thousands of groups and providers using (TINs) and (NPIs). The types of billing codes included in this data represent the continuum of medical services - from inpatient care to physician services to post-acute care and laboratory services. The breadth of the data offers many opportunities for additional work. One challenge for our study is the existence of "ghost codes" which are negotiated rates for services that are unlikely to be performed [28] (ex: a psychiatrist may have a negotiated rate for doing a knee replacement, though it is unlikely they will ever bill for that procedure). To limit the potential impact of ghost codes, we limited our study to hospital inpatient diagnosis related group (DRG) codes for short-term acute care hospitals (thus excluding critical access, children's, long term, psychiatric and rehabilitation hospitals). We assume that because short-term acute care hospitals have emergency departments, they are likely to provide services for most of the DRGs in our sample.

We matched hospitals to a commercial database [29] to identify which hospital system each hospital was part of and linked each hospital to Medicare Cost Report Data from 2021, which includes financial and operational data for all hospitals that accept payments from Medicare [30]. Our analysis file to calculate market share includes the 3,214 short-term acute care hospitals that accept Medicare and reported cost report data to CMS. Our geographic unit of analysis was the core-based statistical area (CBSA) which is defined by the Office of Management and Budget as counties that are socioeconomically tied to an urban core [31]. Hospitals that were in rural areas (non-CBSAs) were combined into a single rural area for each state. Our final study sample, post trimming the sample at top and bottom 1 percentile of the price distribution for each DRG code, consists of 1,350,284 negotiated rates across 770 DRG codes for 1,784 hospitals and three payers spread across 505 CBSAs.

The data on insurer market share was obtained from NAIC for year 2021 and was calculated at the state-level based on the percent of all commercial lives (consisting of large group, small group and individual market) by insurer in the state where each hospital is located.

Table 1 below shows the hospital characteristics in our sample. The mean (median) hospital in our sample has price information for 747 (765) DRGs. The average hospital has a star rating greater than 3, 238 beds, and net patient revenue greater than $331 million.

Overall, our sample contains 56% of the total providers and reflects the fact that not all providers' prices are included in the Price Transparency data or could be matched to provider characteristics. Exhibit A1 in the appendix compares the providers in our sample to the universe of providers in the country and shows that our sample is representative of the country in terms of the characteristics listed above. Hospitals in our sample are located similarly to all hospitals for the Midwest, Northeast and South Census regions, though our sample had fewer Western hospitals.

Regression model

Our main goal is to estimate the strength of association between service level negotiated rates and hospital bargaining power. We assume that the rates are negotiated between health systems and payers, and accordingly it is the bargaining power of the health system rather than an individual hospital that will principally affect prices. We use a given health system's market share as a proxy measure for its ability to negotiate prices with the payer, and we calculate a health system's market share as the total number of beds of a health system in a given market, divided by the total number of beds of all hospitals in the same market. A more detailed explanation of hospital system market share is included in the appendix.

Alternatively, we also calculated market share using total number of discharges and net patient revenue as described above. The estimated association between negotiated rates and market share is robust both when number of beds or discharges is used to calculate market share.[1]

Service-specific negotiated prices for a given hospital and payer are modeled as a linear function of its system's market share and diagnosis or DRG code, health system, payer, and CBSA time-invariant characteristics or fixed effects, hospital star rating, ownership type, and insurer market share, plus other unobservable variables. The cross-sectional linear model estimating the coefficient of interest based on Transparency in Coverage data from the third quarter of the year 2022 can thus be written as:

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[1] We also calculated market share using net patient revenue but since revenue is a direct function of prices, we do not consider market share based on net patient revenue as an outcome variable.

Table 1 Descriptions of provider characteristics in the study sample

| | Variables | Sample | | | | |
		Mean	Std Deviation	Median	No. of Hospitals	No. of Health Systems
Dependent Variable	Price	27,426	16,446	27,354	1,784	794
Market Share Based on:	*No. of Beds*	30.53	30.76	20.11	1,784	794
	No. of Discharges	30.78	31.38	19.66	1,784	794
Provider Characteristics	*Hospital Star Rating*	3.22	1.13	3.00	1,607	700
	Ownership type = private, for profit	0.45	0.50	0.00	1,784	N/A
	Ownership type = private, not for profit	0.23	0.42	0.00	1,784	N/A
	No. of DRG codes w/ price information	747	461	765	1,784	794
	Net Patient Revenue (in million $)	331.80	469.20	180.10	1,775	793
	Operating Margin	-0.01	0.20	0.00	1,760	783
	No. of beds	238	240.70	169	1,784	794
	Average Length of Stay	8.16	146.40	4.70	1,782	792

$$Y_{drg,h,s,i,CBSA} = \beta_0 + \beta_1 * \text{system market share}_{h,s,\,CBSA} + \beta_2 * X_{i,CBSA(state)} + \delta_{drg} + \gamma_s + \varphi_{CBSA} + \kappa_i + \epsilon_{jt}$$

$Y_{drg,h,s,i,CBSA}$ represents the dependent variable, negotiated rate (price) for an inpatient diagnosis code, drg, at a given hospital, h, belonging to a system, s, as negotiated with insurer, i, in a given CBSA. β_1 is the coefficient of interest and represents the association between the hospital's system-level market share –based number of beds and number of discharges - and negotiated rates. $X_{i,CBSA(state)}$ represents the state level market share of a given insurer and it is common across CBSAs in a given state for an insurer. δ_{drg}, γ_s, φ_{CBSA}, and κ_i control for time-invariant characteristics for each diagnosis or DRG code, health system, CBSA, and insurer, respectively. When a CBSA contains a single health system, the CBSA dummy variable is correlated with the health system dummy variable and gets dropped from the model. We compute robust standard errors clustered at the CBSA level to account for common area or market level shocks.

We include insurer or payer market share as it has shown to be associated with pricing [25], however insurer market share is a noisy measure. Data on commercial insurance enrollment is available from the NAIC, but only includes enrollment for fully-insured lives when 65% of commercial workers are covered by self-insured plans and the data is only available at the state level, not at a smaller market-level [27, 32]. For fully-insured lives,

the plans we evaluated had a median state-level market share of fully-insured lives ranging from 1.7–8.1%, so while they are large nationally, they are not particularly large within most states [33]. Thus, we show results both with and without the insurer market share.

We do not include hospital or health system time variant characteristics, such as measures of revenue, as they are a function of dependent variable, prices. The number of beds at a hospital, a key provider characteristic, is an input variable in our definition of market share and thus already included in the model. Other provider characteristics such as average length of stay and payer mix are potentially a function of prices and might lead to selection bias issues, so we do not include them in our main model. However, controlling for these characteristics does not change our results in a meaningful way and are shown in the appendix (exhibit A2).

Following the example of LoSasso, Toczydlowski, and Yang [25], we trim our sample to exclude top and bottom 1 percentile of the price distribution for each DRG code.

We do not have a preferred version of our main specification as our main focus is on the strength of the relationship between providers' market share and negotiated rates rather than the magnitude. In the next section we show results for this outcome variable. However, the results using market share based on number of discharges are essentially the same and included in the appendix (exhibit A3)

Table 2 Estimated association between market share and negotiated rates or prices

		Model 1	Model 2	Model 3	Model 4
Market Share based on: no. of Beds	*coefficient*	117.9***	116.2***	92.67**	87.67**
	std. err.	(36.14)	(36.07)	(43.60)	(43.26)
Hospital Star Rating	*coefficient*			610.7	593.8
	std. err.			(405.1)	(411.7)
Hospital Ownership Type	*coefficient*			61.82	66.66
	std. err.			(118.9)	(119.8)
Insurer Market Share	*coefficient*		979.8		1,854
	std. err.		(10,255)		(8,871)
	N	1,350,284	1,331,312	1,213,597	1,197,159
	r-squared	0.754	0.754	0.763	0.764

Notes: This table shows the association between our preferred measure of market share - number of beds - and negotiated prices. The association was estimated using Ordinary Least Square regression model. All regression models control for diagnosis (DRG) fixed effects, health system fixed effects, CBSA fixed effects, and insurer or payer fixed effects. In addition, models 2 and 4 control for insurer market share and models 3 and 4 control for hospital star rating and hospital ownership type which includes private (for profit), private (not for profit), and other types. Robust standard errors clustered at the CBSA level are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

Results

Table 2 contains the estimated results from our linear model above for system level market share based on number of beds.

We show estimates for four different versions of the linear model – with and without hospital characteristics that might be correlated with prices (models 1 and 2 vs. models 3 and 4), as well as with and without insurer market share which comes with some limitations as discussed in the Methods section (model 1 and 3 versus models 2 and 4).

The results show that a one-percentage point increase in market share is associated with an $88 to $118 increase in average DRG-level price.

We also estimated a weighted version of our main model using the number of service level discharges in year 2019 as weights (source: Healthcare Cost and Utilization Project (HCUP)) [38] and found the results to be essentially unchanged (see Appendix exhibit A4).

Exhibit A3 (in the appendix) contains the results for the main model where we use market share based on *number of discharges* as the dependent variable instead. The estimated association between this measure of market share and prices is similar to the main estimates.

As shown in the exhibit, all else equal, a hospital in a system with ten percentage points higher market share would expect between $880 more per admission from commercial payers (5.4–6.4% of the median negotiated rate of $18,221. This core finding held and we found no substantive difference in the association between prices and market share across the three payers in the study sample.

We also estimated the model separately for categories of services defined by their Medicare reimbursement rates. The services were categorized into four quintiles and the main specification was estimated for each quintile. We find that the association of market share with prices is increasing in level of the rates set by Medicare. Table 3 shows the estimates from model 1. Full results from models 1–4 can be found in the Appendix.

Robustness checks

First, exhibit A2 in the appendix shows results for a version of the main model where we add average length of stay and payer mix – Medicare and payer mix – Medicaid to our existing covariates. Since these hospital characteristics are potentially a function of price, we do not prefer this model due to potential selection bias issues, but nonetheless find it reassuring that the association between market share and prices remains robust.

Second, to investigate whether the strong association between a hospital's system-level market share and negotiated rates is affected by outliers in the service specific rates' distributions, we further trimmed the service specific rates to be between its 5th and 95th percentiles. Appendix Exhibit A5 shows the results for the same regression models as Table 2 for this trimmed sample, and our main findings remain robust.

Finally, we wanted to explore if our results are being driven by services with high utilization and not by low-utilization service. Table 3 below plots main coefficient of interest from Table 2 followed by the estimates from the same model when the study sample is restricted to the top 30, top 25, and top 20 inpatient DRG services by utilization in the year 2019 (the most recent data available where volumes were not significantly impacted by the pandemic) according to the Healthcare Cost and Utilization Project (HCUP) [38]. We picked the results from model 4 as it is the most saturated model – the results

Table 3 Estimated association between market share and negotiated rates or prices, by quintiles based on year 2022 medicare reimbursement rates
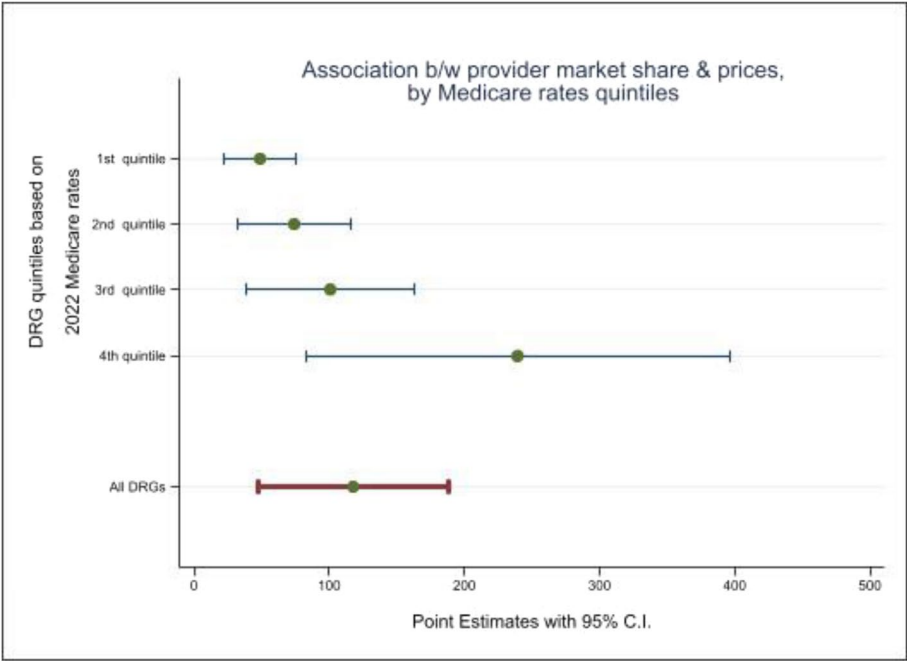
from models 1 to 3 are essentially unchanged and available upon request (Table 4).

Under this more limited sample our core findings remain robust - restricting the sample to the top 30, 25, or 20 inpatient DRG services does not change the strength of the association. And again, using market share based on number of discharges leads to the same results.

Discussion

Implications

Our core findings – that a one-percentage point increase in market share is associated with $88 to $118 more in per-admission prices – provides a useful benchmark for policymakers and decisionmakers to assess the impact of various policy options aimed at reducing provider consolidation in the healthcare market. While these findings have broad implications, we retain our focus on two important ones: hospital system consolidation and provider networks.

Hospital consolidation has been shown to be associated with higher negotiating power and higher prices for the commercial insured [3–5, 12, 14]. When hospitals or hospital systems propose merging, the Federal Trade Commission (FTC) and Department of Justice (DOJ) evaluate the merger for potential negative consequences and then determine whether to allow or block the merger. Hospitals argue that the mergers result in efficiency improvements including streamlining of administrative efforts

that can improve quality, while the FTC/DOJ worry about the impact of the resulting consolidation on prices [2]. So far, limited evidence has been found to support the claim that consolidation leads to efficiency gains [39]. Estimating the impact of a merger on prices, retrospectively or prospectively, has been challenging for a number of reasons. First, the impacts are often localized, specific to certain markets [40], and require analysts to make certain methodological assumptions. Second, access to precise data on prices has been hard to come by since, until recently, the payers and providers were not keen on sharing their negotiated rates. This Transparency in Coverage data is an important new source of information on healthcare prices, information that was until recently now locked away in a black box by providers and payers, and an excellent tool for researchers and policy analysts to shine light on the precise effects of consolidation in the U.S. healthcare markets.

A second area where these findings have relevance is for the covered or the insured - the health insurance purchasers who make choices about provider networks when they choose health insurance plans. Large, self-insured employers, particularly national insurers, often make high-level decisions about which networks to choose without fully understanding the tradeoffs between prices and benefits across different options. The findings here can provide a first estimate of the likely impact on their costs based on the inclusion or exclusion of hospital

Table 4 Plot of estimated coefficient from model no. 4 for all services and top 30, 25, and 20 services by utilization (source: HCUP, 2019)

Estimated relationship between provider market share and negotiated rates for all services, and top 30, 25, and 20 services by utilization.
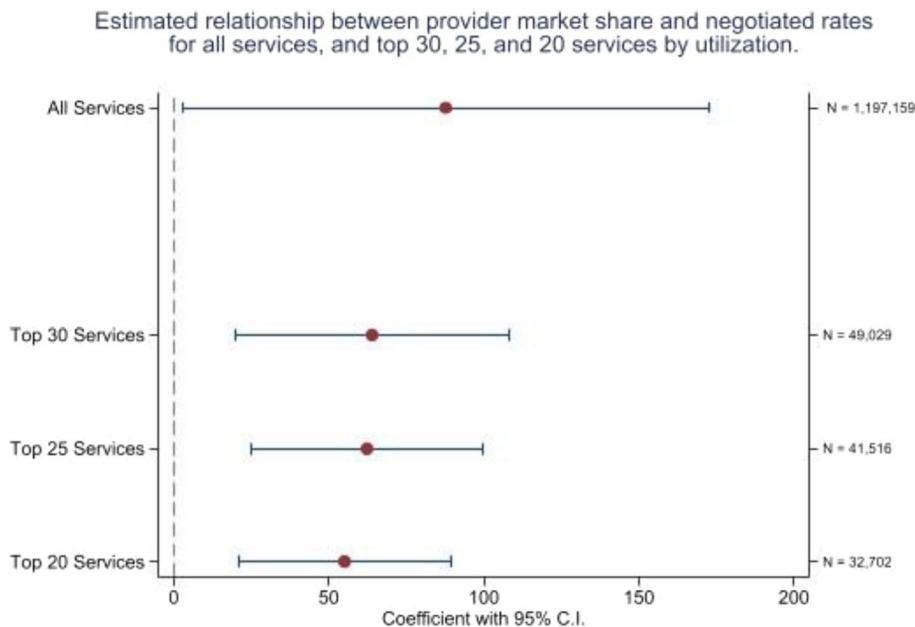
systems with higher market shares and guide their choice of coverage.

Limitations

There are several important limitations to note for this study, all of which warrant further work:

First, as discussed above, insurer market share is inaccurately measured and reported, and we show results both with and without it as a control since insurer market share has been shown to be associated with pricing [25]. We plan to overcome this limitation in future work by expanding this analysis to include dominant local plans (such as regional Blues plans).

Second, we only calculated market share for the hospital system and did not calculate market share by procedure or service line. A hospital, for example, might have a relatively modest total market share but provide a majority of a certain type of care such as certain surgeries or women's health [34].

Third, we used market share as a proxy for bargaining power, but unmeasured attributes, such as local notoriety, connection with a specific academic institution, public rankings or market share across multiple markets likely influence bargaining power [35, 36].

Fourth, we only evaluated a broad national network, not narrower networks; if the insurer has a strong ability to channel patients to specific hospitals, we would expect to see more price discounts [37]. Finally, this analysis is limited to a cross-sectional analysis of hospital prices and focuses on associations. As more waves of Price Transparency data become available to researchers, future work should explore how all these dynamics influence commercial negotiated prices over time.

Conclusions

This study confirms and expands upon previous work that has shown that increased hospital market share is associated with higher commercial negotiated rates. In addition to using new, nationally representative data covering all 50 states, we provide specific, useful financial estimates of the impact of consolidation based on the simple metric of market share. Understanding how market share impacts prices should lead to more informed debate about policies and actions for policy makers and individuals and organizations throughout the healthcare system.

Supplementary Information

Supplementary Material 1.

Supplementary Material 2.

Authors' contributions

Funding

Data availability

The data used for this study come from publicly available information on prices posted by health insurance companies in the United States as required by Transparency in Coverage Act. The files we used were 107GB, 136GB and 5.4TB in size and the links to the raw data are available upon request. As part of the CMS Transparency in Coverage (TIC) initiative, insurance plans are required to release commercial negotiated prices on their website in standardized, machine-readable files (MRF). Each insurer releases a series of Table of Contents (TOC) files which contain all of the plans the insurer offers and the networks associated with each plan. For each of the insurers we scraped all of the TOC files from their websites in the third quarter 2022, shortly after the TIC data was released. The TOC file contains links to a JavaScript Object Notation (JSON) or commas separated values (CSV) file or files that contain the actual negotiated rate information and allowed amounts, which are actual amounts paid for out-of-network care.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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