2020-03-17

Trends in Hospital Prices: Evidence From Hospital Chargemasters

Ulysse G. McCann III
Brigham Young University

Honors Thesis

TRENDS IN HOSPITAL PRICES: EVIDENCE FROM HOSPITAL CHARGEMASTERS

by
Ulysse George McCann III

Submitted to Brigham Young University in partial fulfillment
of graduation requirements for University Honors

Economics Department
Brigham Young University
April 2020

Advisor: Dr. Mark Showalter

Honors Coordinator: Dr. John Stovall

ABSTRACT

TRENDS IN HOSPITAL PRICES: EVIDENCE FROM HOSPITAL CHARGEMASTERS

Ulysse George McCann III

Economics Department

Bachelor of Science

In light of recent price transparency laws, this paper examines evidence from hospital list prices, contained on "chargemasters," with regard to price trends over time, price variation between hospitals, and price variation between categories of goods and services provided by hospitals. I use data from California's Office of Statewide Health Planning and Development (OSHPD) for 32 general acute care hospitals in Los Angeles County from 2011–2019. The data shows that the average list price for hospitals in the sample rises by about 3% annually. Prices between hospitals in the sample, which are similar in geography and the population served, vary significantly. Different categories of goods and services provided by hospitals vary in average price and growth rate of price. Consistent with other research, imaging procedures are twice as expensive as all items, on average, and have grown in price over this time period by about 5%.

ACKNOWLEDGEMENTS

A special thank you to Dr. Showalter, Dr. Eide, and Dr. Stovall, who have been a huge help in completing this project. They helped me brainstorm ideas, gather and analyze data, and write a coherent paper. I am grateful for the time and energy they spent with me.

TABLE OF CONTENTS

LIST OF FIGURES AND TABLES

I. Introduction

Questions surrounding hospital pricing policies have received significant attention in the recent past, even in popular magazines like TIME (Brill, 2013). Such widespread interest in this topic indicates underlying confusion about how hospital prices are determined and why they seem so high. Public concern over these issues have likely played an important role in recent price transparency rules, which have required hospitals to publicly post a list of prices for goods and services, known as a chargemaster. The recent availability of chargemasters presents an opportunity to analyze raw hospital list prices, with the objective of providing insight on questions surrounding hospital prices using information directly from the source. Specifically, what can hospital list prices tell us about price trends over time, price variation between hospitals, and price variation between categories of goods and services provided by hospitals?

Previous work on hospital prices have focused on charge-to-cost ratios, an indirect measure of hospital list prices. This work complements previous work by providing evidence directly from list prices in an effort to better understand hospital prices and their importance for our healthcare system. I use data from 32 general acute care hospitals in Los Angeles County, CA from 2011–2019 and find the average item list price on chargemasters to be $2,401, with an annual growth rate of 2.95%. The data show three important trends. First, hospital prices are rising annually. Second, there is significant variation in prices between hospitals in the same geographic area. Third, there is significant variation in prices between types of goods and services provided by the hospitals. These findings are generally consistent with other research on this topic and help corroborate previous work.

The remainder of the paper is outlined as follows. Section II reviews price transparency policies and their potential value to patients and researchers. Section III explores the role of hospital list prices, including arguments for and against their importance and relevance. Section IV provides details on the data, methods, and results of an empirical analysis of hospital list prices. Section V discusses the main findings in the context of previous work on this topic. Section VI concludes.

II. Price Transparency

Historically, hospital prices in the U.S. have been extremely opaque. Until recently, it was quite difficult for patients to obtain access to any given hospital's list of prices, called a chargemaster. For many years, hospital's prices have been considered proprietary information. However, the recognition of the lack of price transparency has prompted some recent rules aimed at increasing price transparency at hospitals. Starting in 2015, hospitals were required to furnish a list of prices to the public upon request. In 2019, hospitals were required to publish chargemaster prices online in a "machine-readable" format. Most recently, an executive order signed by President Trump in June 2019, will require more significant price transparency, including publishing a list of "standard charges," which includes gross charges, discounted cash price, payer-specific negotiated charges, and de-identified minimum and maximum negotiated charges. Additionally, hospitals will be required to publish a list of at least 300 "shoppable services," meaning services that can be scheduled in advance, in a "consumer-friendly manner" (CMS Fact sheet, 2019). These newest requirements will be implemented at the

beginning of 2021, and they take much larger strides toward price transparency than previous requirements.

Increased prevalence of high deductible health insurance plans mean that patients are responsible for paying for more of their healthcare upfront. This trend may be making patients more price-sensitive to hospital visits, resulting in more demand for the ability to price shop. With a greater degree of price transparency, patients may be better able to control healthcare spending. Patients who could price shop for healthcare services would presumably be better off and would also put a degree of market pressure on hospitals to compete in prices. This would ideally result in lower prices. In practice, price transparency in hospitals may not have as strong of an effect as it does in other industries for several reasons. First, it's hard to shop for prices when you don't know what exactly you are purchasing beforehand. Patients with little medical knowledge may not fully understand the details of the services they consume, which makes it hard to know how much they should expect to pay. Even patients with some medical experience will be confused at the bill they receive after a hospital stay, containing line item prices with indecipherable codes and descriptions (Anderson, 2007). Second, patients will find that because of a lack of standardization in chargemasters, comparing prices between hospitals is virtually impossible. What is called one thing at one hospital is called another thing at another, and item codes are created and maintained by individual hospitals or hospital systems. Third, different people pay very different prices for hospital services, depending on their insurance. The list price does not tell an individual how much they will pay since that is largely dependent on their health insurance plan. This adds another layer of opacity to prices that makes it difficult to shop around for the lowest price.

Fourth, many hospital visits are the result of an emergency. In such cases, a patient is often taken to the nearest hospital, either by an ambulance or a family member. In these cases, there is no time to consider price comparisons or drive to a cheaper hospital that is farther away.

Price transparency in the form of list prices has been criticized for many of the reasons listed above. However, I would argue that while it is somewhat unclear what information or benefits price transparency will provide to patients, the recent focus on price transparency has increased access to hospital prices, which presents an opportunity to find answers to basic questions about hospital prices by examining the raw pricing data. The usefulness of the information from this analysis hinges on the assumption that hospital prices are meaningful. The following section explores this assumption in more detail.

III. The Role of List Prices

The literature on raw hospital pricing data is sparse. Part of the reason for this paucity is the inaccessibility of the data in the recent past. However, it could also be due to the argument that hospital list prices simply don't matter that much. Hospital administrators claim that they are mainly used for negotiation and that no one actually pays those prices (Brown, 2014). Medicare and Medicaid reimbursements are not directly based on chargemaster prices, and private insurers negotiate directly with hospitals to achieve very low rates for their customers. The uninsured sometimes, but not always, receive free or discounted care. It has also been argued that list prices are set arbitrarily

with no systematic methodology and do not convey any useful information. Even those setting the prices have said as much (Reinhardt, 2006).

However, there are many reasons to believe that hospital list prices are important, and that an analysis of list prices may reveal useful information. For example, hospital list prices have risen dramatically in recent years and will likely continue rising. This upward trend in hospital list price has arguably had an impact on the high cost of healthcare in the United States. The proportion of the United States' annual GDP accounting for healthcare has risen from 5% in 1960 to about 18% in 2018 (CMS Historical, 2019). It has been argued that the price of hospital care, drugs, and medical devices produced most of the increase in healthcare's share of GDP over the last decade (Nation III, 2016). Anderson (2007) documented the rise in charge-to-cost ratios for hospitals from 1984–2004 and found that the average charge-to-cost ratio rose from 1.35 in 1984 to 3.07 in 2004. Bai and Anderson (2015) found that the average U.S. hospital charged 3.4 times Medicare-allowable cost. The fifty most expensive hospitals had an average charge-to-cost ratio of 10.1, a markup of more than 1000%. This trend should also be readily visible in chargemaster data and may help provide some idea of how much list prices have risen and how they have changed over time.

Another reason list prices matter is that they affect certain types of patients more than others. High hospital list prices have been condemned by many for their effects on those who are often charged the list price. "Self-pay" patients include the uninsured, international visitors, the insured whose insurer does not contract with the hospital, and those covered by car insurance or workers' compensation plans (Anderson, 2007). The unfortunate, and probably unintended, consequence of the way hospitals set prices is that

those least able to pay for healthcare are the ones who are often charged the most (Brown, 2014). While many hospitals do provide free care to the extremely poor, it's not uncommon that the uninsured are charged astronomical amounts of money for needed healthcare. Many hospitals use aggressive debt collection methods which can result in serious difficulties for those who cannot afford to pay hospital bills (Reinhardt, 2006). Policies like California's Hospital Fair Pricing Act of 2006 have proven effective in protecting the uninsured from this type of price gouging by hospitals (Bai, 2015).

Reasons why self-pay patients are charged such high prices include the fact that some insurance agreements contain "most favored nation" clauses that require the hospital to give the insurer the lowest price charged to any other party (Nation III, 2016). Thus, if hospitals lower prices for the uninsured, they must also lower rates for private insurers, which would be too costly. More obviously, hospitals simply make more money by charging the uninsured higher prices. While many of the uninsured can't and don't pay their outrageous hospital bills, some do. From the hospital's perspective, something is better than nothing.

Hospital list prices also appear to have pervasive effects on overall healthcare prices. Nation III (2016) and Brown (2014) have argued that higher list prices lead to higher overall healthcare prices and end up hurting everyone. Since our taxes pay for Medicare and Medicaid and private health insurers pass along higher charges to their customers, any increase in hospital list price means everyone pays more for healthcare. High list prices also create barriers to entry for new insurance plans. Since hospitals' high list prices are the starting point in negotiations with private insurers, small insurers with less clout have trouble negotiating down from those prices with large hospitals.

Finally, there is clear evidence that hospitals use list prices to maximize revenues. Using data from California hospitals, Batty and Ippolito (2017) found that a one-dollar increase in list price raised the amount paid by the privately insured by about 15 cents. Prior to California's Hospital Fair Pricing Act, a one-dollar increase in list price had a large effect on the prices the uninsured paid but no effect thereafter, demonstrating that the act was effective in dramatically lowering the prices paid by the uninsured in California. It also showed that list prices do have an effect on the uninsured in the absence of such a law, which is the case in many other states. Similarly, Bai and Anderson (2016) found that a one-unit increase in the charge-to-cost ratio resulted in $64 more in patient care revenue per adjusted discharge.

The evidence indicates that list prices have an impact on patients, hospitals, and our healthcare system. This conclusion supports an analysis of raw list prices for trends across hospitals and over time. The empirical work focusing on hospital prices that does exist typically focuses on charge-to-cost ratios. While these ratios are informative about the overall list prices relative to Medicare-allowable costs, they do not provide much detail about the way individual hospital procedures are priced over time. Since the "cost" in charge-to-cost ratios are actually Medicare-allowable costs, which are the government's best estimate at the cost of items and services, the ratio may be somewhat misleading. This would be particularly important if there were reason to believe that Medicare-allowable costs are systematically inaccurate. Estimates of Medicare reimbursements show that payments to hospitals are not covering costs. The American Hospital Association estimates that only 87 cents were paid for every dollar spent caring for Medicare patients in 2018 (AHA Fact Sheet, 2020). This indicates that Medicare-

allowable costs are too low relative to actual costs. Raw prices do not have to be interpreted as a function of any government estimation techniques.

IV. Empirical findings

Since the list prices in hospital chargemasters have effects on our healthcare system, it's important to see what they can tell us, which begins with visualizing the data at its most basic level. Due to new price transparency rules, we have much more chargemaster data at our fingertips than ever before. Unfortunately, because hospital prices haven't been public for very long, longitudinal analysis is difficult. California hospitals, however, have been required to post chargemaster data in a central, publicly accessible database since 2011. To get an idea of how the raw list prices have changed over time, how prices vary between hospitals in the same geographic area, and how prices vary by procedural category, I analyzed list prices from a set of 32 hospitals in Los Angeles County over the years 2011–2019. Data, methods, and results are discussed in more detail below.

Data

Data for this analysis was obtained from the website of California's Office of Statewide Health Planning and Development (OSHPD). This website contains downloadable documents, mostly in excel format, containing hospital pricing data for each hospital in California from 2011–2019. A list of about 80 hospitals with similar desirable characteristics was identified. This list included hospitals in Los Angeles County that had at least basic emergency services and were licensed as general acute care

hospitals. Limiting the data this way allowed me to identify the type of hospitals that provide general healthcare, including some emergency services, as opposed to other types of hospitals like psychiatric or specialty hospitals. I was mainly interested in this subset of hospitals because the results are most applicable to the general public, who use general acute care hospitals more frequently than other hospitals. I chose Los Angeles County for the sake of generalizability because it offered a large, diverse county with a good mix of hospital size and location. Though the sample is small, the proportions of hospital ownership types are comparable to national proportions. About 67% of hospitals in this sample are nonprofit, 28% for-profit, and 6% government. National proportions are 57%, 25%, and 19%, respectively. Additionally, 81% of hospitals in this sample are system affiliated, while the national figure is 67%. The average number of beds per hospital in this sample is 317, with a corresponding 152 per hospital nationally (AHA Fast Facts, 2020). Considering how densely populated LA County is, it's not surprising that the hospitals in this sample are larger than the national average. Results may be best applied to other large metropolitan areas. Notwithstanding, there are a number of smaller community hospitals in the sample, and given the similarities in other characteristics to the national averages, this sample seems to be reasonably representative. Table 1 provides summary statistics of the data, which shows the distribution of prices in each year. There is a clear increase in mean price annually.

Methods

Since one potentially valuable contribution from this work is to give an example of how to use chargemaster data, I'll describe my analytic methods in some detail.

Working with the data proved quite challenging because of the heterogeneity in chargemaster prices, formats, and availability. I started by obtaining chargemaster data for each year between 2011 and 2019 for each hospital in my list. Using Python's Pandas library, I merged spreadsheets for each year together. A sample of the Python code is given in the appendix. There was significant variation in the format and data provided between years even at the same hospital. In order to consistently obtain prices for the same procedure over the nine-year time period, I used an 'inner' merge, which gave the results of an intersection of keys from both dataframes. The key used was a unique procedure code, if available. Merging on procedure codes gave accurate results that were fairly stable, as long as the codes didn't change at some point on the timeline. That was, unfortunately, often the case. This required merging two separate dataframes, one with prices before the change, and one with prices after, and then merging the two dataframes on the procedure description, which was not nearly as stable as the procedure code. This often resulted in the loss of much data, although there is no reason to believe that the procedures that survived are systematically different than the ones that were lost. There were also cases where a hospital did not give a procedure code, which necessitated merging on procedure descriptions. Some hospitals had missing chargemasters for certain years. Those hospitals were dropped from the sample to ensure that hospitals in the sample had complete data across the time period. Notably, in the vast majority of cases where a year of data was missing, it was 2017. There may have been an issue in data collection or storage in the database that year. Besides missing years of data, there were some files that were uploaded as protected .xls files, which were not editable without a password. Working with such files was impossible since they had to be altered in order to

merge them. Starting with 78 possible hospitals in the sample, adequate data was obtained for 32 of them. Again, there is no reason to believe that the process of elimination produced any sort of bias in the data since the reasons for being unable to collect some data were essentially random.

Data for each hospital was appended together in Stata to get a final data set representing 32 hospitals, with prices for 103,570 total procedures from 2011–2019. There was a huge amount of variability in prices for procedures across the years. For example, a procedure that cost $350 from 2011–2014 might suddenly fall to one cent in 2015 and return to the earlier price in 2016. This wild fluctuation was at least partially due to coding error on their part or mine, so I cleaned the data set by dropping procedures with prices less than one dollar in any year. I also created a series of variables that gave the percentage change in price between each year for each procedure in the data set. Large positive fluctuations in price were eliminated by dropping outliers, which for most years occurred above 35 (3,500% increase in price). Variation of percentage change in price in the negative direction was significantly lower since the smallest negative percentage change possible is -1. This modification of the data produces more reasonable and realistic trends and only resulted in the elimination of 1,904 observations from the data set. It is unlikely that this process resulted in the introduction of any systematic bias in the data.

In addition to exploring trends in prices across hospitals and across time, it is also informative to examine trends across different types of procedures. To explore this variation, three subsamples of hospital procedures were identified using the procedure descriptions, including imaging-related items, room-related items, and surgery-related

items. As explained previously, the descriptions are not very descriptive and there is no standardization between hospitals. This made it difficult to accurately identify individual procedures relevant to the subsample of interest. As such, there is no guarantee that the identified subsamples include all relevant procedures in the total sample, nor that each procedure included in a subsample was relevant to the subsample. Despite these concerns, manually cleaning the data produced subsamples of relevant procedures with sufficient accuracy for a rough comparison of average trends.

Results

Table 2 provides a summary of the price trends over time and by procedure category. The average price of a procedure in this sample of hospitals from 2011–2019 is $2,104. The average annual percentage change in price over this time period is 2.95%. Looking at averages shows a surprisingly stable trend in hospital list prices over this time period for hospitals in the sample, especially considering that the average annual inflation rate over this same time period was 1.61% per year (Webster). The literature and news reports paint a much more radical picture of hospital list prices than this evidence supports. One possible explanation for this difference is that hospitals are almost certainly pricing certain groups of procedures strategically higher, while keeping others constant or even decreasing. They may average out to a modest overall increase while the prices for things patients frequently use are higher. As explored in the next section, imaging is one of the most overcharged departments in California hospitals. Imaging charges, along with room-related and surgery-related charges are compared in Table 2. The average price for an imaging procedure during this time period is $3,936, almost

twice as high as the average of all procedures. The average annual percentage change in price is 5.02%, about two percentage points higher than all procedures. Room- and surgery-related charges had average prices of $2,907 and $2,697 and average annual percentage change in price of 4.96% and 3.99%, respectively. Figure 1 provides a visualization of prices for these subsamples, as well as all prices, from 2011–2019.

Results for an analysis of average prices between hospitals in this sample is presented in Table 4. Average prices at each hospital in this sample must be interpreted with caution because of variation in the proportion of chargemaster prices obtained from each hospital. However, it is clear that there is significant variation between hospitals, which would be expected to be somewhat similar due to similarities in geography and populations served.

V. Discussion

The results of this analysis reveal three trends that are worth exploring. First, hospital list prices are rising on an annual basis, though the data suggest it is a modest rate of growth. Some of the most important reasons for this growth explored in other research are cost-shifting, increasing market power of hospitals, anchoring for price negotiations, and taking advantage of Medicare reimbursement policies.

Cost-shifting is one of the major theories put forth by hospital administrators and economists alike as to why prices have been rising so dramatically. The basic idea is that because hospitals don't get enough money from public insurers to cover their costs, they must raise prices for those who still pay based on list price to make up the difference. This theory casts the hospitals as victims of powerful public bullies who simply pay too

little for the hospital to remain solvent. The hospitals have no option but to raise list prices for everyone else if they want to stay in business. There is varying support for the theory of cost-shifting. Tompkins et al. (2006) found that, "more competitive urban areas and markets with higher managed care penetration require higher markup policies to realize similar net revenues," which would support the idea of cost-shifting. As previously discussed, estimates of the Medicare and Medicaid reimbursements show that these payments to hospitals have not covered costs. On the other hand, it has been found that hospitals facing reimbursement cuts lower costs rather than cost-shift, which provides some evidence against the theory (Brown, 2014). A review of the literature on cost-shifting by Frakt (2011) suggests only modest evidence for cost-shifting.

In contrast to the premise of the cost-shifting argument, it has been argued that hospitals, not insurers, are "…the most powerful players in the healthcare system" (Nation III, 2016). From this perspective, powerful hospitals have all the negotiating power with insurers and can charge insurers high rates because they are a "must-have" hospital (i.e. the insurer's network is much more valuable with that hospital in its network). Hospital market power is the major predictor of high list prices, and large, powerful hospitals are compared to monopolists whose prices rise because of a failure of market competition. Hospitals have been gaining more market power recently through consolidation, which, combined with the breakdown of market forces on hospital prices, has contributed to the skyrocketing list price of healthcare (Brown, 2014; Nation III, 2016).

List prices also serve as a starting point for negotiations with private insurers. Hospitals can use inflated prices as an anchor during negotiations with private insurers to

obtain a higher rate for those patients. Raising prices for the privately insured has been shown to increase the amount of revenue obtained from these patients (Batty & Ippolito, 2017).

Finally, Medicare historically paid "outlier" payments for unusually expensive or resource intensive procedures. There was a threshold for reaching those extra payments that was based, at least in part, on the list price. Thus, hospitals that had hugely inflated list prices could more quickly hit that threshold and get extra reimbursements from the government (Brown, 2014).

The second trend that the data reveal is that hospitals in the same county have different average prices, with some significant variation. In general, variation in prices at different hospitals have been attributed to several different hospital characteristics. Bai and Anderson (2016) analyzed charge-to-cost ratios by different hospital characteristics. The average hospital in their sample had a charge-to-cost ratio of 4.32. Government hospitals had a ratio of 3.47, non-profits had a ratio of 3.79, and for-profit hospitals had a ratio of 6.31. This presents very strong evidence that for-profit hospitals tend to have much higher prices. They also found that hospitals with a higher proportion of uninsured patients had a higher charge-to-cost ratio, which they took to mean that hospitals were taking advantage of the uninsured by price gouging them. Alternatively, this result could be interpreted as evidence that hospitals that have to give more charity care must raise prices to cover the cost. System affiliated hospitals and hospitals with regional market power had higher charge-to-cost ratios.

The factors affecting charge-to-cost ratios also appear to explain some of the variation in this sample of hospitals in LA County. For example, larger hospitals tend to

be more expensive. However, there are a few inconsistencies. For-profit hospitals actually tended to have a lower price in this sample. This is likely due to variation in this small sample and the fact that for-profit hospitals in this sample tended to be smaller. Being part of a hospital system was negatively correlated with price. This inconsistency can also be explained through a negative correlation with size and a positive correlation with for-profit status. Correlations between price, size, ownership type, and system affiliation for hospitals in this sample can be seen in Table 3. A larger sample would likely reveal effects similar to those discovered in Bai and Anderson (2016).

The third trend in the results is the stark difference in prices between groups of procedures. Bai and Anderson (2016) found that charge-to-cost ratios varied significantly between a single hospital's departments. Imaging procedures like CT (28.5) and MRI (13.6) were among the departments with the highest charge-to-cost ratios. Consistent with their findings, the data in this sample of California hospitals shows that imaging procedures do have significantly higher average prices, about double the price of all procedures. The average annual growth rate was 2 percentage points (40%) higher than all prices. Room-related and surgery-related charges similarly had higher average prices and higher growth rates than all prices combined. Reasons for this difference in prices across departments could include the cost (and growth rate of costs) of providing these services. It could also be the result of strategic pricing policies to extract more revenue from certain payers. More work must be done to understand variation in prices at this level.

VI. Conclusion

Recent efforts at increasing price transparency in hospitals have led to better access to hospital chargemasters. This information may not yet be useful to consumers, but it does allow for analysis of list prices. Chargemasters contain important information for consumers and our healthcare system, despite dissatisfying arguments to the contrary. Rising chargemaster prices may be contributing to overall higher prices for healthcare, and have particularly devastating effects on certain payers. List prices are also used by hospitals to maximize revenues. The data in this sample of 32 hospitals in LA County reveal three trends. First, hospital prices are rising annually at a modest average rate. Second, hospital prices vary significantly between hospitals, even in the same geographical area. Third, the growth rate of prices varies by type of procedure. These trends are likely similar in other areas of the country, especially those with a similar composition to LA County. Information obtained from chargemasters is particularly policy relevant right now, in this era of healthcare reform. In the near future, even more data on hospital prices will be available, opening up many more opportunities to better understand the inefficiencies and failures of this system.

References

AHA. (2020, January). *Fact sheet: Underpayment by Medicare and Medicaid: AHA.* Retrieved from https://www.aha.org/fact-sheets/2020-01-07-fact-sheet-underpayment-medicare-and-medicaid

AHA. (2020). *Fast facts on U.S. hospitals, 2020: AHA.* Retrieved from https://www.aha.org/statistics/fast-facts-us-hospitals

Anderson, G. F. (2007). From 'soak the rich' to 'soak the poor': Recent trends in hospital pricing. *Health Affairs, 26*(3), 780-789. https://doi.org/10.1377/hlthaff.26.3.780

Bai, G., & Anderson, G. F. (2015). Extreme markup: The fifty US hospitals with the highest charge-to-cost ratios. *Health Affairs, 34*(6), 922-928. https://doi.org/10.1377/hlthaff.2014.1414

Bai, G., & Anderson, G. F. (2016). US hospitals are still using chargemaster markups to maximize revenues. *Health Affairs, 35*(9), 1658-1664. https://doi.org/10.1377/hlthaff.2016.0093

Bai, G. (2015). California's hospital fair pricing act reduced the prices actually paid by uninsured patients. *Health Affairs (Project Hope), 34*(1), 64-70. https://doi.org/10.1377/hlthaff.2014.1072

Batty, M., & Ippolito, B. (2017). Mystery of the chargemaster: Examining the role of hospital list prices in what patients actually pay. *Health Affairs, 36*(4), 689-696. https://doi.org/10.1377/hlthaff.2016.0986

Brill, S. (2013, April). Bitter pill: Why medical bills are killing us. *Time*. Retrieved January 20, 2020, from https://time.com/198/bitter-pill-why-medical-bills-are-killing-us/

Brown, E. C. F. (2014). Irrational hospital pricing. *Houston Journal of Health Law & Policy*, 11-58.

CMS. (2019, November 15). *Fact sheet CY 2020 Hospital Outpatient Prospective Payment System (OPPS) policy changes: Hospital price transparency requirements (CMS-1717-F2).* Retrieved January 22, 2020, from https://www.cms.gov/newsroom/fact-sheets/cy-2020-hospital-outpatient-prospective-payment-system-opps-policy-changes-hospital-price

CMS. (2019, December 17). *Historical*. Retrieved January 20, 2020, from https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical

Frakt, A. B. (2011). How much do hospitals cost shift? A review of the evidence. *The Milbank Quarterly, 89*(1), 90-130. https://doi.org/10.1111/j.1468-0009.2011.00621.x

Nation, G. A. III. (2016). Hospital chargemaster insanity: Heeling the healers. *Pepperdine Law Review*, (3), 745-784.

OSHPD. (n.d.). *Hospital chargemasters*. Retrieved September 1, 2019, from https://oshpd.ca.gov/data-and-reports/cost-transparency/hospital-chargemasters/

Reinhardt, U. E. (2006). The pricing of US hospital services: Chaos behind a veil of secrecy. *Health Affairs, 25*(1), 57-69. https://doi.org/10.1377/hlthaff.25.1.57

Tompkins, C. P., Altman, S. H., & Eilat, E. (2006). The precarious pricing system for hospital services. *Health Affairs, 25*(1), 45-56. https://doi.org/10.1377/hlthaff.25.1.45

Webster, I. (n.d.). *Inflation rate between 2011-2019: Inflation calculator*. Retrieved January 20, 2020, from https://www.officialdata.org/2011-dollars-in-2019?amount=98

Appendix

Table 1: Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
price2011	101,666	1871.83	6142.29	1	315000
price2012	101,666	1939.37	6341.46	1	315000
price2013	101,666	2011.35	6682.96	1	371700
price2014	101,666	2034.09	6786.49	1	446040
price2015	101,666	2085.92	7105.39	1	459421
price2016	101,666	2137.32	7289.09	1	491581
price2017	101,666	2208.36	7540.68	1	546146
price2018	101,666	2287.12	7764.82	1	573453
price2019	101,666	2360.66	7985.42	1	584923

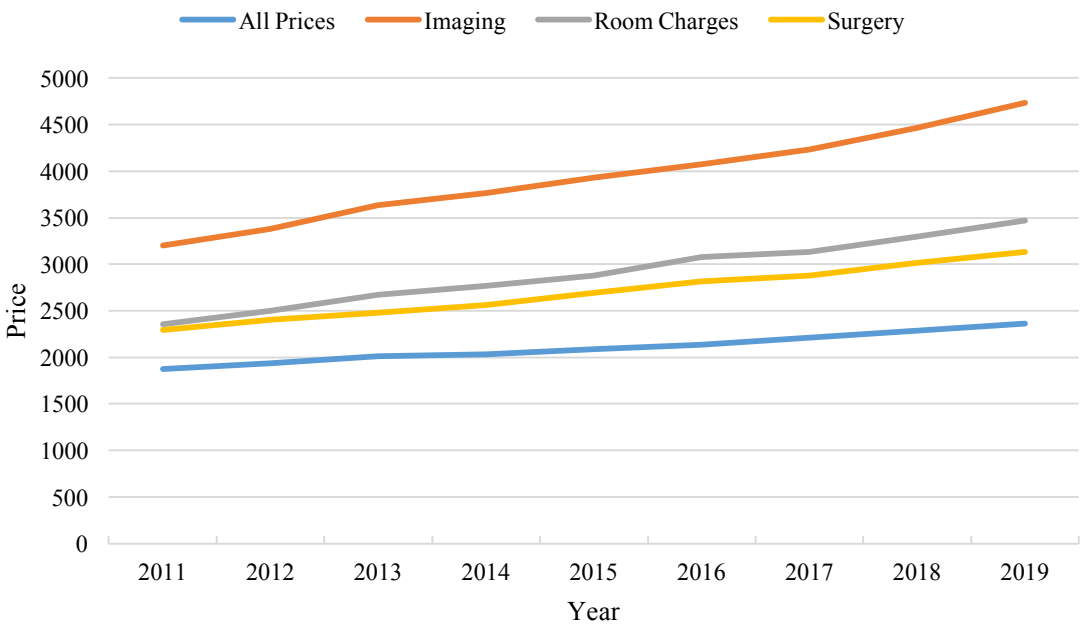
Notes: This table shows descriptive statistics for the data used in the analysis of hospital prices. There are balanced observations across each year of pricing data. The mean price clearly increases annually, as well as the standard deviation, demonstrating a rise over time of prices and price variability. The min price is $1 in every year as a result of cleaning procedures and the max price rises annually with the exception of 2011–2012.

Table 2: Annual Price Trends by Procedure Category

	All prices		Imaging		Room Charges		Surgery	
Year	Price	% Change	Price	% Change	Price	% Change	Price	% Change
2011	$1,871.83		$3,202.72		$2,357.53		$2,293.64	
2012	$1,939.37	3.61%	$3,379.55	5.52%	$2,501.74	6.12%	$2,403.41	4.79%
2013	$2,011.35	3.71%	$3,637.47	7.63%	$2,673.41	6.86%	$2,478.51	3.12%
2014	$2,034.09	1.13%	$3,763.48	3.46%	$2,771.13	3.66%	$2,564.93	3.49%
2015	$2,085.92	2.55%	$3,930.36	4.43%	$2,880.14	3.93%	$2,690.87	4.91%
2016	$2,137.32	2.46%	$4,077.27	3.74%	$3,074.78	6.76%	$2,817.19	4.69%
2017	$2,208.36	3.32%	$4,231.32	3.78%	$3,131.54	1.85%	$2,875.62	2.07%
2018	$2,287.12	3.57%	$4,464.11	5.50%	$3,300.14	5.38%	$3,016.98	4.92%
2019	$2,360.66	3.22%	$4,735.66	6.08%	$3,468.84	5.11%	$3,134.69	3.90%
Mean	$2,104.00	2.95%	$3,935.77	5.02%	$2,906.58	4.96%	$2,697.32	3.99%

Notes: Average prices by year and procedure type are shown, as well as the accompanying annual percent change in price. Averages of prices and percent change for all years are given in the bottom row. The average price for all procedures in the sample was $2,104 with an average annual percent change in price of 2.95%. Imaging, room charges, and surgery related charges all had higher average annual prices and growth rates of prices.

Figure 1: Hospital Price Trends by Type of Procedure



Notes: This figure is a visual representation of the data contained in Table 2. All four sets of procedures have similar trend lines, demonstrating a similar growth pattern over time. Imaging has the highest price level, and all prices have the lowest.

Table 3: Hospital Characteristic Correlations

	Price	For-profit	Beds	Chain
Price	1			
For-profit	-0.2904	1		
Beds	0.7212	-0.4126	1	
Chain	-0.1069	0.3005	-0.2252	1

Notes: This table shows simple correlations for several hospital characteristics. In this sample, price and number of beds in the hospital are positively correlated. However, price and for-profit status are negatively correlated, probably due to the negative correlation between for-profit and number of beds.

Table 4: Prices by Hospital

Hospital Name	Average Price	Hospital Name	Average Price
Antelope Valley Hospital	$2,944.06	Kaiser Foundation Hospital West Los Angeles	$2,184.89
Beverly Hospital	$606.59	Los Angeles Community Hospital	$398.99
Cedars Sinai Medical Center	$4,904.48	Lakewood Regional Medical Center	$2,475.41
Centinela Hospital Medical Center	$2,167.65	Methodist Hospital of Southern California	$2,658.05
Citrus Valley Medical Center - QV Campus	$1,084.70	Monterey Park Hospital	$1,912.99
Encino Hospital Medical Center	$875.02	Pomona Valley Hospital Medical Center	$1,281.22
Foothill Presbyterian Hospital - Johnston Memorial	$563.63	Ronald Reagan UCLA Medical Center	$405.69
Adventist Health Glendale	$2,501.90	San Dimas Community Hospital	$921.35
Glendora Community Hospital	$689.86	San Gabriel Valley Medical Center	$1,374.80
Good Samaritan Hospital - Los Angeles	$1,598.86	St. Mary Medical Center	$2,768.84
Huntington Memorial Hospital	$3,628.98	St. Francis Medical Center	$1,672.96
Kaiser Foundation Hospital Baldwin Park	$2,184.89	St. Vincent Medical Center	$2,383.75
Kaiser Foundation Hospital Downey	$2,184.89	Valley Presbyterian Hospital	$1,139.61
Kaiser Foundation Hospital Los Angeles	$2,184.89	USC Verdugo Hills Hospital	$624.74
Kaiser Foundation Hospital Panorama City	$2,184.89	Adventist Health White Memorial	$2,873.15
Kaiser Foundation Hospital South Bay	$2,184.89	Whittier Hospital Medical Center	$507.94

Notes: This table provides average prices for each hospital in the sample over the time period 2011–2019. All hospitals in the sample are general acute care hospitals in LA County. Prices range from $4904.48 to $398.99.

Sample Python Code

```
#Read in data
CH2011 = pd.read_excel('106190240_CDM_All_2011.xls', sheet_name='CDM',
usecols={'Code', 'Description', 'Price'})
CH2012 = pd.read_excel('106190240_CDM_All_2012.xls', sheet_name='CDM',
usecols={'Code', 'Price'})
CH2013 = pd.read_excel('106190240_CDM_ALL_2013.xls', sheet_name='CDM',
usecols={'Code', 'Price'})
CH2014 = pd.read_excel('106190240_CDM_All_2014.xls', sheet_name='CDM',
usecols={'Code', 'Price'})
CH2015 = pd.read_excel('106190240_CDM_All_2015.xls.xls',
sheet_name='CDM', usecols={'Code', 'Price'})
CH2016 = pd.read_excel('106190240_CDM_All_2016.xls', sheet_name='CDM',
usecols={'Code', 'Price'})
CH2017 = pd.read_excel('106190240_CDM_All_2017.xlsx', sheet_name='CDM',
usecols={'Code', 'Price'})
CH2018 = pd.read_excel('106190240_CDM_All_2018.xlsx', sheet_name='CDM',
usecols={'Code', 'Price'})
CH2019 = pd.read_excel('106190240_CDM_All_2019.xlsx', sheet_name='CDM',
usecols={'Code', 'Price'})

#Format, clean, and merge dataframes
year=2011
hospitals = [CH2011, CH2012, CH2013, CH2014, CH2015, CH2016, CH2017,
CH2018, CH2019]
for x in hospitals:
    x.rename(columns={'Price': year}, inplace=True)
    x.dropna(inplace=True)
    x.set_index('Code', inplace=True)
    dup_idx = x.index[x.index.duplicated()].unique()
    x.drop(index=dup_idx, inplace=True)
    year = year+1
CH_CDM = CH2011.merge(CH2012, left_index=True, right_index=True)
hospitals = [CH2013, CH2014, CH2015, CH2016, CH2017, CH2018, CH2019]
for x in hospitals:
    CH_CDM = CH_CDM.merge(x, left_index=True, right_index=True)
CH_CDM.head()
CH_CDM.to_csv(r'/pathway/Hospital_Name.csv)
```