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Uncovering the interhospital price variations for vasectomies in the United States

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Due to the historic lack of transparency in healthcare pricing in the United States, the degree of price variation for vasectomy is largely unknown. Our study aims to assess characteristics of hospitals reporting prices for vasectomy as well as price variation associated with hospital factors and insurance status. A cross-sectional analysis was performed in October, 2022 using the Turquoise Database which compiles publicly available hospital pricing data. The database was queried for vasectomy prices to identify the cash (paid by patients not using insurance), commercial (negotiated by private insurers) and Medicare and Medicaid prices for vasectomies. Hospital characteristics of those that reported a price for vasectomy and those that did not were compared and pricing differences based on hospital ownership and reimbursement source were determined using multivariable linear regression analysis. Overall, only 24.7% (1657/6700) of hospitals reported a price for vasectomy. Those that reported a price had more beds (median 117 vs 80, $p < 0.001$), more physicians (median 1745 vs 1275, $p < 0.001$). They were also more likely to be nonprofit hospitals (77% vs 14%, $p < 0.001$) and to be in well-resourced areas (ADI 91.7 vs 94.4, $p < 0.001$). Both commercial prices and cash prices for vasectomy were lower at nonprofit hospitals than at for-profit hospitals (commercial: \$1959.47 vs \$2861.56, $p < 0.001$; cash: \$1429.74 vs \$3185.37, $p < 0.001$). Our study highlights the current state of pricing transparency for vasectomy in the United States. Patients may be counseled to consider seeking vasectomy at a nonprofit hospital to reduce their costs, especially when paying with cash. These findings also suggest a need for new policies to target areas with decreased price transparency to reduce price disparities.

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INTRODUCTION

Vasectomy is a common and effective method of permanent contraception in men, with approximately 527,476 performed annually in the United States (US) [1]. Since the overturning of the landmark case *Roe vs. Wade*, there has been growing public interest in contraception with vasectomy receiving heightened attention [2, 3]. However, despite its popularity, there is little to no transparency in the prices patients see and pay when seeking affordable permanent contraception options in the US. The extent of interhospital price variation of vasectomy and the factors contributing to these price discrepancies are therefore largely unknown. This lack of price transparency leaves room for price gouging and other anti-competitive behaviors, which can drive up healthcare costs. Existing studies have shown the US has the highest healthcare expenditure per capita among the 38 Organisation for Economic Co-operation and Development (OECD) member countries with the largest spending differential being the high price Americans pay for healthcare products and services [4, 5].

To address this issue, the Centers for Medicare & Medicaid Services (CMS) implemented the Hospital Price Transparency Regulation (45 CFR §180.50) on January 1, 2021. Under this CMS final rule, hospitals in the US are required to disclose the

undiscounted gross charge and the payer-specific price information for a minimum of 300 common shoppable services that can be scheduled by healthcare consumers in advance. In this study, we focus on the prices paid by vasectomy patients which can include the out-of-pocket cash price, the commercial price through a private insurance, as well as prices for Medicare and Medicaid if they are utilized. While vasectomy is not one of the 70 services that require mandatory price reporting, it falls under the category of shoppable services for which hospitals can choose to provide price information [6]. This regulation aims to improve public visibility of health service prices, thus increasing price competition and reducing the high cost of healthcare. Several recent studies have used the Turquoise Health Database, which contains publicly available prices from reporting hospitals in compliance with the CMS final rule, to uncover variation in prices of common medical procedures and services [7–11]. For example, a prior study found that a colonoscopy can range from \$44 to \$27,679 with the high-pricing hospitals billing at least 4.6 times the national average Medicare reimbursement rate [12].

To date, pricing of vasectomy has not been evaluated in a transparent manner. The purpose of this study is to identify price discrepancies for vasectomies across US hospitals. Additionally, we will characterize interhospital price variations based on

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reimbursement sources and investigate hospital-level factors that drive these differences, such as hospital ownership structures. We will also determine predictors behind the hospital's reporting pattern for vasectomy. We hypothesize that there is a significant variation in the prices charged for vasectomy across US hospitals.

MATERIAL AND METHODS

Study sample and data acquisition

This study follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) reporting guidelines (<https://www.strobe-statement.org/>). Institutional review board approval and informed consent were not required as the study did not involve human subject research. All data were reported in aggregates.

We conducted a nationwide, cross-sectional analysis of hospital pricing data for vasectomy procedures identified by the *Current Procedural Terminology* (CPT) code 55250. The healthcare pricing data was obtained on October 7, 2022, from Turquoise Health, a data service company which maintains a database sourcing publicly disclosed machine-readable files from 6700 US hospitals in compliance with the CMS final rule on hospital price transparency (<https://turquoise.health/researchers>). This CMS final rule requires hospitals to disclose payer-specific negotiated charges, de-identified minimum and maximum negotiated charges, and discounted cash price for at least 300 shoppable services. Out of the 300 shoppable services, 70 are CMS-specified and 230 are hospital-selected. Hospitals must include as many shoppable services as they provide and indicate when a CMS-specified service is not offered. While vasectomy is not one of the 70 CMS-specified list of shoppable services, it is included in the dataset collected by Turquoise as one of the possible hospital-selected shoppable services [6, 13].

To examine factors that may influence reporting behavior as suggested by previous literature, we identified Hospital Service Areas (HSA) using the Dartmouth Atlas Project, determined urban versus rural hospital designations using the 2010 US Census, and extracted Area Deprivation Index (ADI) at the county level from the Neighborhood Atlas database estimates from the 2016–2020 5-year American Communities Survey via the sociome package for R [7, 14, 15]. ADI is scaled to a mean of 100 and standard deviation of 20 with higher scores indicate higher levels of deprivation.

Study variables

Prices for vasectomy were extracted from Turquoise based on reimbursement source – cash price, commercial price, Medicare price and Medicaid price. Cash price refers to the price paid by patients to hospitals in cash or cash equivalents, unilaterally determined by the hospital. Commercial price represents the amount negotiated between hospitals and the top five largest commercial insurers in the US (United Healthcare, Blue Cross Blue Shield, Aetna, Cigna, and Anthem). Medicare and Medicaid rates are set by the government to cover individuals over the age of 65 and those with low income, respectively. We used the median price for a given reimbursement source at a hospital.

In addition, we collected various hospital characteristics from Turquoise, such as hospital type, region, and compliance score that ranks completeness of information provided by hospitals to better understand factors potentially associated with higher reporting rate. Hospital size was approximated by the total number of beds and the total number of staff with a Doctor of Medicine degree across the hospital system. For urban or rural status, if the hospital location was within 'urbanized area' or 'urban cluster' based on 2010 Census, then it was considered an urban hospital, otherwise it was considered rural. We used the number of hospitals from Turquoise in each HSA as a proxy for competition level, categorized into "1," "2–10," or "11+," and used ADI to investigate potential disparities in hospital reporting patterns. Finally, hospital ownership structures were categorized into for-profit ("proprietary," "physician"), nonprofit ("non-profit," "government"), and "other/unknown" ("Tribal," missing data).

Statistical analysis

We determined the percentage of hospitals within Turquoise that reported a price for vasectomy and then utilized descriptive statistics to compare hospital-level factors between hospitals that provided price data versus those that did not. We used Mann–Whitney U tests for continuous variables and chi-square tests for categorical variables. Significance level is set at a $p < 0.05$.

Prices by payer source and hospital ownership were plotted via box plots to show variability. Average prices by payer source and ownership were calculated on the log scale and transformed back to dollars. The 95% confidence intervals for average price were calculated via bootstrap resampling with 1000 replicates.

For our multivariable linear regression, we log transformed hospital prices for vasectomy before determining whether the following hospital factors are predictors of a higher cash or commercial price: 1) number of hospitals in the HSA, 2) urban/rural location designation, 3) number of beds (0–100, 101–500, 501–1000, 1001+), 4) ADI, and 5) hospital ownership. Estimated marginal means, transformed back to the dollar scale, were calculated from the fitted models, and used to further assess price as a function of hospital ownership, adjusting for the other factors. Separate analyses were conducted for each payer source. All data analyses were performed using R (version 4.1.2).

RESULTS

Out of the 6700 hospitals identified in the Turquoise Health database, only 1657 (24.73%) reported at least one price for vasectomy. Of these, 1389 hospitals reported a commercial rate (20.73%) while 1134 hospitals reported a cash rate (16.93%). Hospitals that reported at least one price for vasectomy had more beds (median [IQR], 117 [30–295] vs 80 [30–194.5], $p < 0.001$), more doctors (1745 [437–4789] vs 1275 [224.5–3003], $p < 0.001$), and a higher compliance score (5 [4,5] vs 4 [3–5] $p < 0.001$). They were also more likely to be nonprofit (78% vs 15%, $p < 0.001$) and be in well-resourced areas (91.7 [82.5–101] vs 94.4 [84.4–103.6], $p < 0.001$). Furthermore, hospital type and regions were also associated with a difference in the reporting pattern of vasectomy prices ($p < 0.001$). Interestingly, a higher number of institutions in a HSA, which was used as a proxy for competition, is associated with a lower likelihood of providing a rate for vasectomy (2 [1–8] vs 3 [1–10], $p < 0.001$) (Table 1).

Significant variation was observed in the prices of vasectomy across hospitals based on the four different payer types (Fig. 1). This variation ranged from as low as \$124 to as high as \$14,339, with both extremes attributable to the out-of-pocket cash price that patients would incur. Compared to for-profit hospitals, nonprofit hospitals tended to have a lower average commercial price (\$1959.47 [95% CI, 1865.07–2063.13] vs \$2861.56 [95% CI, 2654.42–3081.98]), a lower cash price (\$1429.74 [95% CI, 1352.00–1513.57] vs \$3185.37 [95% CI, 2714.55–3750.83]) and a lower Medicare price (\$1169.19 [95% CI, 1113.96–1229.45] vs \$1562.15 [95% CI, 1429.38–1682.39]) for vasectomies. Among nonprofit hospitals, the lowest price reported was for Medicaid (\$769.35 [95% CI, 726.33–815.53]), followed by Medicare (\$1169.19 [95% CI, 1113.96–1229.45]), cash (\$1429.74 [95% CI, 1352.01–1513.57]), and then commercial insurers (\$1959.4 [95% CI, 1867.78–2064.35]). In for-profit institutions, the Medicaid price was lowest (\$850.22 [95% CI, 713.08–1011.36]), followed by Medicare price (\$1562.15 [95% CI, 1429.38–1682.39]), then cash (\$3185.37 [95% CI, 2714.55–3750.83]) and commercial price (\$2861.56 [95% CI, 2654.31–3088.77]), which did not differ significantly. For all other types of hospital ownership structures or missing data, the lowest price was the Medicaid price at \$1017.80 (95% CI, 864.48–1179.48).

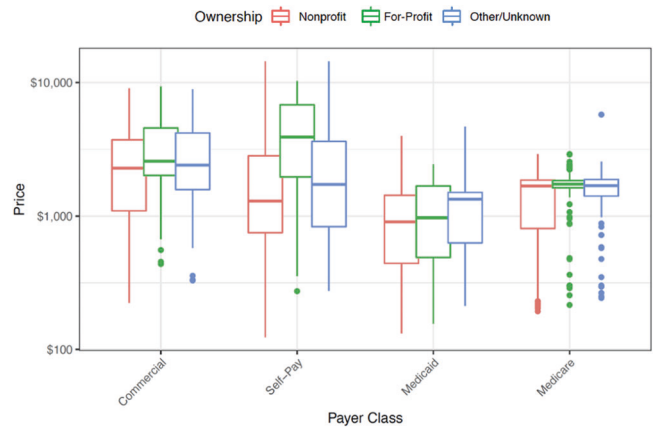
Our multivariate linear regression analysis revealed several hospital-level factors that contributed to the variation in vasectomy prices. Specifically, we found that both the commercial and cash price of vasectomy was negatively associated with ADI, such that prices were lower in more deprived areas (Tables 2 and 3). For-profit hospitals were associated with significantly higher cash prices relative to nonprofit hospitals. Translating this difference in price back to dollars gives an adjusted estimated price for for-profit hospitals of \$3011 (95% CI, 2576–3519) and for nonprofit hospitals of \$1441 (95% CI, 1361–1525). There were no consistent trends relating the number of hospitals in an HSA or the number of beds to either cash or commercial prices. Finally,

Table 1. Hospital factors impacting reporting pattern of hospitals or vasectomy.

Total observations	Did not report a price	Reported a price	P-value
	5043	1657	
Total beds			
Mean (SD)	146.2 (173.2)	201.0 (230.2)	<0.001
Median (IQR)	80.0 (30.0, 194.5)	117.0 (30.0, 295.0)	
Missing	1812	14	
Total doctors			
Mean (SD)	2948.7 (4303.8)	3438.4 (4368.2)	<0.001
Median (IQR)	1275.0 (224.5, 3003.0)	1745.0 (437.0, 4789.0)	
Missing	2201	269	
Hospital type			
Nonprofit	57% (2880)	78% (1286)	<0.001
For-profit	16% (822)	15% (253)	
Other/Unknown	27% (1341)	7.1% (118)	
Region			
Northeast	13% (657)	14% (239)	<0.001
South	43% (2158)	33% (550)	
North Central	25% (1248)	34% (563)	
West	19% (979)	18% (305)	
Puerto Rico	0.02% (1)	0% (0)	
Compliance score			
Mean (SD)	3.8 (1.2)	4.6 (0.7)	<0.001
Median (IQR)	4.0 (3.0, 5.0)	5.0 (4.0, 5.0)	
Missing	1843	32	
Hospitals in HSA			
Mean (SD)	8.4 (12.5)	7.5 (12.7)	<0.001
Median (IQR)	3.0 (1.0, 10.0)	2.0 (1.0, 8.0)	
Urban or rural status			
Rural	17% (878)	16% (269)	0.29
Urban	83% (4165)	84% (1388)	
ADI			
Mean (SD)	92.7 (17.8)	90.6 (17.6)	<0.001
Median (IQR)	94.4 (84.4, 103.6)	91.7 (82.5, 101.0)	
Reported medicare price			
Missing	0% (0)	0% (0)	<0.001
Yes	2.1% (106)	58% (964)	
No	98% (4937)	42% (693)	
Reported medicaid price			
Missing	0% (0)	0% (0)	<0.001
Yes	1.7% (84)	41% (672)	
No	98% (4959)	59% (985)	

commercial prices were significantly higher for for-profit hospitals relative to nonprofit. The estimated average commercial price, adjusted for the other variables in the model, for for-profit hospitals was \$2647 (95% CI, 2389–2932), whereas for nonprofit hospitals it was \$1991 (95% CI, 1898–2089).

After accounting for the differences in hospital size (number of beds), number of neighboring hospitals (N in HSA), urban or rural

**Fig. 1 Comparison of mean vasectomy prices.** Comparison of mean vasectomy prices based on reimbursement source and hospital ownership structures.**Table 2.** Results of multivariable model assessing hospital-level predictors for cash price variation of vasectomy.

	Beta	95% CI	p-value
(Intercept)	7.1	6.9, 7.2	<0.001
Hospitals in HSA			
1			
2–10	0.24	0.11, 0.37	<0.001
11	0.14	−0.03, 0.32	0.10
Urban or Rural			
Rural			
Urban	0.02	−0.12, 0.16	0.8
Beds			
0–100			
101–500	0.20	0.08, 0.33	0.002
501–1000	0.16	−0.06, 0.37	0.2
1001	0.16	−0.30, 0.61	0.5
Unknown	−0.33	−0.86, 0.20	0.2
ADI	−0.12	−0.17, −0.07	<0.001
Hospital type			
Nonprofit			
For-profit	0.74	0.57, 0.90	<0.001
Other/Unknown	0.21	−0.02, 0.44	0.076

Coefficients are on log scale. The coefficient for ADI is per standard deviation increase in ADI (more deprived).

location, and ADI, we found that the largest financial benefit patients will experience when using a nonprofit hospital versus a for-profit one is when they are paying out-of-pocket in cash or cash equivalents (−\$1570, SE = 244, $t(1123) = -6.44$, $P < 0.001$), rather than when they use their private insurance coverage (−\$656, SE = 148, $t(1378) = -4.44$, $p < 0.001$). This larger gap in price variation is also seen in Fig. 1.

DISCUSSION

This cross-sectional analysis of 6700 hospitals across the US found significant price variation for vasectomy procedures between different hospitals, ranging from \$124 to \$14,339. Overall, nonprofit hospitals tended to have lower prices compared to for-profit hospitals, and within nonprofit hospitals, public

Table 3. Results of multivariable model assessing hospital-level predictors for commercial price variation of vasectomy.

	Beta	95% CI	P-value
(Intercept)	7.3	7.2, 7.4	<0.001
Hospitals in HSA			
1			
2–10	0.2	0.09, 0.30	<0.001
11	0.3	0.17, 0.42	<0.001
Urban Or Rural			
Rural			
Urban	0.02	−0.10, 0.15	0.7
Beds			
0–100			
101–500	0.29	0.19, 0.40	<0.001
501–1000	0.18	0.01, 0.34	0.035
1001	0.08	−0.33, 0.49	0.7
Unknown	−0.29	−0.78, 0.20	0.2
ADI	−0.07	−0.11, −0.03	<0.001
Hospital type			
Nonprofit			
For-profit	0.28	0.17, 0.40	<0.001
Other/Unknown	0.17	0.00, 0.34	0.053

Coefficients are on the log scale. The coefficient for ADI is per standard deviation increase in ADI (more deprived).

insurance may offer better coverage than both private insurance rates and cash payments. Hospital ownership structure, hospital location and number of neighboring hospitals all contributed to the variation in prices. Hospitals reporting vasectomy prices had more beds, more doctors, higher compliance scores, and were more likely to be nonprofit and located in well-resourced areas.

Despite a daily monetary penalty imposed on noncompliant hospitals, existing studies have shown only about a quarter of the largest hospital systems in the US are fully compliant with all requirements of the CMS final rule [16]. These previous findings of poor price transparency seem to also hold true for vasectomy procedures as our study revealed that only about 25% of the hospitals in the Turquoise Health database reported a price for vasectomy. This raises concerns for the efficacy and enforcement of the CMS final rule. Notably, for-profit hospitals and hospitals in resource-deprived areas are less likely to report a price for vasectomy. In other words, patients who are already disadvantaged socioeconomically may face reduced price transparency, resulting in a disproportionately high price ceiling for vasectomy. Perhaps stricter and more standardized processes should be implemented, especially in resource-deprived areas, to increase reporting of healthcare prices and promote fair price competition.

Self-pay patients are an important yet understudied and financially vulnerable population. The 30 million individuals with no health insurance coverage and the 40% of privately insured individuals with high deductible health plans in the US are paying higher prices at for-profit hospitals for vasectomy [17, 18]. For men seeking affordable vasectomy options who have not met their deductibles, it may be less expensive for them to pay with cash or cash equivalents rather than through commercial insurance, especially at nonprofit hospitals. Similar findings of lower cash versus commercial price have been reported for other common urologic procedures [8]. Furthermore, critics of the CMS final rules argue that increased price transparency will lead to a price floor rather than a price ceiling as private insurers are already bargaining for the lowest price with hospitals. However, outcomes

of our study suggest otherwise, as cash price unilaterally determined by hospitals may be even cheaper than the bilaterally negotiated commercial price.

There are several limitations to our study that need to be considered. Foremost, vasectomy is not a CMS-specified shoppable service that must be reported. While our study commented on hospital reporting patterns, we cannot draw conclusions on hospital compliance to the CMS final rule. Secondly, hospitals that do not offer vasectomy as a service are not excluded which may result in an underestimation of hospital's reporting pattern. The generalizability of this study is limited by lack of data from the private practice sector as private practices are not subject to the CMS final rule unless they are affiliated with a hospital. In addition, there is a reporting bias for hospitals within the database. Hospitals that had a higher price or more pricing variability for vasectomy might be less willing to report and contribute data to Turquoise Health. Since for-profit hospitals were less likely to report a price, our findings might underestimate the price disparity between for-profit and nonprofit hospitals and observed prices may represent lower end of the pricing spectrum. Another limitation is the possibility of incomplete pricing information as reported prices do not include associated costs like hospital overheads, cost of anesthesia, and cost of independent practitioners [6].

Despite these limitations, our study underlines an opportunity to form new policies to increase price transparency and reduce healthcare disparities in the US. It may be important to patients to consider both hospital ownership structures and payment methods when planning their reproductive care.

CONCLUSIONS

This cross-sectional study highlights the importance of considering both hospital ownership structures and payment methods when seeking affordable vasectomy options in the US. Overall, we found significant price variations of the procedure, indicating that patients may financially benefit from choosing a nonprofit hospital to reduce costs, especially when paying with cash. Notably, paying in cash or cash equivalent may be cheaper than using private insurance at nonprofit hospitals. This information can help patients make informed decisions regarding their reproductive care. In addition, this study also revealed that hospitals that are larger, nonprofit, and in resource-rich areas are more likely to report a price for vasectomy. These findings suggest a need for new policies to target areas with decreased price transparency to reduce price disparities.

DATA AVAILABILITY

Study data will be made available to interested parties upon request to the corresponding author.

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AUTHOR CONTRIBUTIONS

All authors meet all four criteria for authorship, including. (1) Conceived and/or designed the work that led to the submission, acquired data, and/or played an important role in interpreting the results. (2) Drafted or revised the manuscript. (3) Approved the final version. (4) Agreed to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

COMPETING INTERESTS

The authors declare no competing interests.

ADDITIONAL INFORMATION

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