Ann Surg Oncol
https://doi.org/10.1245/s10434-024-16738-z

Annals of
SURGICAL ONCOLOGY
OFFICIAL JOURNAL OF THE SOCIETY OF SURGICAL ONCOLOGY

ORIGINAL ARTICLE – RECONSTRUCTIVE ONCOLOGY

Lower Commercial Rates for Breast Surgical Procedures are Associated with Socioeconomic Disadvantage: A Transparency in Coverage Analysis

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ABSTRACT

Background. The Centers for Medicare & Medicaid Services (CMS) implemented the Transparency in Coverage Rule in 2022, which requires payers to disclose commercial rates for the first time in the history of the US healthcare system. The purpose of this study was to characterize payer-disclosed commercial facility rates and examine the relationship with county-level social disadvantage for common breast surgical procedures.

Materials and Methods. We performed a cross-sectional study of 2023 pricing data for 14 ablative and reconstructive breast procedures from Turquoise Health. Socioeconomic disadvantage was quantified using the Social Vulnerability Index (SVI). Within- and across-payer ratios quantified rate variation. Linear regression assessed the relationship between relative value unit (RVU)-adjusted median commercial rates and facility-level variables including SVI quartile.

Results. There were 4,748,074 unique commercial rates disclosed by four payers from negotiations with 10,023 hospitals. Rates varied by a factor of 9.8–15.6 within and 10.0–18.1 across payers. RVU-adjusted commercial rate decreased in a stepwise fashion as SVI quartile increased and varied by payer ($p < 0.001$). Higher RVU-adjusted rates were associated with hospitals compared with ambulatory facilities ($\beta = 138$, 95% CI 138–139, $p < 0.001$). Lower rates were associated with areas of less healthcare infrastructure ($\beta = -37$, 95% CI -38 to -37, $p < 0.001$).

Conclusions. Facility rates for breast surgical procedures varied significantly within and between payers and were higher for hospitals compared with ambulatory surgery centers. Facilities in areas of higher social vulnerability were associated with lower negotiated rates. The health equity implications of lower payment in areas of higher disadvantage, particularly in terms of access to care, deserve further investigation.

Keywords Transparency in coverage · Commercial facility rates · Price variation · Social vulnerability index · Breast surgery · Health equity

Commercial price transparency presents a novel lens through which we can examine known racial and economic disparities in access to breast surgery. Black race, Hispanic ethnicity, poverty, lack of education, and lack of health insurance are well-established predictors of more advanced stage at breast cancer diagnosis, higher odds of delayed surgical treatment, and/or lower disease-specific survival.[1,2] In terms of breast reconstruction, women who are Black, socioeconomically disadvantaged, non-fluent in English, have low median income, and/or lower education are less likely to receive breast reconstruction.[3–6] While various factors influence access to care, including awareness, acceptability, availability, and accessibility of therapeutic and

First Received: 1 November 2024
Accepted: 10 December 2024

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Published online: 24 December 2024

reconstructive options, affordability is a key barrier to surgical treatment.[7] Historically, since actual dollar payments from insurers (i.e., payers) to hospitals have been withheld as proprietary trade secrets, affordability of care has been gauged using incomplete metrics such as insurance status, patients' out-of-pocket expenditures, and chargemaster rates, which are notoriously unrepresentative of the actual cost of care.[8] As a result, the role that negotiated commercial prices between insurers and hospitals play in access to and affordability of care remains opaque.

Our prior work examining hospital-disclosed commercial rates for breast reconstructive procedures, in addition to other procedures within surgical oncology and plastic and reconstructive surgery, has demonstrated substantial variation in prices without consistent relation to value.[9–13] These studies were based on data disclosed following the Hospital Price Transparency Rule, which the Centers for Medicare & Medicaid Services (CMS) implemented on 1 January 2021 and requires hospitals to disclose negotiated commercial rates for shoppable services.[14] On 1 July 2022, CMS implemented a complementary rule, Transparency in Coverage (TiC), which requires insurers to disclose all in-network negotiated rates for commercial plans.[15] Payer-disclosed commercial rate data have been generally consistent with hospital-disclosed data.[16] However, with a greater noncompliance penalty of $100 per day per affected individual and stricter reporting guidelines with TiC, payer-disclosed data present advantages in terms of completeness and comprehensiveness compared with hospital-disclosed data.[17]

The primary objective of this study was to examine the association between payer-disclosed commercial facility rates and county-level social vulnerability for breast ablative and reconstructive procedures. The secondary objective was to evaluate the variation in facility rates from the payer perspective compared with the hospital perspective, providing a more complete picture of price variability within the US market for breast surgery. Given our prior price transparency research and known associations between patient-level socioeconomic characteristics and access to breast cancer care, we hypothesized that there would be large variation in payer-disclosed prices for breast surgical procedures with lower prices corresponding to areas of greater social vulnerability.

MATERIALS AND METHODS

Study Design and Data Sources

We performed a cross-sectional study of negotiated payer-disclosed commercial rates for six ablative and eight reconstructive breast procedures by current procedural terminology (CPT) code (see Supplementary Table 1 for list of CPT codes with full descriptors). These data were extracted from Turquoise Health, a data service platform that collates price disclosures from hospitals and payers. As of March 2023, Turquoise Health had accumulated data from more than 200 payers, representative of more than 95% of the US commercial insurance market.[18] Data encompass more than 56 billion in-network negotiated rates, with payers disclosing as a single entity or with multiple entries (e.g., separate disclosures for subsidiaries or branches).[17] Data from Maryland were excluded due to the state's global budget program for hospital services.[19] Pricing data were restricted to institutional fees, negotiated rates, and surgical facilities (clinic/centers, general acute care hospitals, and specialty hospitals). Owing to the size and complexity of the payer dataset, we limited our analysis to four large national insurers that collectively accounted for approximately 44% of US commercial market share in 2021: Aetna (now CVS Health), Anthem (now Elevance Health), Blue Cross Blue Shield (BCBS; Health Care Service Corporation), and United Healthcare.[16,20]

Pricing data for each hospital were merged at the county level with the 2020 Centers for Disease Control/Agency for Toxic Substances and Disease Registry (CDC/ATSDR) Social Vulnerability Index (SVI), a location-based index designed to quantify demographic and socioeconomic factors related to community stress.[21] Though originally designed to identify communities that are more likely to be negatively impacted by public health emergencies, the SVI has been increasingly used as a metric of general socioeconomic disadvantage in studies examining health inequity related to cancer, chronic disease, and other medical conditions.[22–24] The SVI encompasses four themes on the basis of 16 variables from the 2016–2020 US Census Bureau's American Community Survey 5-year estimates: socioeconomic status (below 150% poverty, unemployed, housing cost burden, no high school diploma, no health insurance), household characteristics (aged 65 years and older, aged 17 years and younger, civilian with a disability, single-parent households, English language proficiency), racial and ethnic minority status, and housing type and transportation (multi-unit structures, mobile homes, crowding, no vehicle, group quarters).[25] These themes are combined into an overall vulnerability metric, with higher score indicative of greater vulnerability. SVI data were included on the basis of the RPL_THEMES variable, which quantifies SVI as a national percentile ranking. We selected the SVI over alternative measures of social vulnerability and deprivation due to methodology that allowed for examination of the component themes in a disaggregated fashion (RPL_THEMES1-4), in addition to the absence of component themes with known associations with price (e.g., healthcare infrastructure or market concentration). Healthcare infrastructure and access were quantified with an independent variable extracted from the Minority Health SVI, an extension of the CDC/ATSDR SVI, and measures the number of hospitals, pharmacies,

primary care physicians, and urgent care clinics per 100,000 population; higher values represent less infrastructure and access.[26]

Statistical Analysis

Commercial rates were adjusted to account for geographic variation in input costs using the CMS Geographic Adjustment Factor (GAF).[27] GAF-adjusted commercial rates per CPT code were summarized descriptively with medians and interquartile ranges (IQRs). Analogous to prior methodology quantifying commercial price variation among hospitals for hospital-disclosed data,[13] variation in payer-disclosed data was measured by comparing ratios within and across payers for CPT codes. Within-payer ratios per CPT code were calculated as the median of the 90th percentile commercial rate divided by the 10th percentile commercial rate for each payer. Across-payer ratios per CPT code were calculated as the 90th percentile median commercial rate divided by the 10th percentile median commercial rates across all payers. Rates above the 90th and below the 10th percentiles were excluded from ratio calculations to lower the likelihood of including outliers suggestive of "zombie rates," or rates not representative of services rendered.[16]

For each CPT code, GAF-adjusted commercial rates were divided into four groups on the basis of SVI quartile, with higher quartile representing greater social vulnerability. Rates were compared among the first and fourth quartiles using the Welch two-sample *t*-test for the overall vulnerability ranking and independently for each of the four themes. GAF-adjusted commercial rates were divided by relative value units (RVUs) per CPT code to normalize for inherent differences in value among procedures within the breast surgery market basket, generating an outcome measure of dollars per RVU. Linear regression modeled RVU-normalized commercial rate as a function of SVI quartile, payer, facility type (ambulatory surgery center versus hospital), US census region (Northeast, Midwest, South, and West), healthcare infrastructure and access, and procedure type (ablative versus reconstructive). Two sensitivity analyses for this linear regression were performed: first, using GAF-adjusted commercial rate as the outcome variable and controlling for CPT code, and second, using RVU-normalized commercial rate aggregated at the payer and hospital level. The first sensitivity analysis was performed in case RVU amounts did not accurately reflect procedural value.[28] The second sensitivity analysis was performed to address bias that may result in over- or underrepresentation of some price samples due to differences in the number of plans offered by a payer at a given hospital rather than differences in patient enrollment or utilization.[29,30] Model selection was based on comparison of Akaike information criterion (AIC), Bayesian information criterion (BIC), and *R*-squared values. *p*-Values of less than 0.05 were considered significant. Analyses were conducted using R version 4.3.2.

RESULTS

There were 4,748,074 unique commercial rates disclosed by 4 payers for the 14 queried CPT codes, including 1,940,065 ablative and 2,808,010 reconstructive rates. These rates were negotiated across facilities with 10,023 unique National Provider Identifiers (NPIs). Descriptive statistics for GAF-adjusted commercial rates are presented in Table 1. Median (IQR) facility rate ranged from $1400 ($762, $3634) for radical mastectomy (CPT 19305) to $2883 ($1138, $6243) for tissue expander placement (CPT 19357). Within-payer ratios ranged from 9.9 for a single-pedicle transverse rectus abdominis myocutaneous (TRAM) flap (CPT 19367) to 15.6 for delayed implant placement (CPT 19342). Across-payer ratios ranged from 10.0 for lumpectomy to 18.1 for latissimus dorsi reconstruction (CPT 19361). Figure 1 displays within-payer ratios by insurer for select ablative and reconstructive CPT codes.

Figure 2 illustrates GAF-adjusted commercial rates attached to hospitals in first versus fourth SVI quartiles for a sample of CPT codes. Overall, rates in the fourth SVI quartile (i.e., higher vulnerability) were significantly lower than those of the first SVI quartile for 6 (42.9%) CPT codes, significantly higher for five (35.7%) CPT codes, and not significantly different for three (21.4%) CPT codes (data shown in Supplementary Table 2). Supplementary Tables 3–6 show these comparisons per CPT code for each of the four SVI themes, with similar mixed directionality and significance for first versus fourth quartile comparisons.

Linear regression output for RVU-normalized commercial rate is detailed in Table 2. RVU-normalized commercial rate decreased in a stepwise fashion as SVI quartile increased ($p < 0.001$); compared with the first SVI quartile, facility dollar amounts per RVU were lower for the second ($\beta = -\$6.9$, 95% CI $-\$7.3$ to $-\$6.6$, $p < 0.001$), third ($\beta = -\$14$, 95% CI $-\$14$ to $-\$13$, $p < 0.001$), and fourth ($\beta = -\$23$, 95% CI $-\$23$ to $-\$22$, $p < 0.001$) quartile. Figure 3 illustrates the adjusted difference in RVU-normalized rate by SVI quartile. Prices without RVU normalization are shown in the sensitivity analysis (Supplementary Table 7); compared with the first SVI quartile, facility rates were lower for the second ($\beta = -\$191$, 95% CI $-\$201$ to $-\$181$, $p < 0.001$), third ($\beta = -\$401$, 95% CI $-\$411$ to $-\$391$, $p < 0.001$), and fourth ($\beta = -\$654$, 95% CI $-\$664$ to $-\$664$, $p < 0.001$) quartiles. Rates varied significantly by payer and region ($p < 0.001$). RVU-adjusted rates were higher for hospitals compared with ambulatory surgery centers ($\beta = \$138$, 95% CI $138–139, $p < 0.001$), and lower in areas of less healthcare infrastructure and access ($\beta = -\$37$, 95% CI $-\$38$ to $-\$37$, $p < 0.001$) and for reconstructive compared

TABLE 1 Descriptive statistics for payer-disclosed negotiated commercial facility rates

Service (CPT code)	*n*	Median (IQR), US$	Within-payer ratio	Across-payer ratio
Ablative	1,940,065			
Lumpectomy (19301)	377,970	1561 (894, 3507)	10.47	10.03
Lumpectomy with ALND (19302)	374,129	2303 (1297, 4760)	10.79	10.56
Mastectomy, simple (19303)	368,491	2020 (1116, 4124)	12.69	11.09
Mastectomy, radical (19305)	225,578	1400 (762, 3634)	13.59	15.04
Mastectomy, radical, urban (19306)	224,102	1413 (762, 3587)	11.05	14.55
Mastectomy, modified radical (19307)	369,795	2211 (1188, 4520)	11.45	11.45
Reconstructive	2,808,010			
Mastopexy (19316)	383,176	1928 (1027, 3929)	11.47	11.93
Reduction mammaplasty (19318)	387,673	2119 (1084, 4391)	12.30	12.82
Implant, immediate (19340)	401,357	1808 (878, 3869)	12.43	14.40
Implant, delayed (19342)	392,600	2153 (978, 4,481)	15.55	15.45
Tissue expander (19357)	395,253	2883 (1138, 6243)	14.04	15.07
Latissimus dorsi ± implant (19361)	252,740	1419 (729, 3672)	14.14	18.07
Free flap (19364)	353,929	2325 (1093, 4481)	10.23	11.85
TRAM, 1 pedicle (19367)	241,282	2254 (1089, 4517)	9.89	13.34

ALND axillary lymph node dissection, *CPT* current procedural terminology, *IQR* interquartile range, *TRAM* transverse rectus abdominis myocutaneous

with ablative procedures ($\beta = -$ \$2.9, 95% CI $-$ \$3.1 to $-$ \$2.7, $p < 0.001$). Supplementary Table 8 displays output from sensitivity analysis using RVU-adjusted commercial price data aggregated at the payer-hospital level. The directionality and trends for all variables in the aggregated analysis remained consistent except for procedure type.

DISCUSSION

In this cross-sectional analysis of nearly 5 million payer-disclosed commercial facility rates among four major national insurers, we demonstrate a stepwise decline in reimbursement for hospitals in areas of higher social vulnerability. Specifically, compared with hospitals located in the first (least vulnerable) quartile, hospitals in second, third, and fourth quartile SVI counties earned \$191, \$401, and \$654 fewer dollars per RVU ($p < 0.001$), respectively, for the collective market basket of breast ablative and reconstructive procedures. Building upon our prior work that showed substantial within- and across-hospital variation in hospital-disclosed commercial rates for breast reconstructive procedures,[13] our current analysis also demonstrates large within- and across-payer variation in payer-disclosed commercial rates for ablative and reconstructive breast procedures. For instance, for simple mastectomy (CPT 19303), the rate that a given payer reimbursed one hospital was 12.7 times that of another hospital, on average; across all payers and hospitals, the average price that one payer reimbursed varied by a factor of 11.1 compared with another payer. As previously noted in the context of hospital-disclosed data,[9–11,13,31–36] such marked commercial price variation represents an opportunity for cost containment if such pricing is reflective of anticompetitive behavior rather than value-based care delivery.

The demonstrated relationship between commercial facility rate and social vulnerability supports inequities in rate negotiation between payers and hospitals on the basis of socioeconomic resources. The data support price discrimination on the part of payers, as payers negotiate lower prices for equivalent procedures with hospitals in areas of greater social disadvantage. These hospitals may have less demand elasticity and leverage in contract negotiations if, for instance, they have fewer financial resources, are positioned within smaller hospitals systems, and/or have less skilled administrators and negotiators. It is also possible that lower rates in high SVI areas reflect worse patient outcomes; however, our prior analyses have not demonstrated a consistent association between price and outcomes.[9] Hospitals in areas of lower SVI are more likely to be safety net facilities with a higher proportion of Medicaid and Medicare beneficiaries (unpublished analysis, see Supplementary Table 9).[37] If low SVI hospitals were able to price discriminate, we would expect to see hospitals in areas of lower SVI negotiate higher commercial rates in accordance with the economic practice of cost-shifting, whereby hospitals raise prices for commercial payers in response to shortfalls from public payers.[38] Our data in this and prior studies do not support cost-shifting for these procedures,[10,13] and instead suggest that payers, as profit-maximizing entities, have the upper hand in negotiations with hospitals that treat socially vulnerable patients.

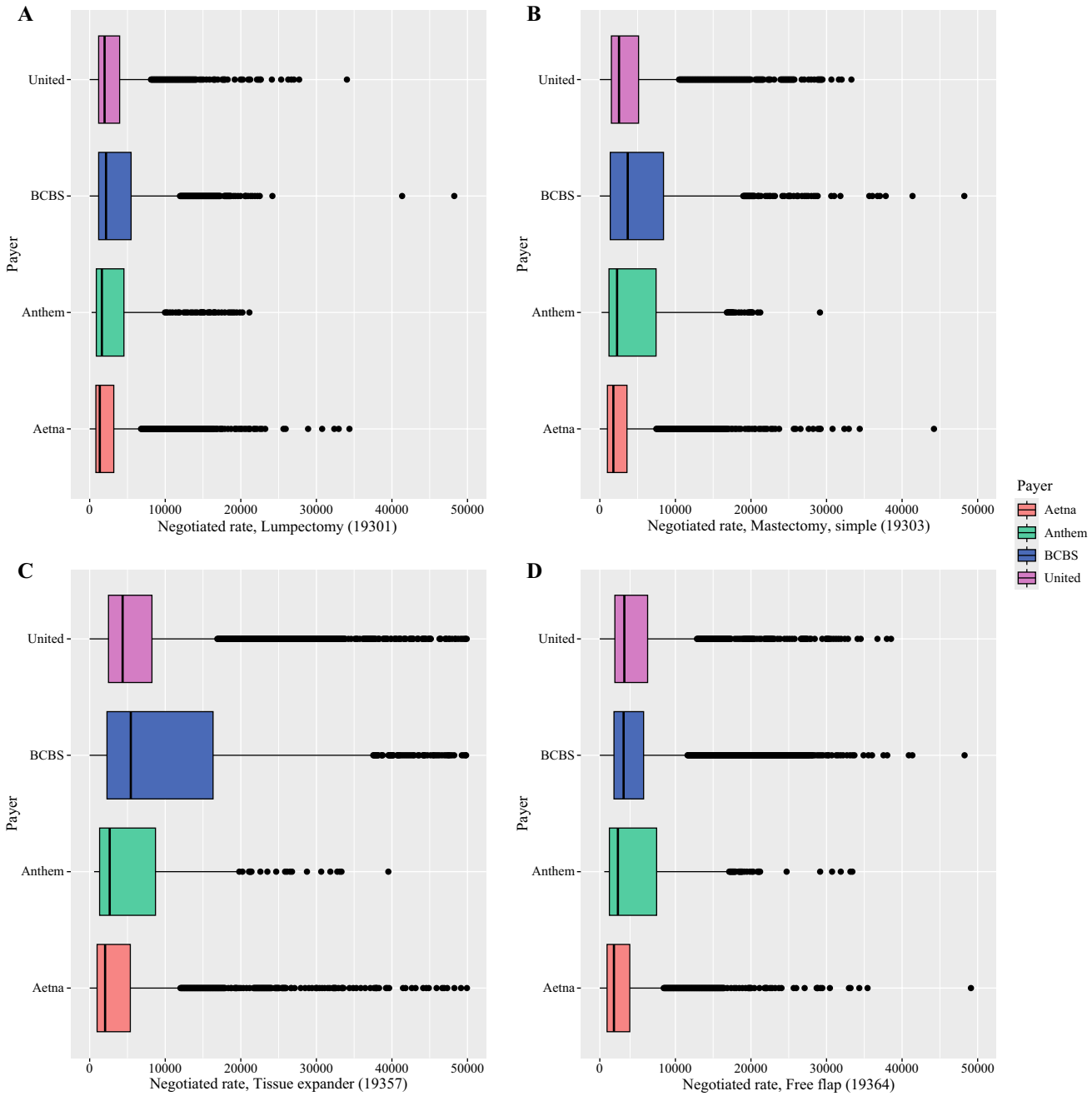

FIG. 1 Within-payer ratios for four major national insurers; ratios are shown for **A** CPT 19301: lumpectomy, **B** CPT 19303: simple mastectomy, (C) CPT 19357: breast reconstruction with tissue expander, and **D** CPT 19364: breast reconstruction with free flap; rates are in US$; *BCBS* Blue Cross Blue Shield

Lower commercial facility rates paid to hospitals serving disadvantaged patients may explain some of the disparities in access to breast surgical care. Hospitals may be less willing and able to support these procedures in the setting of inadequate reimbursement,[39] especially considering that baseline care delivery is often more costly for these institutions with a larger pool of uninsured patients. Previous studies have shown that rates of autologous breast reconstruction are proportionate to physician payments,[40] and the ratio of free flap to implant-based reconstruction directly correlates with physician reimbursement.[41] With declining Medicare reimbursement and an inability to cost-shift,[42] hospitals serving a high proportion of publicly insured patients in socially vulnerable areas may find it financially unsustainable to offer these procedures. Furthermore, from the patient perspective, lower commercial facility rates theoretically

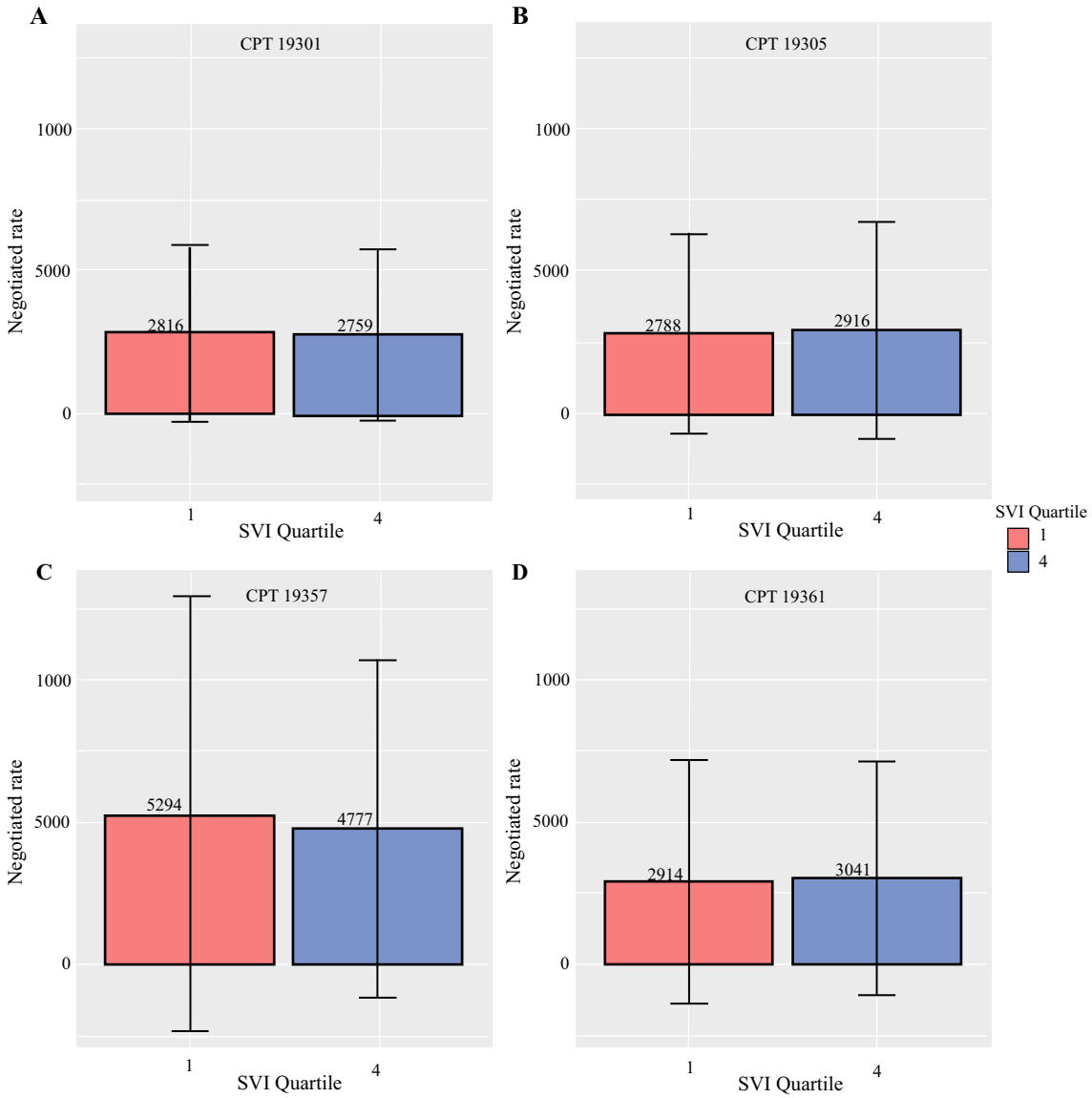

FIG. 2 GAF-adjusted commercial rate by SVI quartile; comparisons are shown for **A** CPT 19301: lumpectomy, **B** CPT 19305: radical mastectomy, **C** CPT 19357: breast reconstruction with tissue expander, and **D** CPT 19361: latissimus dorsi flap with or without implant; rates are in US$; *SVI* Social Vulnerability Index

translate into lower out-of-pocket expenses and premiums for commercially insured and uninsured patients, making breast procedures more affordable for these vulnerable groups. Ultimately, there is a delicate balance between availability and affordability that underpins such questions of breast surgery equity and access.

The relationship between SVI and commercial rate was not consistent on univariable analysis, indicating that factors beyond SVI impact commercial price. Facility type was a significant predictor of commercial rate, as hospitals earned $138 per RVU more than ambulatory surgery centers for identical breast surgery procedures ($p < 0.001$). This is consistent with the demonstrated lower cost of procedures at ambulatory facilities compared with hospitals and externally validates our findings.[29,43] However, from the perspective of a large hospital system with both inpatient and ambulatory facilities, the difference in payment may incentivize health systems to prioritize hospital locations for procedural care despite known value-based advantages of ambulatory surgery. In addition, hospitals in areas of less healthcare infrastructure were paid less per RVU ($\beta = -\$37$, 95% CI $-\$38$ to $-\$37$, $p < 0.001$). Lastly, reconstructive procedures were undervalued related to ablative procedures ($\beta = -\$2.9$, 95% CI $-\$3.1$ to $-\$2.7$, $p < 0.001$), consistent with prior comparisons of RVU-based valuation across surgical subspecialties,[28] though the directionality of this association

TABLE 2 Linear regression model for RVU-normalized commercial rate and SVI, n = 4,748,075

Characteristic	Beta (US$/RVU)	95% CI (US$/RVU)	*p*-Value
(Intercept)	62	61, 62	< 0.001
SVI quartile			
1	–	–	
2	− 6.9	− 7.3, − 6.6	< 0.001
3	− 14	− 14, − 13	< 0.001
4	− 23	− 23, − 22	< 0.001
Payer			
Aetna	–	–	
Anthem	41	40, 42	< 0.001
BCBS	88	88, 89	< 0.001
United	37	37, 37	< 0.001
Facility type			
Ambulatory Healthcare Facilities	–	–	
Hospitals	138	138, 139	< 0.001
Region			
Northeast	–	–	
Midwest	6.5	6.1, 7.0	< 0.001
South	10	10, 11	< 0.001
West	36	35, 36	< 0.001
Healthcare infrastructure/access	− 37	− 38, − 37	< 0.001
Procedure type			
Ablative	–	–	
Reconstructive	− 2.9	− 3.1, − 2.7	< 0.001

Units of coefficients are US$ per RVU.

BCBS Blue Cross Blue Shield, *CI* confidence interval, *RVU* relative value unit, *SVI* Social Vulnerability Index

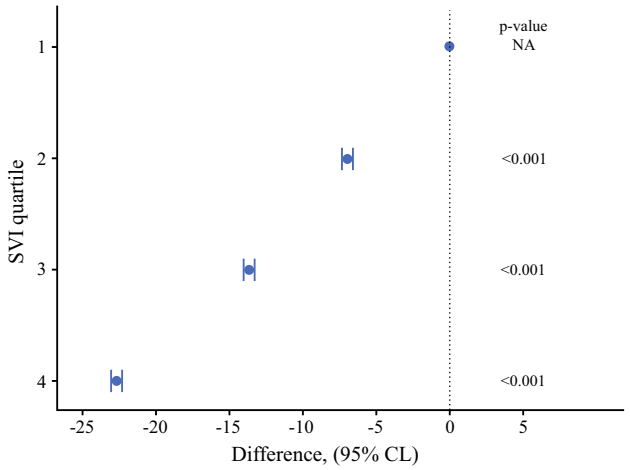

FIG. 3 Adjusted difference in RVU-normalized commercial rate by SVI quartile; coefficients adjusted for payer, facility type, region, healthcare infrastructure/access, and procedure type; *CI* confidence interval, *NA* not applicable, *RVU* relative value unit, *SVI* Social Vulnerability Index

was not constant on sensitivity analysis. Hospital region also demonstrated significant differences in commercial rate ($p < 0.001$), though it was mainly included in our analysis to control for geographic variation in negotiated prices beyond that attributable to input costs.

Limitations of this study largely stem from weaknesses of our assembled dataset. The dataset omits professional fees and smaller insurance carriers, the latter of which may have less negotiating power resulting in an overestimate of variation in their absence. We did not account for procedure-specific hospital volume, which may affect cost.[44] Additionally, we did not control for healthcare market competition using the Herfindahl–Hirschman Index (HHI, i.e., sum of the squared market share of each hospital system in a market multiplied by 10,000), which has been correlated with price and may affect the ability of a hospital to cost-shift,[13,45–47] due to the degree of missingness that this variable introduced into our dataset. Our healthcare infrastructure variable (i.e., the number of hospitals, primary care physicians, pharmacies, and urgent care centers per 100,000 population) may overlap to some degree with HHI, but predominantly measures access to basic healthcare rather than market consolidation.

CONCLUSIONS

Payer-disclosed commercial facility rates for breast ablative and reconstructive procedures have substantial variation within and across payers, with rates decreasing in a stepwise fashion as social vulnerability increased. While price variation identifies potential waste within our healthcare financing system, the association of lower commercial payment with hospitals serving more socially disadvantaged patients highlights an inequity that may explain existing access disparities and will likely worsen over time if Medicare reimbursement continues to lag behind commercial rates. Price transparency regulations are a new yet enduring element of the US healthcare system, as CMS continues to issue mandates to strengthen and enforce price transparency disclosure requirements.[48] This study is the first to examine the intersection of price transparency and social determinants of health, illustrating how price information may be viewed in the context of healthcare disparities to identify and address ongoing inequities. Additional investigation is needed to further disentangle the association between facility rates and social vulnerability demonstrated in this study.

SUPPLEMENTARY INFORMATION The online version contains supplementary material available at https://doi.org/10.1245/s10434-024-16738-z.

ACKNOWLEDGEMENTS This research was supported in part by the Cancer Center Support Grant P30 CA008748 that supports the research infrastructure at Memorial Sloan Kettering Cancer Center. In addition, Clifford C. Sheckter MD is supported by the National Center for Advancing Translational Sciences of the National Institutes of Health under Award Number KL2TR003143. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

DISCLOSURES None of the authors has a financial interest in any of the products, devices, or drugs mentioned in this manuscript. Babak J. Mehrara, MD, is the recipient of investigator-initiated research grants from Pfizer, Integra, and Regeneron and has received royalty payments from Elsevier; he also has served as a consultant for Mediflix Corp. Yang Wang, PhD, and Gerard Anderson, PhD, receive funding from Arnold Ventures LLC. Jonas Nelson has served as a consultant for RTI surgical. This research was supported in part by the Cancer Center Support Grant P30 CA008748 that supports the research infrastructure at Memorial Sloan Kettering Cancer Center. In addition, Clifford C. Sheckter, MD, is supported by the National Center for Advancing Translational Sciences of the National Institutes of Health under Award Number KL2TR003143. The content is solely the responsibility of the authors and does not necessarily represent the official views of the NIH.

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