Health Affairs Scholar, 2025, **3**(2), qxaf004
https://doi.org/10.1093/haschl/qxaf004
Advance access publication: February 5, 2025
Research Article

Health Affairs Scholar
EMERGING & GLOBAL HEALTH POLICY
OXFORD

What explains the growth in hospital assets from 2000 through 2019? A decomposition analysis

Stephanie Teeple[1,*], Caroline Andy[2], William L. Schpero[2,3], Paula Chatterjee[4,5]

[1]Department of Biostatistics, Epidemiology and Informatics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, 19104, United States
[2]Division of Health Policy and Economics, Department of Population Health Sciences, Weill Cornell Medical College, New York, NY, 10065, United States
[3]Center for Health Equity, Cornell University, New York, NY, 10021, United States
[4]Department of Medicine, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, 19104, United States
[5]Leonard Davis Institute of Health Economics, University of Pennsylvania, Philadelphia, PA, 19104, United States

*Corresponding author: Department of Biostatistics, Epidemiology and Informatics, Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA, 19104, United States. Email: stephanie.teeple@pennmedicine.upenn.edu

Abstract

Understanding disparities in hospital finances is essential for ensuring equitable systems of care. One understudied element is total assets, which include both financial and capital resources that hospitals acquire. We evaluated changes and drivers of variation in US hospital assets from 2000 through 2019 using data from the Centers for Medicare and Medicaid Services and American Hospital Association Annual Survey. We decomposed overall variation in total assets to determine the level (hospital, health system, or health care market) that contributed most to variation, and examined the extent to which asset growth was associated with changes in common inputs to hospital wealth vs changing relationships with these inputs or other unmeasured factors. Total assets held by US hospitals increased from $750 billion in 2000 to $1.6 trillion in 2019. Most variation occurred between hospitals, such that high-asset hospitals tended to remain high-asset and low-asset hospitals remained low-asset. Most of the increase in assets was due to unmeasured factors (ie, not patient revenue). We conclude that hospital wealth in the form of assets has grown substantially over time and accrued primarily to wealthy hospitals. Policymakers should consider broader measures of hospital wealth when targeting financial resources and efforts to strengthen data on hospital financing.

Lay summary

Health care assets are an important structural input toward achieving equity in care delivery, but they have been understudied in health care financing. Hospital assets include the "financial" (eg, cash, deposits, and investments) and "capital" (eg, buildings, equipment, land) resources that hospitals acquire and own. Hospitals need some level of assets to provide high-quality care, but excess accumulation may reflect inefficient spending and drive cost growth. This study shows that total assets held by US hospitals more than doubled from 2000 through 2019, from $750 billion to $1.6 trillion. This increase is not explained by factors that experts commonly think of as impacting hospital financial performance. For example, there was no proportional increase in revenue from patient care over this same period. Across this period, wealthy (high-asset) hospitals remained wealthy and poor (low-asset) hospitals remained poor. Consistent with economic theory, the factor most associated with asset growth was historical asset levels. These findings may have implications for patients served by low-asset hospitals, which are often safety-net providers. Ensuring these hospitals have resources to remain financially viable and compete in markets may require improvements in data transparency and regulatory efforts to monitor for unchecked asset growth among wealthy hospitals.

Key words: hospital finance; hospital markets; health care disparities; disproportionate share hospital payments.

Introduction

Hospital and health system assets, which include financial (eg, cash, deposits, investments) as well as capital or fixed (eg, buildings, equipment, land) resources, are an important but understudied structural input to achieving equity in health care. The possession of some level of assets is essential for the provision of high-quality health care (eg, adequate physical space, well-maintained facilities, updated medical equipment).[1,2] However, excessive accumulation of assets may represent health care resource consolidation that drives cost growth without clinical benefit to patients—for example, via diminished competition or investment in high-cost, low-value therapeutics.[2-6] Indeed, hospital consolidation has resulted in higher prices for patients but limited evidence for quality improvement.[7-9] Inequitable health outcomes may be partially attributable to disparities in facility-level resources, such as assets, as well as assortment of minoritized patients to lower resourced facilities.[10-12] Unequal distribution of hospital assets may also contribute to widening financial inequality across health care institutions in ways that ensure the viability of some and risk the closure of others.

Recent policy decisions, in failing to consider hospital assets, may have compounded differences in hospital wealth and financial inequality in health care markets. For example, federal pandemic funds were primarily allocated to hospitals

Received: October 8, 2024; Revised: December 11, 2024; Accepted: January 28, 2025
© The Author(s) 2025. Published by Oxford University Press on behalf of Project HOPE - The People-To-People Health Foundation, Inc.
This is an Open Access article distributed under the terms of the Creative Commons Attribution-NonCommercial License (https://creativecommons.org/licenses/by-nc/4.0/), which permits non-commercial re-use, distribution, and reproduction in any medium, provided the original work is properly cited. For commercial re-use, please contact reprints@oup.com for reprints and translation rights for reprints. All other permissions can be obtained through our RightsLink service via the Permissions link on the article page on our site—for further information please contact journals.permissions@oup.com.

in strong financial positions, and this was associated with delays in funding to safety-net hospital providers.[13-18] These policy choices overlaid a history in which hospitals that serve communities of color are substantially poorer in physical resources than other hospitals,[1] reflecting a cumulative disadvantage in hospital financing over decades.[19] Capital assets, in particular, have grown over the past decade[3] and this growth has been distributed unequally across hospitals: hospitals serving patients of color are significantly less likely to offer capital-intensive surgical, radiological, and cardiac services.[1] Taken together, these factors can widen financial inequality within and across health care markets. But, to our knowledge, no studies have characterized growth in total assets, despite their evolving role in hospital profitability, nor have they explored potential drivers of this growth.[17]

In this study, we examined the variation and drivers of changes in total assets held by US hospitals over time. To do so, we merged administrative and survey records covering 2 decades of data on financial and operating characteristics among US hospitals nationally. We then decomposed differences in assets between health care markets, health care systems, and individual hospitals. Given evidence suggesting disparities in wealth occur within health care markets and within health care systems[4,20] (eg, markets and systems contain both wealthy and non-wealthy hospitals), we also hypothesized that a significant proportion of variation in assets occurred at the hospital level. We conclude by examining the extent to which the growth in assets could be explained by existing measures of hospital finances.

Data and methods

Data and sample

We used the 2000–2019 Centers for Medicare and Medicaid Services' (CMS') Healthcare Provider Cost Reporting Information System (HCRIS) compiled by RAND[21] and the American Hospital Association (AHA) Annual Survey of Hospitals.[22] The HCRIS data contain yearly information on every Medicare-certified institutional provider in the United States, including facility characteristics, health services utilization information, costs, and some financial statement data. The AHA survey is an annual survey of the approximately 6500 hospitals in the United States. For this study, we focused on the subset of short-term, general, acute-care hospitals identified in HCRIS.

The dataset was composed of hospital-year observations for 2000–2019. Hospitals are frequently situated within health systems, which, in turn, are situated within health care markets. A single health system can span multiple health care markets. In this study, we defined hospital membership in health systems using the Agency for Healthcare Research and Quality (AHRQ) Compendium of US Health Systems identifier contained in the HCRIS data, which aggregates 4 independent sources to assign a system membership designation[23] and reflects system membership as of 2018. Annual time-varying system membership was not available since the Compendium was only developed for 2016 and 2018 at the time of this study.

We defined health care markets using the Dartmouth Atlas of Health Care's hospital referral regions (HRRs) as identified in the AHA survey, which represent regional markets for tertiary medical care, and were defined based on utilization data for major cardiovascular procedures and neurosurgery, resulting in 306 unique market areas in the United States.[24] In our primary analyses, hospitals were assigned to HRRs independently (eg, 2 hospitals within the same system may be located in different HRRs) based on zip code.

Variables and measures

The outcome of interest for all analyses was the HCRIS variable for total assets, which includes fixed, liquid, and other hospital assets, and is a reliable measure of total hospital asset holdings when compared with gold-standard audited financial statements.[25] For all analyses, we inflation-adjusted total assets to 2019 dollars. Additional details on data preparation are available in the Supplementary Methods. These details focus on potential accounting differences across and within health systems, and our interrogation of HCRIS data to maximize confidence that total assets were reported for individual hospitals and not health systems.

Predictors were drawn from HCRIS and included common inputs to hospital wealth[26]: net patient revenue (in dollars), hospital income from investments (dollars), hospital income from contributions (dollars), hospital income from government appropriations (dollars), administrative expenses (dollars), Medicare Disproportionate Share Hospital (DSH) payments (dollars),[27] status as a major teaching hospital, ownership status (nonprofit, for-profit, government), size (discretized as "small" [<100 beds], "medium" [100–300 beds], or "large" [≥300 beds]), urbanicity, and the Herfindahl-Hirschman Index (HHI). The HHI is a measure of health system market consolidation and defined as the sum of the squared market shares of each health system or hospital competing in a given health care market, resulting in a value that ranges from 0 (not consolidated) to 10 000 (maximally consolidated).[28] We calculated HHI in our study using share of inpatient admissions.[28] All financial variables (net patient revenue, income, DSH payments, and administrative expenses) were inflation-adjusted to 2019 dollars. Urbanicity was defined using Rural-Urban Continuum (RUC) codes from the US Department of Agriculture Economic Research Service. The RUC codes are a 9-part county-level classification system where "1" is the most urban (counties in metro areas of 1 million population or more) and "9" is the most rural (completely rural or less than 2500 urban population, not adjacent to a metro area).[29]

Statistical analyses

We first performed a descriptive analysis, plotting common hospital financial measures across time, in total and averaged per hospital bed. We include the year 2020 for additional descriptive context during the first year of the COVID-19 pandemic. The purpose of this analysis was to evaluate trends in assets relative to other financial measures.

We then performed 2 main statistical analyses. First, we conducted a variance partition analysis to explore which hierarchical level or levels contributed most to overall variation in total assets. This analysis explored how much of the total variation in hospital assets was driven by variation within, or between, hospitals (eg, across years), health systems, HRRs, or some combination of the 3. The goal of this analysis was to offer important context for policy interventions. For example, if some health care markets were systematically less wealthy than others, then these markets could be targeted for additional support if resources were not commensurate with

underlying need or if outcomes were disproportionately worse. We fit a series of variance component models. Variance component models are multilevel models that do not contain predictor variables; instead, they have a random effect for each hierarchical level in the data (hospital, health system, HRR), which is fit to the outcome of interest.[30,31] Using these fitted models, we then calculated the variance partition coefficient for each level, which is the proportion of outcome variance attributable to cluster membership at that level.[31] We fit an overall model using all years of data, as well as year-specific models to evaluate whether the contribution of certain factors changed over time. We cube-root-transformed the outcome to normalize right skewness and preserve rare (0.5% of observations) negative values. We also fit overall and year-specific models including a fixed effect at the level of the state in which the hospital was located to test for additional geographic clustering. Finally, we calculated the between-unit variation for each level (see Appendix Figure S1 for details). For example, if between–health care market variation was low, that would suggest that markets were similar in terms of total assets and that most variation was occurring within markets. If between-hospital variation was high, then this would mean there were large hospital-level differences. If variation within hospitals over time was low, then hospitals that were asset-rich tended to stay asset-rich over time, and asset-poor hospitals tended to remain asset-poor over time.

In the second part of our analysis, we examined the extent to which the increase in assets from 2000 through 2019 was associated with changes in the levels of common inputs to hospital wealth ("explained" variation) vs the extent to which the increase in total assets was suggestive of changing relationships across these inputs, or other unmeasured factors entirely ("unexplained" variation). To evaluate this, we conducted a nonlinear 2-way decomposition derived from principles in Kitagawa's decomposition of differences using standardization methods and the Oaxaca-Blinder approach of using regression to explain differences in means between groups (subsequently referred to as Kitagawa-Oaxaca-Blinder [KOB] decomposition).[32,33] Regression decomposition has recently been extended to nonlinear models, including count models,[34,35] allowing for their additive decomposition of the difference in the average observed outcomes. Thus, we used a Poisson modeling approach in our decomposition to account for the right skewness in our outcome variable. Categorical variables were normalized such that the decomposition results are not sensitive to choice of reference category.[32] In nonlinear decompositions, results are sensitive to the order in which independent variables are entered into the decomposition. To address this, the KOB decomposition was performed in Stata using the "mvdcmp" package, which uses a weight-based approach[36] to generate detailed decomposition estimates that are not path-dependent. All other statistical analyses were conducted in R version 4.1.1. Data from the year 2000 were used as the reference group. (See Appendix Figure S2 for the overall decomposition formula.)

Sensitivity analyses

We conducted several sensitivity analyses. First, we repeated the variance partition analysis with all hospitals in health systems assigned to a single HRR based on the zip codes for the plurality of their beds, regardless of individual hospital location. We also repeated the variance analysis and KOB decomposition with total assets per bed as the outcome to account for hospital size. Second, we repeated the KOB decomposition stratified on subsets of hospitals: wealthy hospitals (defined as hospitals in the top decile of assets holders by year), safety-net hospitals (defined as hospitals in the top quartile of Medicaid inpatient-day share by state and year), and critical-access hospitals (a group of rural hospitals designated by CMS based on their service to geographically isolated populations). We also repeated the KOB decomposition subset to a balanced panel. We used the entire imbalanced cohort for our primary analyses to prevent selection bias in the variance partition (eg, poorer hospitals may be more likely to cease operations) and because our population of interest was all short-term acute-care hospitals in the United States (not just those that "survived" the entire period 2000–2019). Next, we repeated the KOB decomposition for the years 2010 to 2019, as significant reporting changes for the Medicare Cost Reports occurred in 2010. Additionally, health system affiliation may be associated with hospital assets via a variety of mechanisms. However, robust longitudinal data on health system membership are limited: the AHA survey contains self-reported health system affiliation for a limited number of years, but discrepancies exist in comparison to Compendium data (eg, in 2018 the AHA identifier places 2844 hospitals in 421 systems; the AHRQ Compendium places 3180 hospitals in 607 systems). Thus, we repeated the variance analysis and KOB decomposition using AHA health system data from 2008 through 2019 to supplement our main analyses. Finally, to provide further context to our results, we calculated the totals of different types of assets held by short-term acute-care hospitals over the study period: (1) fixed assets, (2) capital assets, and (3) other assets.

Results

Sample characteristics

The study sample included 117 789 hospital-years from 2000 through 2019 for 7337 hospitals (Table 1). The majority of hospitals were small (53.7%), metropolitan (60.0%), not major teaching hospitals (93.8%), and nonprofit hospitals (57.6%). The average total yearly net patient revenue was $153 million (SD: $260 million). The average total yearly income from contributions, government appropriations, and investments was $382 000 (SD: $2.79 million), $1.65 million (SD: $19.9 million), and $1.49 million (SD: $8.33 million), respectively. The average yearly administrative expenses were $26.2 million (SD: $45.4 million) and average Medicare DSH adjustments were $1.80 million (SD: $4.35 million). The 2019 sample, relative to the 2000 sample, was composed of slightly more large hospitals (14.7% vs 11.4%), slightly more metropolitan hospitals (60.3% vs 58.2%), more major teaching hospitals (8.2% vs 5.2%), and more for-profit (19.4% vs 15.3%) hospitals. Hospitals in 2019 also had higher net patient revenue, income, and administrative expenses relative to the 2000 sample.

Changes in assets over time

Total assets held by US short-term acute-care hospitals increased from $750 billion to $1.6 trillion over 2000–2019, with larger year-to-year increases observed in the last 10 years (Figure 1). Contributions of fixed (capital), current (financial), and other assets to total hospital assets by year are depicted in

Table 1. Characteristics of the study cohort, 2000–2019.

	2000 ($n = 4882$)	2019 ($n = 4551$)	Overall ($n = 117\,789$)
Size, *n* (%)			
Small (<100 beds)	2604 (53.3%)	2556 (56.2%)	63 259 (53.7%)
Medium (100–300 beds)	1717 (35.2%)	1318 (29.0%)	38 536 (32.7%)
Large (>300 beds)	556 (11.4%)	669 (14.7%)	15 788 (13.4%)
Missing	5 (0.1%)	8 (0.2%)	206 (0.2%)
Urbanicity, *n* (%)			
Metropolitan	2842 (58.2%)	2746 (60.3%)	70 660 (60.0%)
Micropolitan	803 (16.4%)	750 (16.5%)	19 559 (16.6%)
Not urban	1235 (25.3%)	1050 (23.1%)	27 482 (23.3%)
Missing	2 (0.0%)	5 (0.1%)	88 (0.1%)
Major teaching hospital, *n* (%)			
Yes	255 (5.2%)	372 (8.2%)	7299 (6.2%)
No	4627 (94.8%)	4179 (91.8%)	110 490 (93.8%)
Ownership, *n* (%)			
For-profit	745 (15.3%)	885 (19.4%)	21 958 (18.6%)
Government	1258 (25.8%)	1006 (22.1%)	28 022 (23.8%)
Nonprofit	2879 (59.0%)	2660 (58.4%)	67 808 (57.6%)
Missing	0 (0%)	0 (0%)	1 (0.0%)
Net patient revenue (millions $)			
Mean (SD)	106 (161)	216 (387)	153 (260)
Median [min, max]	46.1 [−19.0, 2230]	85.2 [−9.9, 6420]	63.0 [−176, 6420]
Missing, *n* (%)	46 (0.9%)	101 (2.2%)	1663 (1.4%)
Other income: contributions (millions $)			
Mean (SD)	0.343 (2.39)	0.571 (4.39)	0.382 (2.79)
Median [min, max]	0.0 [−1.6, 71.7]	0.0 [−2.2, 196]	0.0 [−49.7, 196]
Missing, *n* (%)	86 (1.8%)	103 (2.3%)	2424 (2.1%)
Other income: government appropriations (millions $)			
Mean (SD)	1.31 (14.6)	2.06 (22.9)	1.65 (19.9)
Median [min, max]	0.0 [0.0, 434]	0.0 [−0.8, 761]	0.0 [−15.8, 948]
Missing, *n* (%)	86 (1.8%)	103 (2.3%)	2424 (2.1%)
Other income: investments (millions $)			
Mean (SD)	1.50 (5.05)	2.25 (17.3)	1.49 (8.33)
Median [min, max]	0.1 [−11.6, 127]	0.0 [−33.9, 680]	0.0 [−395, 709]
Missing, *n* (%)	86 (1.8%)	103 (2.3%)	2423 (2.1%)
Administrative expenses (millions $)			
Mean (SD)	17.3 (26.5)	39.1 (67.1)	26.2 (45.4)
Median [min, max]	7.9 [0.0, 354]	15.7 [0.1, 921]	10.8 [−5.4, 1850]
Missing, *n* (%)	0 (0%)	5 (0.1%)	114 (0.1%)
DSH adjustment (millions $)			
Mean (SD)	1.57 (3.83)	0.714 (1.50)	1.80 (4.35)
Median [min, max]	0.0 [0.0, 57.6]	0.1 [0.0, 26.5]	0.1 [0.0, 117]

The sample includes general short-term acute-care hospitals from the Healthcare Provider Cost Reporting Information System (HCRIS) during the stated time period. All financial variables (net patient revenue, income variables, administrative expenses, and Disproportionate Share Hospital [DSH] adjustment) were inflation adjusted to 2019 levels.
Abbreviations: max, maximum; min, minimum.

Appendix Figure S3. Capital, financial, and other assets comprised 43.4%, 30.5%, and 28.4% of total assets in 2000; in the year 2019, they comprised 39.0%, 35.5%, and 29.8%, respectively. In 2019, total capital assets were $476.9 billion, total financial assets were $434.4 billion, and total other assets were $363.9 billion. Net patient revenue, net expenses, and all other income also increased over this period, with patient revenue and expenses more so than other income. However, net patient revenue and net expenses sharply declined in 2020, while total assets and other income did not. Adjusting variables by total number of US hospital beds per year did not change descriptive trends.

Variation in total assets by level

When partitioning the variance in total assets using random intercepts at each hierarchical level (hospital, system, and HRR), 5.1% of the variation occurred between HRRs, 31.8% occurred between health care systems, and 86% occurred between hospitals (Figure 2). Accordingly, 94.9% of variation in total assets occurred within health care markets; 68.2% occurred within health systems. A small portion of the total variation (14.1%) occurred within individual hospitals across time.

Over time, variation in total assets between health care markets decreased (from 7.0% in 2000 to 4.0% in 2019), variation between health systems increased (from 30.5% to 34.8%), and variation between hospitals decreased (from 69.5% to 65.2%). When we incorporated state fixed-effects into the variance partition models, the results remained largely unchanged, except variation between health care markets decreased further (eg, for the overall model, to 2.8%; 1.7% in the 2019 year-specific model) (Appendix Table S1).

When we repeated the variance partition analysis mapping health systems to HRRs via a plurality of beds, there remained little variation between markets (5.4% in the all-years model), some variation between health systems (18.2%), and most variation between hospitals (85.7%) (Appendix Table S2).

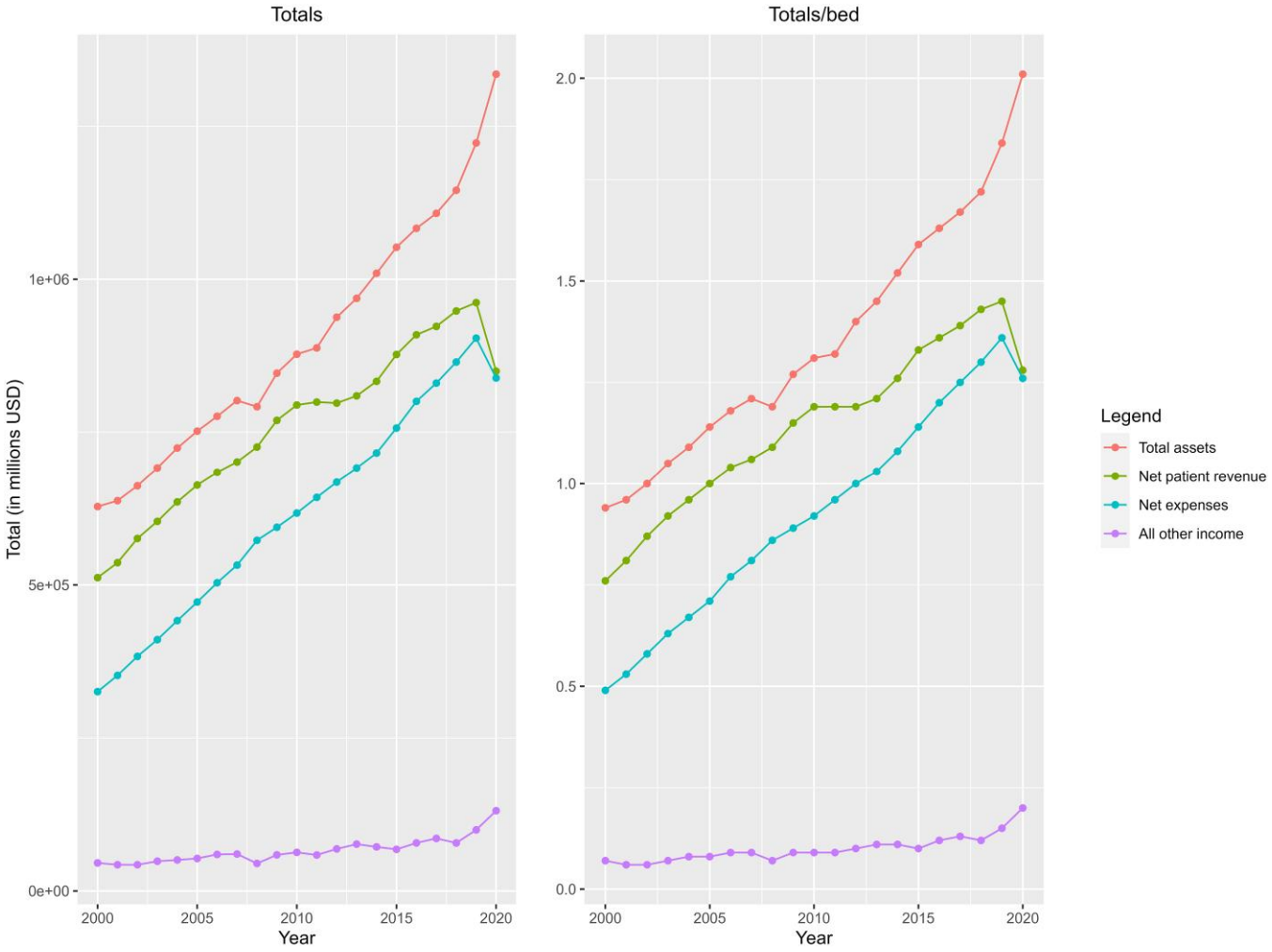

Figure 1. Total assets and other hospital financial measures, 2000–2019. The sample includes general short-term acute-care hospitals from the Healthcare Provider Cost Reporting Information System (HCRIS) during the stated time period. All variables were inflation adjusted to 2019 levels. In the right panel, variables were further adjusted by total number of beds in the sample as reported in HCRIS data for that year. Abbreviation: USD, US dollars.

Results were of a similar relative magnitude when using total assets per bed as the outcome (Appendix Table S3).

Factors associated with growth in hospital assets

Of the increase in total assets held by short-term acute care hospitals between 2000 and 2019, 47.2% was attributable to the "explained" KOB component and 52.8% to the "unexplained" component (Table 2). That is, 47.2% of the increase in total assets was associated with changes in the values of the predictors (hospital financial and operating characteristics), holding the relationships between them (coefficients) constant. In contrast, 52.8% of the increase in total assets was associated with changes in the predictors' coefficients or with unmeasured factors not included in the analysis. After accounting for hospital size (decreases in the number of small hospitals and increases in the number of large hospitals contributed 41.3% to the overall explained change in total assets), lagged (3-year) total assets was the greatest factor in the explained component, contributing 11.1% of the total change.

Unmeasured factors were the main contributor to the unexplained decomposition component (56.3%). The decomposition coefficients for the unexplained component indicate how the relationship of the predictor with the outcome is changing over time. The coefficient for lagged total assets decreased between 2000 and 2019, indicating that lagged assets were less strongly associated with total assets in 2019 vs 2000. The coefficient on net patient revenue was also negative, indicating a weaker association in 2019 vs 2000. In contrast, administrative expenses and hospital government and nonprofit ownership have positive coefficients, indicating they were more strongly associated with total assets in 2019 vs 2000 (Table 2). Of note, the coefficient on urbanicity is negative due to the negative association between rural locale and total assets increasing over the study time period. (See Appendix Table S4 for the full results of the KOB component regression models.)

In stratified analyses, mean total assets increased from $669 million in 2000 to $1.62 billion in 2019 for wealthy hospitals, from $198 million to $442 million for safety-net hospitals, and from $30 million to $56 million for critical-access hospitals. For wealthy hospitals, 69.2% of the change in assets was explained by known covariates, of which lagged total assets (43.7%) was the biggest contributor; net patient revenue was the second-greatest contributor (30.3%) (Appendix Table S5). Lagged total assets was also the greatest contributor for safety-net hospitals (37.7%), followed by net patient revenue (26.7%); known covariates explained 57.4% of the total change

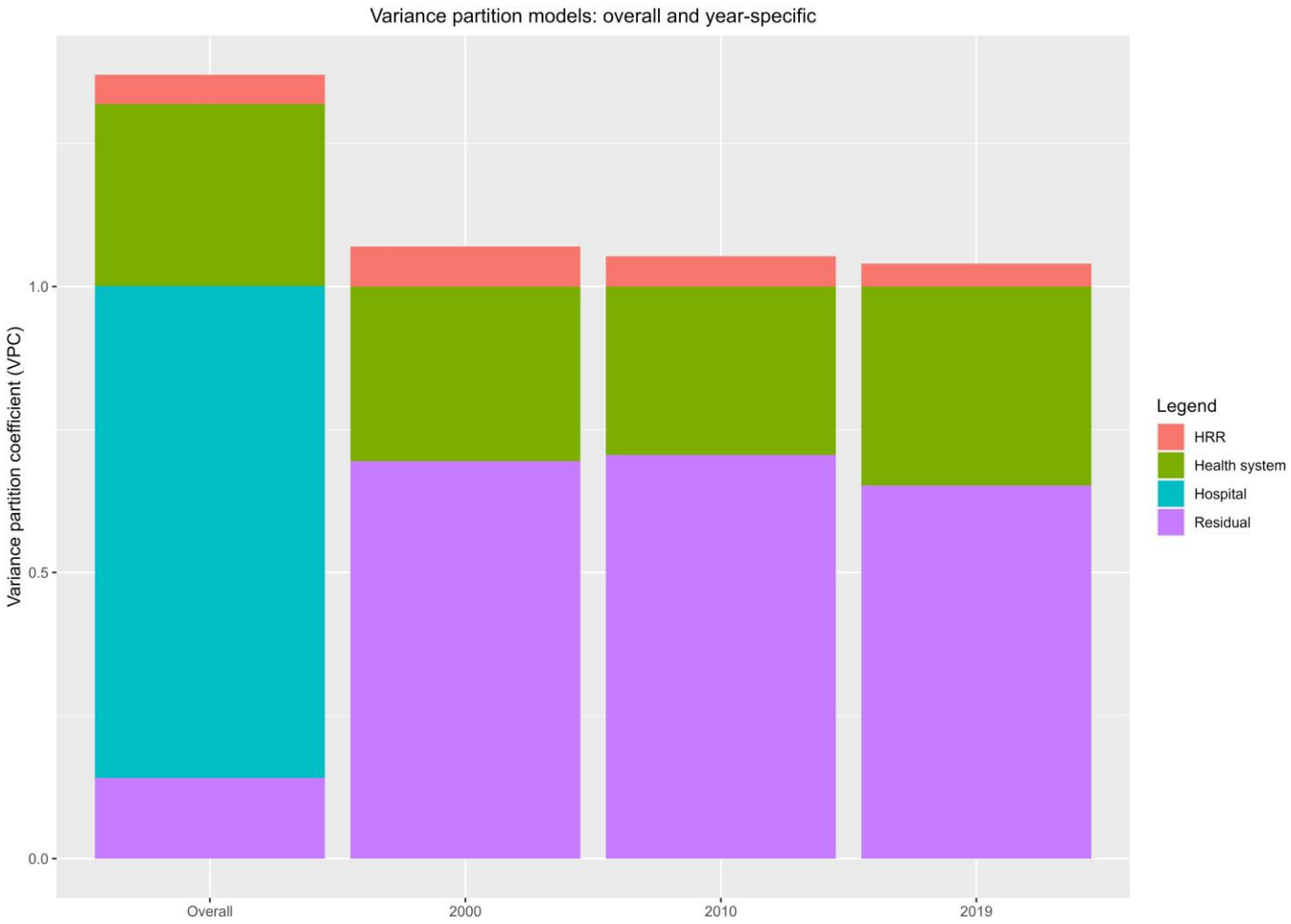

Figure 2. Variation in total assets by level, overall and year-specific. All financial variables were inflation adjusted to 2019 levels. Hospitals were assigned to health care systems via the Agency for Healthcare Research and Quality Compendium of US Health Systems identifier contained in the Healthcare Provider Cost Reporting Information System (HCRIS) data, reflecting system membership as of 2018. Hospitals were assigned to health care markets using the Dartmouth Atlas of Health Care's hospital referral regions (HRRs) as identified in the American Hospital Association (AHA) survey. In our primary analyses, hospitals were assigned to HRRs independently (eg, 2 hospitals within the same system may be located in different HRRs) based on their zip code.

in assets (Appendix Table S6). For critical-access hospitals, 66.6% of the change in total assets was explained by known covariates; DSH payments were the largest contributor (24.1%) (Appendix Table S7). For all stratified decompositions, the largest contributor was from factors not included in the model.

When we repeated the KOB decomposition using balanced panel data and data from 2010–2019 to check for robustness against Cost Report reporting changes, results were largely unchanged (Appendix Tables S8 and 9). When we repeated the KOB decomposition using total assets scaled by number of beds as the outcome, results were similar: lagged assets are the most important endowments factor, and unmeasured factors not included in the analysis are the main contributor to the coefficients component (Appendix Table S10). Finally, when we repeated the variance analysis and KOB decomposition for the period 2008–2019 using the AHA health system data, there was a modest effect of health system affiliation on total assets (4.49% of the endowments component), and the importance of system affiliation is somewhat increasing over time (the coefficient is positive), but this effect is small compared with unmeasured factors (2.72% vs 55%) (Appendix Tables S11 and 12). The remainder of our results were unchanged.

Discussion

In this study, we explored variation and changes over time in a previously understudied dimension of hospital wealth—total assets, which includes both capital assets (eg, land, buildings, equipment) and financial assets (eg, investments). Total assets among US hospitals grew from $750 billion to $1.6 trillion over the study period and outpaced the growth in other measures that are typically considered drivers of hospital wealth, such as net patient revenue. When we decomposed the variation in assets across time and hierarchy, we found that the majority of variation occurred between hospitals. This suggests that health care markets (and, to a lesser extent, health care systems) contain both wealthy and poor hospitals, rather than hospitals in certain markets systematically having more assets than hospitals in other markets.

Furthermore, hospitals that had high assets at the start of the study period were likely to continue to have high assets, and vice versa. When we decomposed the increase in assets between 2000 and 2019, outside of hospital size, a lagged measure of the sum of historical assets was the most important correlate. This was especially true for wealthy hospitals, where lagged assets comprised almost half of the explained component. However, the strength of the association between both lagged assets and

Table 2. Kitagawa-Oaxaca-Blinder decomposition, increase in total assets: 2000–2019.

Variable	Coefficient[a]	*P*	(95% CI)	% Share
Summary				
Endowments	6.88	.000	(6.88, 6.88)	47.2%
Coefficients	7.71	.000	(7.71, 7.71)	52.8%
Endowments				
Net patient revenue	−184.0	.000	(−184.0, −184.0)	7.3%
Other income (investments)	−7.7	.000	(−7.7, −7.7)	0.3%
Other income (contributions)	7.2	.000	(7.2, 7.3)	0.3%
Other income (government appropriations)	−6.0	.000	(−6.1, −6.0)	0.2%
Administrative expenses	−208.0	.000	(−208.0, −208.0)	8.3%
DSH adjustment	−52.2	.000	(−52.2, −52.2)	2.1%
Major teaching hospital	−50.6	.000	(−50.7, −50.5)	2.0%
Ownership: government	100.0	.000	(100.0, 100.0)	4.0%
Ownership: for-profit	209.0	.000	(208.0, 209.0)	8.3%
Ownership: nonprofit	19.2	.000	(19.1, 19.2)	0.8%
Size: >300 beds	−34.4	.000	(−34.5, −34.3)	13.7%
Size: 100–300 beds	17.2	.000	(17.1, 17.2)	6.8%
Size: <100 beds	69.5	.000	(69.4, 69.5)	27.6%
Urbanicity	59.9	.000	(59.8, 60.1)	2.4%
HHI (market concentration)	−124.0	.000	(−124.0, −124.0)	4.9%
Lagged total assets (3 y)	−278.0	.000	(−278.0, −278.0)	11.1%
Coefficients				
Net patient revenue	−12.7	.000	(−12.7, −12.7)	6.1%
Other income (investments)	0.01	.000	(0.01, 0.01)	0.1%
Other income (contributions)	0.07	.000	(0.07, 0.07)	0.3%
Other income (government appropriations)	−0.001	.000	(−0.001, −0.001)	0.0%
Administrative expenses	0.91	.000	(0.91, 0.91)	4.4%
DSH adjustment	−0.18	.000	(−0.18, −0.18)	0.9%
Major teaching hospital	0.11	.000	(0.11, 0.11)	0.5%
Ownership: government	0.85	.000	(0.85, 0.85)	4.1%
Ownership: for-profit	−0.62	.000	(−0.62, −0.62)	3.0%
Ownership: nonprofit	0.30	.000	(0.30, 0.30)	1.4%
Size: >300 beds	0.32	.000	(0.32, 0.32)	1.6%
Size: 100–300 beds	−0.57	.000	(−0.57, −0.57)	2.7%
Size: <100 beds	−0.57	.000	(−0.57, −0.57)	2.7%
Urbanicity	−1.67	.000	(−1.67, −1.66)	8.0%
HHI (market concentration)	−.066	.000	(−0.66, −0.66)	0.3%
Lagged total assets (3 y)	−1.59	.000	(−1.59, −1.59)	7.7%
Intercept	11.7	.000	(11.7, 11.7)	56.3%

All financial variables were inflation adjusted to 2019 levels. Percentage share in the above table shows that 47.2% of the change in total assets from 2000 through 2019 is explained by changes in the levels of predictors; 52.8% is due to changes in the relationships of these predictors with total assets (eg, changes in their coefficients) or due to unmeasured factors. Of the unexplained component, unmeasured factors not included in the analysis is the largest contributor (56.3%, given by the intercept).
[a]All coefficients and 95% CIs have units of scientific notation e + 7.
Abbreviations: DSH, Disproportionate Share Hospital; HHI, Herfindahl-Hirschman Index.

total assets waned over the study period. Instead, increasing administrative expenses and ownership (decreasing government ownership and increasing nonprofit ownership) were both more strongly associated with increased assets in 2019 vs 2000.

Our findings indicate that poor hospitals tended to remain relatively poor over time, and wealthy hospitals tended to remain wealthy (or get wealthier), suggesting a pattern of cumulative advantage or disadvantage in hospital financing. These patterns are consistent with recent evidence on resource allocation to hospitals. In 2020, the Coronavirus Aid, Relief, and Economic Security Act distributed over $180 billion primarily based on expected income loss, disproportionately sending funds to hospitals in relatively strong financial positions.[14-18] While a variety of federal subsidies are designed to support less wealthy hospitals, they are often suboptimally targeted.[37,38] These forces may be contributing to the patterns in this study, which suggest an entrenchment of financial resource allocation across US hospitals that has persisted over time.

Our decomposition analysis also reveals changes in the relationship between common measures of hospital financial performance and assets, and that currently unmeasured factors will be key to understanding the growth of hospital assets over time. There are several possible explanations for these unmeasured factors, which may include alternative sources of health system income and mechanisms of asset capture through health system consolidation. Some have attributed growth in hospital financial assets to a series of decisions by the Internal Revenue Service, culminating in the 1998 Revenue Ruling 98-15, which allowed nonprofit hospitals to establish large for-profit subsidiaries for the first time.[10,36] Hospitals with these subsidiaries may engage in financial strategies outside of patient care, including stock market investments,[14] although, in practice, only large nonprofit medical centers may have the resources to extensively pursue such investments.[10,37] These sources of income are likely not captured in our analysis, and would be consistent with our finding that the importance of nonprofit hospital status has increased over time in terms of its explanatory contributions for

the growth in assets. Moreover, increasing health system consolidation, wherein more hospitals are affiliated with health systems, could drive increasing assets via multiple mechanisms. Consolidation may change how individual hospitals are able to access and grow assets. For instance, assets that are held at a health system level may be flexibly used and/or invested among affiliated members. Hospitals also could gain new access to public subsidies or capital markets. Health systems may transfer assets from 1 hospital in a system to or from another hospital that may have been acquired or closed.[37] While there is currently no national source of accounting data that delineates financial performance at the hospital vs health-system level, this information will be crucial to understanding future trajectories of hospital wealth as hospital consolidation continues at a rapid pace.

Taken together, these findings offer a new dimension on understanding hospital financial resources and highlight opportunities to improve the targeting of policies designed to support financially struggling hospitals. First, policymakers might consider targeting subsidies to hospitals in persistent financial poverty, as opposed to relying on year-to-year financial fluctuations to direct financial resources. Second, CMS might consider requesting more detailed information on the financial circumstances of hospitals to better capture potentially "hidden" dimensions of wealth. Data transparency will be key to better understanding hospital finances. Most of the growth in hospital assets remained unexplained by current data available on hospital finances, with the single largest contributor being unmeasured factors not included in the analysis. A bipartisan group of senators recently requested more information about community benefit-spending activities from nonprofit hospitals, suggesting that additional data-collection efforts on sources of wealth may be in line with existing efforts to promote financial transparency.[39,40]

This study has limitations. First, the HCRIS is intended for cost accounting. The data are not gold-standard audited financial statements and there are attendant concerns with data quality.[41] Thus, we focused our analyses on total assets, an HCRIS variable that has been shown to be 1 of the most reliable financial indicators in external validation studies.[25] Second, this analysis focused on assets held at the hospital level. Depending on a health system's financial practices, some or all assets may be held or administered at the health-system level. To mitigate this possibility, we excluded hospitals with implausibly high assets (defined as hospitals with greater than 20 times the amount as the next highest asset holding hospital with a similar number of beds in the same geographic region) and hospitals with exactly duplicated values within health care systems for a given year. We were unable to fully control for time-varying hospital-system affiliation in our findings due to data limitations. Future work could leverage audited financial statements, which report at the entity level, to explore health systems as the unit of analysis. Third, we used only 1 definition for health care markets and our results may be sensitive to alternative definitions. Finally, there may be censoring in the study sample. Hospitals that suffered financial insults so severe that they closed were no longer captured in the data, which could have influenced our results. We hypothesize that the bias resulting from this would lead facilities in systems to look more similar over time as hospitals in precarious financial positions closed.

Conclusion

Hospital assets, a previously understudied aspect of hospital finances, have more than doubled over the past 2 decades. This growth has outpaced that of net patient revenue, and variation in hospital assets is largely driven by between-hospital differences. While some of the growth in hospital assets can be explained by existing measures of hospital financial inputs, the majority of growth remains unexplained by current measures. Results suggest evolving within-market, hospital-level dynamics that should be explored further in future research.

Supplementary material

Supplementary material is available at *Health Affairs Scholar* online.

Funding

W.L.S. and P.C. were supported by the Laura and John Arnold Foundation, grant no. 21-06179; S.T. was supported by the US National Library of Medicine, grant no. F31LM013403.

Conflicts of interest

Please see ICMJE form(s) for author conflicts of interest. These have been provided as supplementary materials.

Notes

1. Himmelstein G, Himmelstein KEW. Inequality set in concrete: physical resources available for care at hospitals serving people of color and other U.S. Hospitals. *Int J Health Serv*. 2020;50(4):363-370.
2. Gaffney A, McCormick D, Bor D, Woolhandler S, Himmelstein DU. Hospital capital assets, community health, and the utilization and cost of inpatient care: a population-based study of US counties. *Med Care*. 2024;62(6):396-403.
3. Qi K, Jiang X, Bai G. Land, buildings, and equipment acquisitions in U.S. Hospitals: a fifteen-year perspective. *PLoS One*. 2022;17(8):e0272370.
4. Appelbaum E, Batt R. Financialization in health care: the transformation of US hospital systems. Center for Economic and Policy Research; 2021. p. 104. Accessed May 16, 2023. https://cepr.net/publications/working-paper-financialization-in-health-care-the-transformation-of-us-hospital-systems/
5. Pomorski C. The death of Hahnemann hospital. The New Yorker. 2021 May 31;87.
6. Thomas K, Silver-Greenberg J. How a hospital chain used a poor neighborhood to turn huge profits. The New York Times. 2022 Sep 24;A1.
7. Beaulieu ND, Dafny LS, Landon BE, Dalton JB, Kuye I, McWilliams JM. Changes in quality of care after hospital mergers and acquisitions. *N Engl J Med*. 2020;382(1):51-59.
8. Beaulieu ND, Chernew ME, McWilliams JM, et al. Organization and performance of US health systems. *JAMA*. 2023;329(4):325-335.
9. Liu JL, Levinson ZM, Zhou A, Zhao X, Nguyen P, Qureshi N. Environmental scan on consolidation trends and impacts in health care markets. RAND Corporation; 2022. Accessed December 1, 2023. https://www.rand.org/pubs/research_reports/RRA1820-1.html
10. Hasnain-Wynia R, Baker DW, Nerenz D, et al. Disparities in health care are driven by where minority patients seek care: examination of the hospital quality alliance measures. *Arch Intern Med*. 2007;167(12):1233-1239.
11. Dimick J, Ruhter J, Sarrazin MV, Birkmeyer JD. Black patients more likely than whites to undergo surgery at low-quality hospitals in segregated regions. *Health Aff (Millwood)*. 2013;32(6):1046-1053.

12. Bonner SN, Kunnath N, Dimick JB, Ibrahim AM. Hospital-Level racial and ethnic segregation among Medicare beneficiaries undergoing common surgical procedures. *JAMA Surg*. 2022;157(10):961-964.
13. Appelbaum E, Batt R. Curbing inequities in the distribution of emergency relief. Center for Economic and Policy Research; 2022. p. 28. https://cepr.net/publications/curbing-inequities-in-the-distribution-of-emergency-relief-lessons-from-the-cares-act-in-health-care/
14. Cantor J, Qureshi N, Briscombe B, Chapman J, Whaley CM. Association between COVID-19 relief funds and hospital characteristics in the US. *JAMA Health Forum*. 2021;2(10):e213325.
15. Grogan CM, Lin Y-A, Gusmano MK. Unsanitized and unfair: how COVID-19 bailout funds refuel inequity in the US Health Care System. *J Health Polit Policy Law*. 2021;46(5):785-809.
16. Schwartz K, Damico A. Distribution of CARES Act funding among hospitals. Kaiser Family Foundation; 2000 May 13. Accessed May 16, 2023. https://www.kff.org/coronavirus-covid-19/issue-brief/distribution-of-cares-act-funding-among-hospitals/
17. Liss S. Healthcare Dive. Nonprofit health systems — despite huge cash reserves — get billions in CARES funding. Accessed May 17, 2023. https://www.healthcaredive.com/news/nonprofit-health-systems-despite-huge-cash-reserves-get-billions-in-car/580078/?:%202020-06-23%20Healthcare%20Dive%20%5Bissue:28080%5D. 2020.
18. Drucker J, Silver-Greenberg J, Kliff S. Wealthiest hospitals got billions in bailout for struggling health providers. The New York Times. 2020 May 25; A1.
19. Himmelstein G, Ceasar JN, Himmelstein KE. Hospitals that serve many Black patients have lower revenues and profits: structural racism in hospital financing. *J Gen Intern Med*. 2022;38(3):586-591. https://doi.org/10.1007/s11606-022-07562-w
20. Burns LR, Pauly MV. Big Med's spread. *Milbank Q*. 2023;101(2):287-324.
21. White C. RAND Hospital data: web-based tool. RAND Corporation; 2018. Accessed May 17, 2023. https://www.rand.org/pubs/tools/TL303.html
22. AHA annual survey databaseTM | AHA data. Accessed February 17, 2023. https://www.ahadata.com/aha-annual-survey-database
23. Furukawa MF, Machta RM, Barrett KA, et al. Landscape of health systems in the United States. *Med Care Res Rev*. 2020;77(4):357-366.
24. Weinstein JN. Appendix on the geography of health care in the United States. In: Birkmeyer JD, eds. *The Dartmouth Atlas of Musculoskeletal Health Care: the Center for the Evaluative Clinical Sciences and the Center for Outcomes Research and Evaluation*: American Hospital Publishing, Inc; 2000:289–307.
25. Ozmeral AB, Reiter KL, Holmes GM, Pink GH. A comparative study of financial data sources for critical access hospitals: audited financial statements, the Medicare cost report, and the Internal Revenue Service form 990. *J Rural Health*. 2012;28(4):416-424.
26. Bai G, Anderson GF. A more detailed understanding of factors associated with hospital profitability. *Health Aff*. 2016;35(5):889-897.
27. Centers for Medicare and Medicaid Services (CMS). Disproportionate Share Hospital (DSH). Accessed August 8, 2024. https://www.cms.gov/medicare/payment/prospective-payment-systems/acute-inpatient-pps/disproportionate-share-hospital-dsh
28. Fulton BD. Health care market concentration trends in the United States: evidence and policy responses. *Health Aff*. 2017;36(9):1530-1538.
29. US Department of Agriculture - Economic Research Service. Documentation. 2020. Accessed May 18, 2023. https://www.ers.usda.gov/data-products/rural-urban-continuum-codes/documentation/#background
30. Goldstein H, Browne W, Rasbash J. Partitioning variation in multilevel models. *Understanding Stat*. 2002;1(4):223-231.
31. Leyland AH, Groenewegen PP. Apportioning variation in multilevel models. In: Leyland AH, Groenewegen PP, eds. *Multilevel Modelling for Public Health and Health Services Research: Health in Context*. Springer International Publishing; 2020:89-104.
32. Jann B. A Stata implementation of the Blinder-Oaxaca decomposition. *Stata J*. 2008;8(4):453-479.
33. Rahimi E, Hashemi Nazari SS. A detailed explanation and graphical representation of the Blinder-Oaxaca decomposition method with its application in health inequalities. *Emerg Themes Epidemiol*. 2021;18(1):12.
34. Bauer T, Gohlmann S, Sinning M. Gender differences in smoking behavior. *Health Econ*. 2007;16(9):895-909.
35. Park TA, Lohr L. A Oaxaca–Blinder decomposition for count data models. *Appl Econ Lett*. 2010;17(5):451-455.
36. Yun M-S. Decomposing differences in the first moment. *Econ Lett*. 2004;82(2):275-280.
37. Chatterjee P, Sinha S, Reszczynski O, Amin A, Schpero WL. Variation and changes in the targeting of Medicaid disproportionate share hospital payments. *Health Aff*. 2022;41(12):1781-1789.
38. Schpero WL, Chatterjee P. Structural racial disparities in the allocation of disproportionate share hospital payments. *JAMA Netw Open*. 2022;5(11):e2240328.
39. Senator Chuck Grassley, Chairman, Finance Committee. Grassley to Colleagues: rules for non-profit hospitals need scrutiny. Accessed August 15, 2023. https://www.grassley.senate.gov/news/news-releases/grassley-colleagues-rules-non-profit-hospitals-need-scrutiny
40. Halleman, Sydney. Healthcare Dive. 2023 Aug 9. Senators crack down on nonprofit hospitals' charity care, tax-exempt status. Accessed August 15, 2023. https://www.healthcaredive.com/news/senators-letter-nonprofit-hospitals-charity-care-tax-exempt-status/690394/.
41. Kane NM, Magnus SA. The Medicare cost report and the limits of hospital accountability: improving financial accounting data. *J Health Polit Policy Law*. 2001;26(1):81-106.