CONNECTICUT
Health Strategy

Impacts of Connecticut Hospital and Health Care System Consolidation (2016-2021)

A report prepared by Altarum
on behalf of the
Office of Health Strategy
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Acronym Glossary

APCD	All-Payer Claims Database
AAGR	Average Annual Growth Rate
CON	Certificate of Need
CAGR	Compound Annual Growth Rate
CPR	Connecticut Planning Region
CPT	Current Procedural Terminology
DRG	Diagnosis-Related Group
HHI	Herfindahl-Hirschman Index
HDD	Hospital Discharge Database
MCR	Medicare Cost Reports
MDC	Major Diagnostic Code
OHS	Office of Health Strategy
PSA	Primary Service Area

Glossary

Acute care hospital: A type of hospital providing short-term urgent care and emergency services to a broad array of patients.

All-Payer Claims Database (APCD): A set of data provided by the Office of Health Strategy of inpatient, outpatient, physician, and pharmaceutical medical claims from individuals treated in Connecticut.

Average annual growth rate (AAGR): A measure of a change in an outcome over time, as an average of the period's annual growth rates.

Certificate of Need (CON): Referring to laws and applications that trigger State regulatory mechanisms that approve major capital expenditures and projects for certain new health care facilities.

Compound annual growth rate (CAGR): A measure of average change in an outcome from the first year to the final year of study, annualized.

Commercial/Private Insurance: Health insurance offered by private health insurers, as opposed to government-run insurance programs. Coverage is typically provided through an employer or union or purchased by an individual directly from the insurance company.

Contribution Margin (Margin): A measure of how much money a company is making (revenue) on its products or services after subtracting all the costs involved.

Current Procedural Terminology (CPT): A system of medical codes used to categorize patients based on the type of procedure they receive. Billed and paid amounts in medical claims are often set individually for each CPT code. *CPT Copyright 2024 American Medical Association. All rights reserved. CPT® is a registered trademark of the American Medical Association.*

Diagnosis-Related Group (DRG): A system used to classify hospital inpatient care and used to define payment amounts.

Health care price: The amount paid to a health care provider by payers and patients for each healthcare service.

Health care spending: The amount spent on health care and related activities. It is a function of health care utilization and prices and is expressed as: Spending = Prices x Utilization.

Health care utilization: The use of health care services, often measured as the number of services used or number of visits.

Herfindahl-Hirschman Index (HHI): A calculation of the concentration of a market, based on the number of competitors and their size. Reported on a scale of 1 to 10,000.

Hospital charges: The initial prices asked by a provider for their services, also known as the "list price." Payers usually negotiate these charges lower.

Horizontal consolidation: A merger or purchase that occurs between two organizations in the same industry (such as one hospital system buying another hospital).

Hospital Discharge Database (HDD): A set of data provided by the Office of Health Strategy that summarizes the cost and treatment of all hospital discharges, by hospital and region in Connecticut

between 2016 and 2021. The discharge database measures visit costs as Total Charges, which include the total initial billed amounts from a hospital. Insurers typically negotiate these charges to lower "paid amounts."

Hospital negotiated prices: The final price paid to a provider for their services, after negotiations between payers and providers.

Market power: A company or organization's ability to negotiate a more favorable price for a good or service within a market. Greater market power can include increasing prices for services they sell or decreasing prices for goods and services they use.

Medicare Cost Reports (MCR): Data submitted by hospitals and health care facilities to the Centers for Medicare and Medicaid Services, reporting on hospital financial and operational outcomes.

Operating margin: For a health care company, the margin from activities related to patient care. Operating margin excludes other revenues like investment income and other costs like construction expenditures.

Price index: A way to measure how prices change over time for a given set of goods or services. We use it in these analyses to measure overall price growth across many health care services at the same time.

Vertical consolidation: A purchase by a company or organization of another business who offers a product or service that is an input or is part of the supply chain (such as a hospital buying a physician group practice or hiring-away individual physicians).

Executive Summary

Over the past decade, Connecticut has experienced hospital and health care consolidation. During this period, four large health systems acquired or partnered with smaller hospitals and local physician group practices. When smaller, previously independent facilities combine with major health systems, markets become less competitive. As such, less competition can result in increased health care costs and prices for consumers. Residents in affected regions also may have fewer independent choices for health care services. Additionally, patients who are uninsured, paying out-of-pocket, or have private insurance are often the most affected.

The Office of Health Strategy and Altarum analyzed the impact of hospital and health care system consolidation in Connecticut between 2013 and 2019 on health care utilization, spending, and prices from 2016 to 2021. We compared trends for hospitals and regions where hospital consolidation occurred to those where it did not. We collected and analyzed data from State databases on hospital discharges and medical claims—the CT Hospital Discharge Database (HDD) and All-Payer Claims Database (APCD)—to inform this study.

First, we identified Connecticut hospital system mergers, acquisitions, or affiliations with other hospitals and large physician practices between 2013 and 2019. We then determined which of these transactions led to fewer choices for patients and greater market power for hospitals. In addition, we measured trends in economic outcomes including health care prices, spending, service utilization, and facility operating outcomes. Finally, we examined how those trends changed for hospitals and regions that gained market power compared to the rest of the State.

Hospital consolidation from 2013 to 2019 increased market power for hospitals and systems in seven of the nine Connecticut regions between 2016 and 2021. When hospitals and systems gained market power, the prices for health care services rose faster at those facilities compared to those whose market power did not increase. This faster price growth occurred for both inpatient and outpatient services.

Key Report Findings

- Between 2013 and 2021 hospital consolidation in Connecticut caused twelve hospitals (*Charlotte Hungerford, Danbury, Hartford, Johnson Memorial, Midstate Medical, Norwalk, Saint Francis, Saint Mary's, Saint Vincent's Medical, Central Connecticut, William W. Backus, and Windham Community Memorial*) to have fewer competitors and greater market power.
- Faster price growth for inpatient and outpatient hospital care was observed among hospitals impacted by consolidation. This was especially true for prices paid by private insurers.
- A greater use of some high-profit services and less use of some low-profit services was observed among hospitals impacted by consolidation.
- Smaller differences were observed in consolidating entities in the overall amount of care provided, average length of stay, the types of patients receiving care, and physician prices, providing evidence that consolidation did not substantially impact these outcomes.
- Hospitals impacted by consolidation had comparatively better operating margin trends.

While hospitals with greater market power provided an increased number of high-profit services such as cardiac and musculoskeletal care, use of certain low-profit services such as pregnancy/childbirth and behavioral health care services decreased at a faster rate.

Hospitals that experienced consolidation had small differences in growth in overall bed occupancy rates and reported smaller declines in operating margins over this period. These favorable financial outcomes may have been due to greater revenues or lower expenses.

We also analyzed changes in the overall number of hospital visits (measured as discharges), the average length of stay, and the mix of patients receiving care (e.g., Medicaid vs. private insurance patients), and professional claims and physician service prices. The differences in outcomes between the hospitals gaining market power and those that did not were much smaller for these measures. In Connecticut, these smaller differences provide evidence it is less likely that consolidation affected these outcomes. Differences in changes in professional claims or physician services prices between those impacted by consolidation and those not impacted were also small and price growth trends were observed to be generally similar across the two groups.

Consolidation Definitions

Horizontal Consolidation: a merger or acquisition that occurs between two organizations in the same industry. For example, one hospital system buying or affiliating with another hospital.

Vertical Consolidation: the purchase or affiliation of an organization that offers a product or service as an input or part of the supply chain. For example, a hospital buying a physician group practice or hiring individual physicians.

In summary, we observed faster increases in health care prices and greater use of "high profit" health care services during the study period among hospitals impacted by consolidation. Conversely, consolidation did not appear to contribute to changes in the total amount of care provided or types of patients accessing care, based on smaller observed differences in these measured trends.

This study has several limitations. While a longitudinal study, the period analyzed was only a five-year time period. The study period overlapped in part with the COVID-19 pandemic, disrupted and impacted health sector trends (e.g., overall spending, access, and utilization). Due to the small sample size of hospital mergers over this five-year period, we were unable to conduct statistical analysis of observed differences. Lastly, given the sample of mergers is specifically focused on one state, this study is not necessarily generalizable to other states or periods of time.

To produce the best study of consolidation impacts given the inherent limitations, we compared trends over time in consolidated versus non-consolidated hospitals. Even with this approach, other factors could have affected differences in the health economic trends between hospitals. Therefore, these results should be considered alongside additional research on hospital consolidation impacts linked in the background and conclusion report sections.

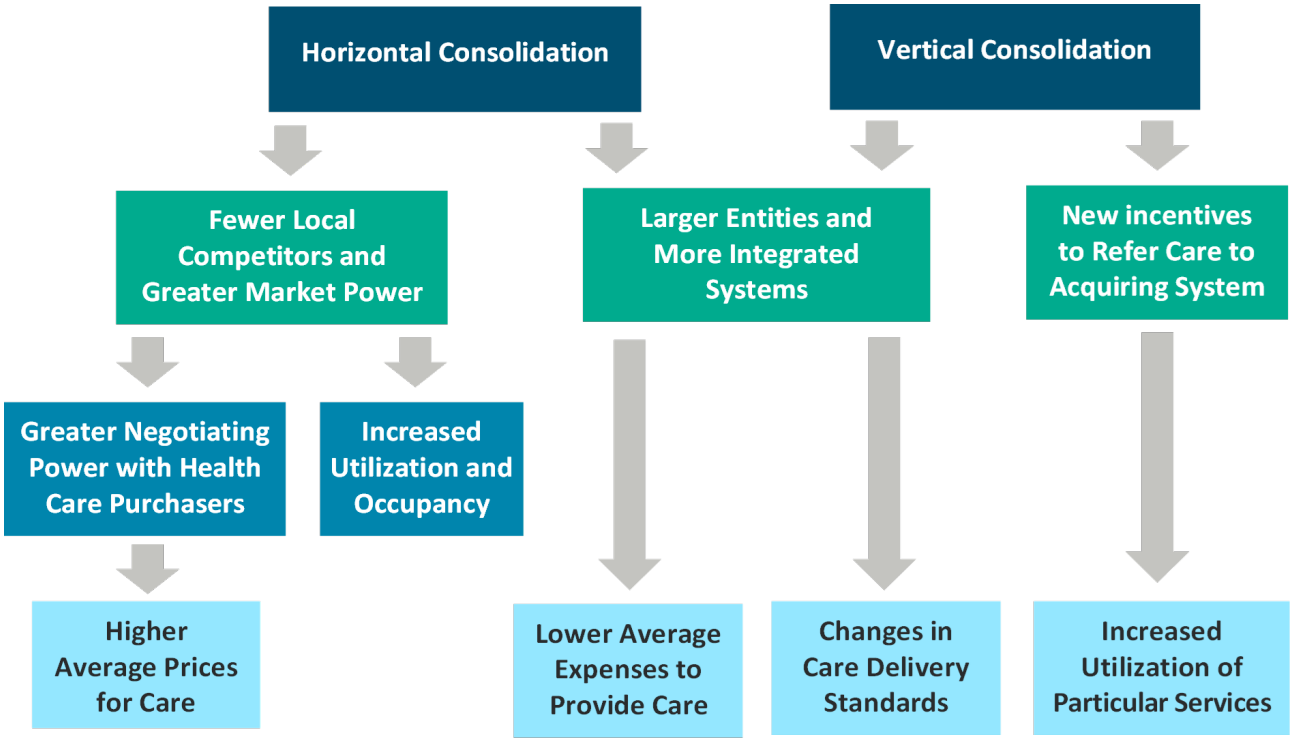
Background on Health Care and Hospital Consolidation

Health care consolidation can result from mergers, acquisitions, partnerships, or affiliations between different health care businesses. There are two primary types of consolidation: *horizontal consolidation* and *vertical consolidation.* Each can affect patient outcomes and health economic trends. Prior research

has found health care consolidation leads to increases in the prices charged to patients and insurers,[1] and greater costs of care.[2] Consolidation has also been associated with some decreased expenses to run facilities (**Figure 1**).[3]

There is some evidence that hospital mergers can decrease costs of delivering care by reducing operating and non-operating expenses.[4] Cost savings could result from larger systems removing redundancies in non-operating activities such as administrative costs.[5] Decreased costs may be an effect of hospitals slowing the rate of pay increases for health care workers.[6] Horizontal consolidation is also associated with lower wages for health care workers.[6] This decreases overall costs for providing care, but at the expense of decreased earnings for employees.[6]

Figure 1: Flowchart of Consolidation Impacts



[1] Vita, M.G. & Sacher, S. (2001). The competitive effects of not-for-profit hospital mergers: A case study. *The Journal of Industrial Economics*, *49*, 63-84. https://doi.org/10.1111/1467-6451.00138

[2] Cooper, Z., Craig, S. V., Gaynor, M., & Van Reenen, J. (2019). The price ain't right? Hospital prices and health spending on the privately insured. *The Quarterly Journal of Economics, 134*(1), 51–107. https://doi.org/10.1093/qje/qjy020

[3] Schmitt, M. (2017). Do hospital mergers reduce costs? *Journal of Health Economics, 52*, 74-94. https://www.sciencedirect.com/science/article/abs/pii/S0167629617300930

[4] Craig, S. V., Grennan, M., & Swanson, A. (2021). Mergers and marginal costs: New evidence on hospital buyer power. *The RAND Journal of Economics, 52*(1), 151-178. https://onlinelibrary.wiley.com/doi/abs/10.1111/1756-2171.12365

[5] Kaul, A., Prabha, K.R., & Katragadda, S. (2016). Size should matter: Five ways to help healthcare systems realize the benefits of scale. *PwC*. www.strategyand.pwc.com/media/file/Size-should-matter.pdf

[6] Prager, E., & Schmitt, M. (2021). Employer consolidation and wages: Evidence from hospitals. *American Economic Review, 111*(2), 397-427. https://www.aeaweb.org/articles?id=10.1257/aer.20190690

Horizontal hospital mergers and acquisitions create larger systems and increased market power. Increased market power gives hospital systems more power in negotiations with payers such as businesses and insurers.[7] This is often associated with higher negotiated prices paid for hospital care and prices charged to consumers.[2] Higher negotiated prices have also been associated with increased overall hospital and health care spending. Higher prices are most often seen in care provided to privately insured patients (those who receive insurance from their employers or purchase their own insurance) as these prices are negotiated between hospitals and insurers.[8] Higher prices for care can occur for two primary reasons: 1) moving care from physician offices to hospital facilities can cause new facility fees, and/or 2) hospitals can negotiate higher prices with insurance companies. There is less of an impact on prices paid by public insurance (e.g., Medicare or Medicaid), as these prices are set by the government.

Hospital purchases of physician groups, affiliations with physicians, or the direct hiring of physicians from previously independent practices (vertical consolidation) is associated with different impacts including lower average expenses to provide care, changes in care delivery standards, and increased utilization of particular services.[9] There is mixed evidence regarding impacts on patient quality of care and access. Some studies have shown vertical integration of hospitals and physicians increases quality of care and patient access,[10] but that overall spending likely also increases.[11]

The impact of hospital mergers and affiliations on access,[12] utilization,[13] quality,[14] and equity[15] are less clear, with a mix of findings across multiple studies.[8] Hospital mergers could lead to larger, better coordinated systems that have greater care standardization. There is also increased coordination, efficiency, and financial stability associated with larger hospital systems, though there may be pressure to cut costs or produce greater financial returns once hospitals join larger systems. While there is

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[7] Devers, K. J., Casalino, L. P., Rudell, L. S., Stoddard, J. J., Brewster, L. R., & Lake, T. K. (2003). Hospitals' negotiating leverage with health plans: How and why has it changed? *Health services research*, *38*(1 Pt 2), 419–446. https://doi.org/10.1111/1475-6773.00123

[8] Liu, J. L., Levinson Z. M., Zhou A., Zhao X., Nguyen P., & Qureshi N. (2022). Environmental scan on consolidation trends and impacts in health care markets. *RAND Corporation*. https://www.rand.org/pubs/research_reports/RRA1820-1.html

[9] Sinaiko A. D., Curto V.E., Ianni K., Soto M., Rosenthal M.B. (2023). Utilization, steering, and spending in vertical relationships between physicians and health systems. *JAMA Health Forum, 4*(9), e232875. https://www.doi.org/10.1001/jamahealthforum.2023.2875

[10] Neprash H. T. (2020). Vertical integration likely increases spending, but does it also improve quality of care? *Journal of general internal medicine*, *35*(3), 630–632. https://doi.org/10.1007/s11606-019-05602-6

[11] Ho, V., Metcalfe, L., & Vu, L. et al. (2020). Annual spending per patient and quality in hospital-owned versus physician-owned organizations: An observational study. *Journal of General Internal Medicine, 35*, 649–655. https://doi.org/10.1007/s11606-019-05312-z

[12] O'Hanlon, C. E., Kranz, A. M., DeYoreo, M., Mahmud, A., Damberg, C. L., & Timbie, J. (2019). Access, quality, and financial performance of rural hospitals following health system affiliation. *Health Affairs*, *38*(12), 2095-2104. https://doi.org/10.1377/hlthaff.2019.00918

[13] Hayford T. B. (2012). The impact of hospital mergers on treatment intensity and health outcomes. *Health services research*, *47*(3 Pt 1), 1008–1029. https://doi.org/10.1111/j.1475-6773.2011.01351.x

[14] Beaulieu, N. D., Dafny, L. S., Landon, B. E., Dalton, J. B., Kuye, I., & McWilliams, J. M. (2020). Changes in quality of care after hospital mergers and acquisitions. *The New England journal of medicine*, *382*(1), 51–59. https://doi.org/10.1056/NEJMsa1901383

[15] Desai, S. M., Padmanabhan, P., Chen, A. Z., Lewis, A., & Glied, S. A. (2023). Hospital concentration and low-income populations: Evidence from New York State Medicaid. *Journal of health economics*, *90*, 102770. https://doi.org/10.1016/j.jhealeco.2023.102770

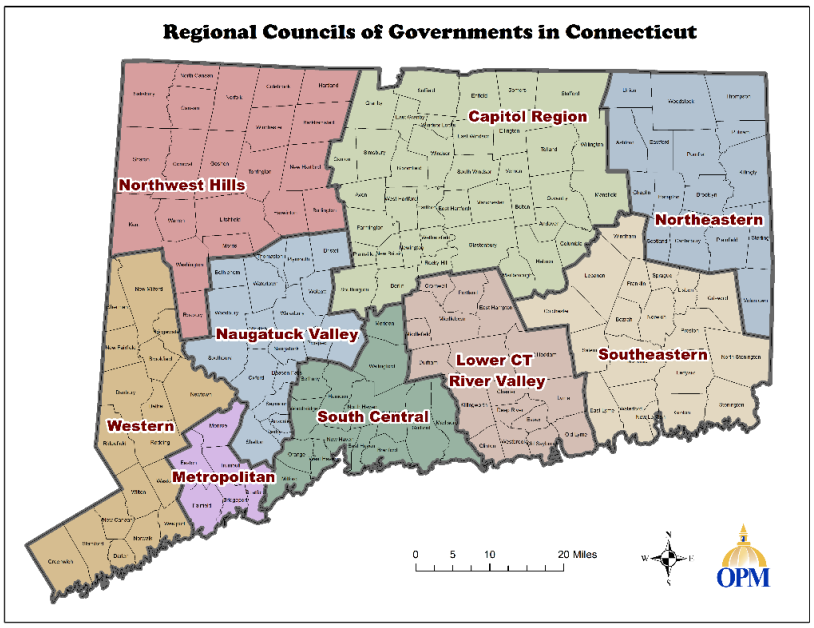
evidence for these affects related to coordination and efficiency, and stability, it is not as strong as the evidence on mergers' impacts on hospital prices.

Methodology

Connecticut Health Care Region Definitions

We used Connecticut Planning Regions (CPRs) to understand how health care consolidation affects outcomes. CPRs best represent the economic and population centers within the State where hospitals and health care providers compete for business. We defined hospital facility primary service areas (PSAs) based on Office of Health Strategy (OHS) City/Town definitions. We then mapped PSAs to each CPR region within the State. **Figure 2** shows the nine CPR regions used in the consolidation analyses: Capitol Region, Greater Bridgeport Region (also known as the Metropolitan Region), Lower Connecticut River Valley Region, Naugatuck Valley Region, Northeast Connecticut Region, Northwest Hills Region, South Central Region, Southeastern Connecticut Region, Western Connecticut Region.

Figure 2: Map of Regions for Hospital Markets, Defined by Connecticut Planning Regions (CPRs)



We conducted three types of analyses across the nine regions. First, we assessed overall competitiveness of each CT Planning region (CPR), based on the number of hospitals in each region and each hospital's relative size. Second, we examined changes in market power by determining which hospital systems' acquisitions and mergers led to increased market power by region over the period of study. There were two ways a hospital's market power could have been impacted by acquisitions and mergers over this period:

1. a hospital could have been acquired by a larger system that was already operating in its region and therefore have fewer competitors for its products and services.
2. other hospitals in an acquiring system who were already operating in the same region as a hospital that was acquired/affiliated, could also be impacted by having fewer competitors as a result of the merger of the previously competing hospital.

It is also important to note that a hospital could be acquired and not result in a change in a market's competitiveness, if the acquiring system was not already operating in that region. **Table 1** below details the set of hospital mergers and acquisitions and the table in **Appendix C** denotes which hospitals had a change in market power over the period of study and the cause of that change.

In a third and final analysis, we separately assess the impacts of vertical consolidation by measuring differences in changes in per-patient physician spending among physicians in groups that were acquired by hospitals over the period of study. Vertical consolidation is a result of the acquisitions of individual physicians and physician groups by health systems.

Analysis

Hospital Consolidation Market Analysis

Over the past decade the Connecticut hospital sector has consolidated smaller hospitals and major health systems through mergers and acquisitions. Between 2013 and 2019, the four large systems operating in the State either joined or purchased 14 different hospitals (**Table 1**). The resulting horizontal consolidation increased market power for many of the large systems.

Table 1: Connecticut Hospital Horizontal Mergers, Acquisitions and Affiliations (2013 to 2019) *

Year	System	Activity	Impacts on Regional Market Power
2013	Hartford Healthcare	Affiliation with William W. Backus Hospital	Increased market power for three Hartford system hospitals in the Southeastern and Northeast regions
2014	Trinity Health	Acquisition of Saint Francis Hospital	No impacts
2014	Western Connecticut Health Network	Affiliation with Norwalk Hospital	Increased market power for Norwalk and Danbury hospitals in the Western region
2015	Trinity Health	Acquisition of Saint Mary's Hospital and Johnson Memorial Hospital	Increased market power for Trinity Health hospitals in the Capitol and Naugatuck Valley regions
2015	Mayo Clinic	Middlesex Hospital joins Mayo Network	No Impacts
2016	Yale New Haven Health	Lawrence and Memorial Hospital merges with Yale-New Haven	No Impacts
2017	Hartford Healthcare	Charlotte Hungerford partners with Hartford Healthcare	Increased market power for Hartford Healthcare hospitals in the Northwest Hills region
2019	Nuvance Health	The merger of HealthQuest and Western Connecticut Healthcare creates Nuvance Health	No Impacts
2019	Hartford Healthcare	Acquires Saint Vincent's Medical Center	Increased market power for four Hartford Healthcare hospitals in

Year	System	Activity	Impacts on Regional Market Power
			the South Central and Naugatuck Valley regions

*Hospital consolidations as recorded by OHS and other publicly available data sources including news reports.

Methods Detail: Calculating Hospital Market Competitiveness

We used the Herfindahl-Hirschman Index (HHI) to calculate the level of market competitiveness for each of the nine Connecticut regions. The HHI is a value that incorporates data on the number of competitors and their relative size in each market. A greater number of competitors and competitors that are more similar in size will result in a more competitive market and a lower HHI index. Fewer competitors and competitors that vary significantly in size will result in less competitive markets and greater HHI values. To compute HHI, we used the market share of each competing organization as follows:

$$HHI = (\text{Market Share for Organization \#1})^2 + (\text{Market Share for Organization \#2})^2 + (\text{Market Share for Organization \#3})^2 + \ldots$$

The value for HHI ranges from 1 to 10,000, with 1 being the most competitive market and 10,000 being the least competitive and most highly concentrated market.

We used the number of hospital discharges for Connecticut residents in a year to compute market share for each hospital in this report's analyses. These values of market competitiveness may vary from previously published calculations because we only considered care provided at Connecticut-based hospitals in this report. Also, other calculations may have used different measures of a hospital's relative size (e.g., total revenues or total patient days).

Most of the Connecticut hospital regions are highly concentrated and market power for local systems has been increasing (**Table 2**). In 2016, two of the CPRs were "Moderately Concentrated," while six of the regions were "Highly Concentrated." One was "Very Highly Concentrated" based on the HHI. Between 2016 and 2021, the HHI market concentration index increased in 78% of CPRs. The greatest increase occurred in the Northwest Hills region. The Lower Connecticut River Valley and Western Connecticut, were the two regions that saw their HHI values fall slightly from 2016 to 2021—yet both remained "Highly Concentrated." In 2021, the least concentrated region for acute care services was Naugatuck Valley, while the most concentrated was the South Central CPR.

Table 2: Connecticut Hospital Region Competitiveness Based on Hospital Discharges

Region	Hospitals with Primary Service Areas in each Region	2016 Competitiveness *(HHI Index)*	2021 Competitiveness *(HHI Index)*	Change in HHI Value
Capitol Region	Bristol, CT Children's Medical Center, Hartford, Hospital of Central CT, John Dempsey, Johnson Memorial, Manchester Memorial, Middlesex Memorial, Rockville General, Saint Francis, Windham Community	**Highly Concentrated** *(3,098)*	**Highly Concentrated** *(3,381)*	**+ 283**
Greater Bridgeport Region	Bridgeport, Saint Vincent's Yale-New Haven	**Highly Concentrated** *(4,604)*	**Highly Concentrated** *(4,832)*	**+ 228**
Lower CT River Valley Region	Hartford, Middlesex Memorial	**Highly Concentrated** *(3,738)*	**Highly Concentrated** *(3,710)*	**- 29**
Naugatuck Valley Region	Bridgeport, Bristol, Griffin, Hartford, Saint Mary's, Saint Vincent's, Waterbury, Yale-New Haven	**Moderately Concentrated** (1,557)	**Moderately Concentrated** *(1,596)*	**+ 38**
Northeastern Region	Day Kimball, William W. Backus	**Highly Concentrated** *(3,622)*	**Highly Concentrated** *(3,973)*	**+ 351**
Northwest Hills Region	Charlotte Hungerford, Hartford, Sharon	**Moderately Concentrated** *(2,368)*	**Highly Concentrated** *(4,587)*	**+ 2,219**
South Central Region	Bridgeport, Midstate Medical Center, Hartford, Saint Vincent's Medical Center, Yale-New Haven	**Very Highly Concentrated** *(6,477)*	**Very Highly Concentrated** *(6,699)*	**+ 222**
Southeastern Region	Lawrence and Memorial, Hartford, Windham Community Memorial, William W. Backus	**Highly Concentrated** *(4,258)*	**Highly Concentrated** *(4,297)*	**+ 39**
Western Region	Danbury, Greenwich, Norwalk, Stamford	**Highly Concentrated** *(3,741)*	**Highly Concentrated** *(3,623)*	**- 118**
HHI Index Categories range from: <1,500 indicating a Unconcentrated Market; 1,500 – 2,499 is Moderately Concentrated; 2,500 – 4,999 is Highly Concentrated; and 5,000+ is Very Highly Concentrated				

We used the consolidation and market power data shown in **Table 1** to sort hospitals into two groups: (1) hospitals that gained market power between 2013 and 2019 due to a merger, acquisition, or affiliation in their region, and (2) hospitals that did not gain market power over this period. Mergers and affiliations affected the market power of **12 hospitals** between 2013 and 2019 (the list of 12 hospitals

and reasons for changes in market power are detailed in **Appendix C**). We tracked changes in price, utilization, and operational outcomes from 2016 to 2021. The outcomes were compared to the **15 hospitals** that did not have any reported change in ownership or affiliation between 2013 and 2021 (also shown in **Appendix C**).

Methods Detail: Measuring Consolidation Impacts and Displaying Data

Our goal was to assess how health care consolidation affects outcomes such as access/use, affordability/price, and operational/financial results. To do this, we compared trends in outcomes between two groups:

1. Consolidation Group: hospitals impacted by mergers, acquisitions, or affiliations between 2013 to 2019 and subsequently gained market power.

2. Comparison Group: all other hospitals that were not impacted by consolidation.

A hospital could be included in the **Consolidation Group** as a result of increased market power due to either being acquired by a larger system that was already operating in its region or by being part of a system that acquired another hospital in its region who was previously a competitor.

We measured the effects of consolidation in this report by comparing outcomes between the two groups because this approach helps limit the effect of other changes that may influence results. For example, when the COVID-19 pandemic hit in 2020, the use of many hospital services declined. If we only assessed changes in utilization for the consolidation hospitals over time, these trends would affect our results.

We used the comparison group, which was also affected by the state trends, to compare findings between the two groups to isolate the effect consolidation has on outcomes. By using a comparison group in this analysis, we attempt to control for (or eliminate the impact of) outside effects, although some intrastate trends could still impact results.

Because each hospital and market is unique, the raw average prices, utilization rates, and types of services are not necessarily directly comparable and could lead to misleading findings. So, we calculated trends in outcomes as ***average annualized growth rates*** from each hospital's baseline, initial year of data. If consolidation has an impact on outcomes, it will promote faster or slower growth in the outcome of interest over time, beginning in the first year following the merger/acquisition.

To interpret the findings from the analyses, we measured differences in the size of the average growth rates between the two groups. The small number of hospital mergers and necessary standardization of data (e.g., creating price indexes) made statistical significance testing poorly suited to testing differences between outcomes.

The figures and tables in this report show average annualized average growth rates for the two groups of hospitals. To interpret findings, **compare the difference in average growth rates between the two groups.**

More broadly, it is important to note this study assessed consolidation in Connecticut based on a small number of transactions, and we encourage readers to evaluate results in the broader context of evidence cited in the report's background. In interpreting report findings below, we discuss how the results of Connecticut analyses compare to expectations based on prior literature. As a result of study limitations, these findings cannot be used to definitively prove observed differences in outcomes result from consolidation, but rather should be assessed as evidence for impacts based on the observed magnitude of the differences between the two groups.

Hospital Services Price Analyses

Higher prices for hospital care, particularly prices paid by private insurance, were observed among hospitals impacted by consolidation.

Hospitals that gained market power between 2013 and 2019 had faster increases in service price growth compared to other hospitals that did not gain market power. Average charges per private insurance hospital discharge, average prices for private insurance inpatient facility claims, and average prices for outpatient facility services all increased.

We used Hospital Discharge Database data to measure changes in total charges per discharge over time. **Figure 3** shows the average annualized growth in average charges per private insurance hospital discharge. It compares hospitals that gained market power between 2013 and 2019 to a group of hospitals not affected by consolidation. We measured growth in prices for the years that followed a merger/acquisition.

The **Connecticut Hospital Discharge Database (HDD)** is a dataset containing records of all inpatient hospital visits at hospitals in the state. We use these data to assess trends in hospital use and prices.

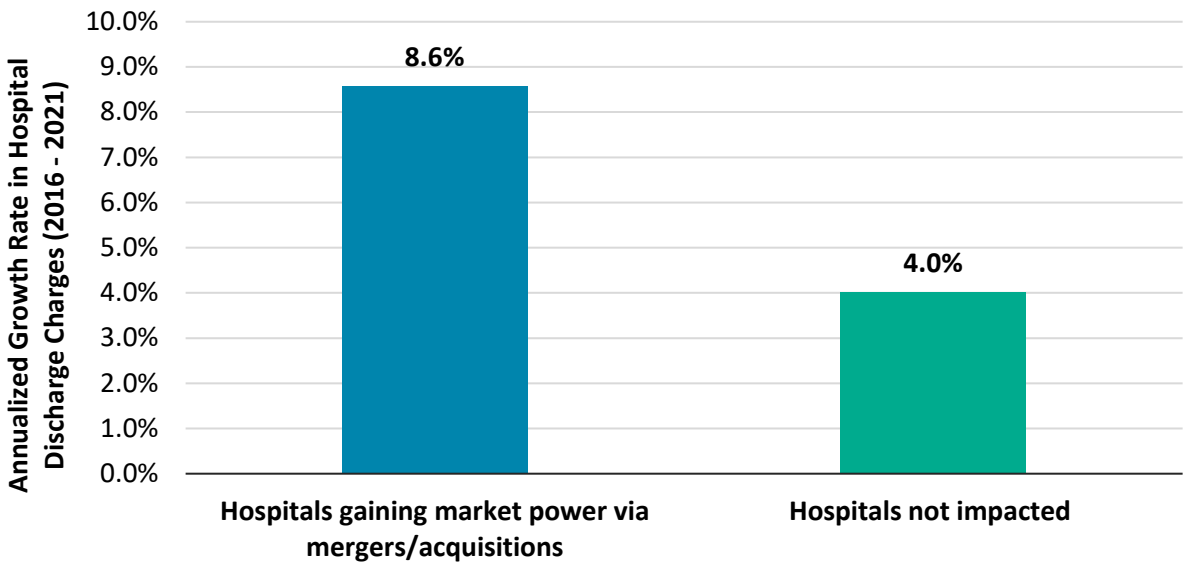
The discharge database measures visit costs as **Total Charges**, which include the total initial billed amounts from a hospital. Insurers typically negotiate these charges to lower "paid amounts." We show trends in paid amounts in subsequent charts.

As shown in **Figure 3** the average charge per hospital discharge increased at a faster rate among hospitals that gained market power (8.6% vs. 4.0%). This is consistent with prior analyses that found greater market power results in stronger negotiating leverage with private insurance payers and would lead to hospitals raising total billed charges and prices faster with more market power.[2,16,17] This can lead to higher hospital charges overall and could contribute to faster price growth over time.

Figure 3: Annualized Growth in Hospital Discharge Charges, Private-Insurance Patients (2016 - 2021)

[16] Dafny, L., Ho, K., & Lee, R. (2016). The price effects of cross-market hospital mergers. *National Bureau of Economic Research*. https://doi.org/10.3386/w22106

[17] Abelson, R. (2018, November 18). When hospitals merge to save money, patients often pay more. *New York Times*, https://www.nytimes.com/2018/11/14/health/hospital-mergers-health-care-spending.html

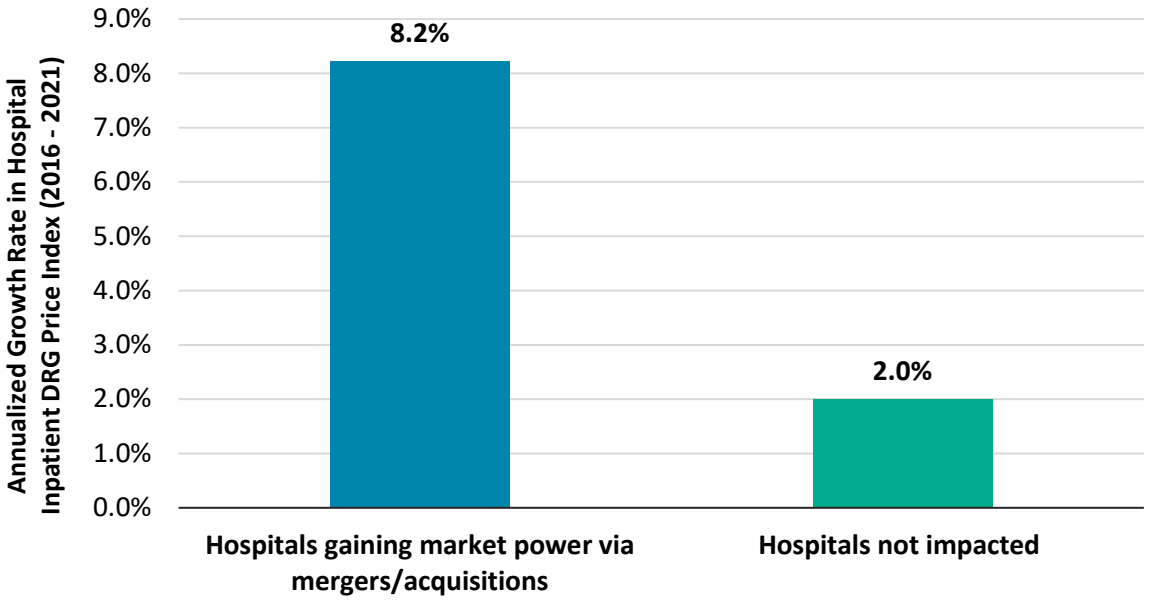


In addition to measuring hospital discharge average charges cost growth, we calculated growth in the average price of inpatient services. For this analysis, we used hospital insurance claim data from the Connecticut All-Payer Claims Database (APCD). We assessed average price while controlling for the type of Diagnosis-Related Groups (DRGs) billed. We used average "paid amount" data to measure changes in health care prices for inpatient care. As shown in **Figure 4**, we compared total paid amounts per hospital DRG payment for private insurance patients by hospital market power status. Similar to the charges cost growth differences, growth rates in "paid amounts" were greater (8.3%) in the "Consolidation Group" of hospitals impacted by mergers/acquisitions than among other non-impacted hospitals (2%).

The **Connecticut All-Payer Claims Database (APCD)** is a dataset containing medical claims from major health payers on their beneficiaries.

A **Diagnosis Related Group (DRG)** is a system of inpatient medical codes used to categorize patients based on the type of care they need.

Figure 4: Average Annualized Growth in Hospital Inpatient Diagnosis Related Group (DRG) Price Index (2016 - 2021), Private Insurance Patients

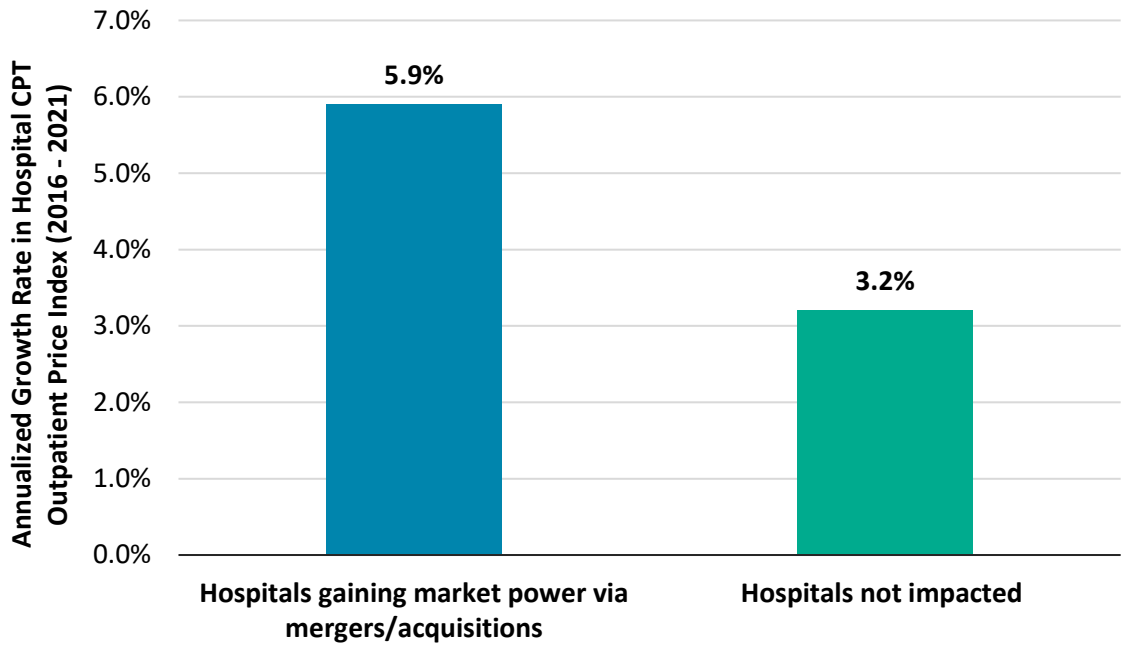


When examining growth in the overall price index of outpatient procedure facility claims, for privately insured patients, we found that prices for outpatient care rose faster at hospitals with increased market power (5.9%) than other hospitals (3.2%). We measured this growth by assessing changes in average prices for the most common CPT codes in the APCD dataset (see **Figure 5**).[18] Growth in average prices paid for outpatient care grew 2.7 percentage points faster for market power increasing hospitals. This suggests that greater market power is leading to hospitals negotiating higher prices for comparable mixes of care.

Figure 5: Average Annualized Growth in Hospital Outpatient Current Procedural Terminology (CPT) Price Index (2016 - 2021)

Current Procedural Terminology (CPT)[18] is a system of medical codes used to categorize patients based on the type of procedure they receive. Billed and paid amounts in medical claims are often set individually for each CPT code.

[18] *CPT Copyright 2024 American Medical Association. All rights reserved. CPT® is a registered trademark of the American Medical Association.*



Hospital Services Utilization, Revenues, and Patient Mix Analyses

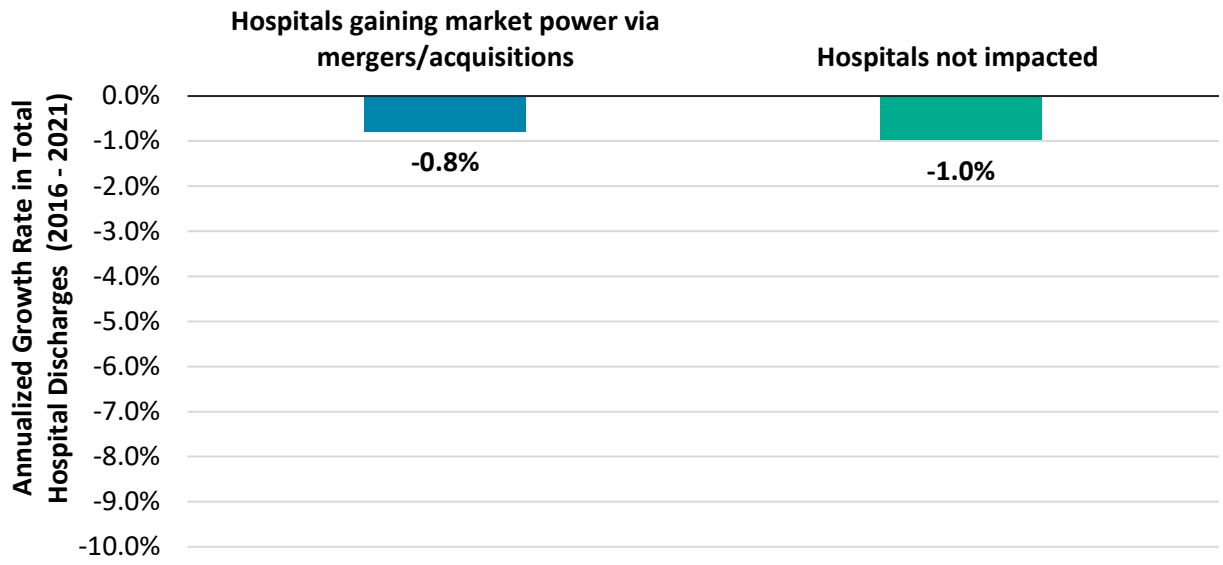
Differences in the overall volume of care, average length of stay, or the types of patients that receive care were small between hospitals impacted by consolidation and those not impacted.

Greater market power does not appear to be affecting access to care, or the amount of care received. According to the data, there are no changes or small differences in the amount of care provided to different patients, in the types of patients that receive care, or in the share of hospital revenues coming from different payers. Though hospital consolidation may be impacting the overall price of care across service lines, it does not appear to be impacting care to patients based on either insurance coverage or demographics.

Utilization rates, as measured by annualized growth in total discharges, were similar for both hospital groups from 2016-2021. Hospitals with greater market power saw a -0.8% annualized growth rate compared with those whose market power remained the same, which saw a -1% rate, demonstrating that increased market power does not necessarily lead to increased utilization (see **Figure 6**). If horizontal mergers in Connecticut led to increased utilization at those facilities gaining market power, we would expect there to be a larger difference between the two groups.

Hospitals and systems that gain market power in local regions could use that more dominant position in the market to increase use of their facilities and services by residents in their service area. If this were occurring, it would show up in analyses as hospitals with greater market power serving a greater proportion of individuals within a region. It would also increase growth rates for total discharges during the period following a merger. Data from **Figure 6** does not show strong evidence for this result.

Figure 6: Annualized Growth in Total Discharges (2016 - 2021)



Another effect of market power is that hospitals and systems could attempt to steer more profitable patients to their facilities, while discouraging care for those who are less profitable. If this were occurring, it would result in hospitals with greater market power increasing their share of private insurance patients over time. At the same time, their share of Medicare and Medicaid patients served would decrease. Increasing the share of private insurance patients is financially advantageous because reimbursement rates are higher for private insurance.[19] This leads to greater margins on private insurance individuals receiving care.

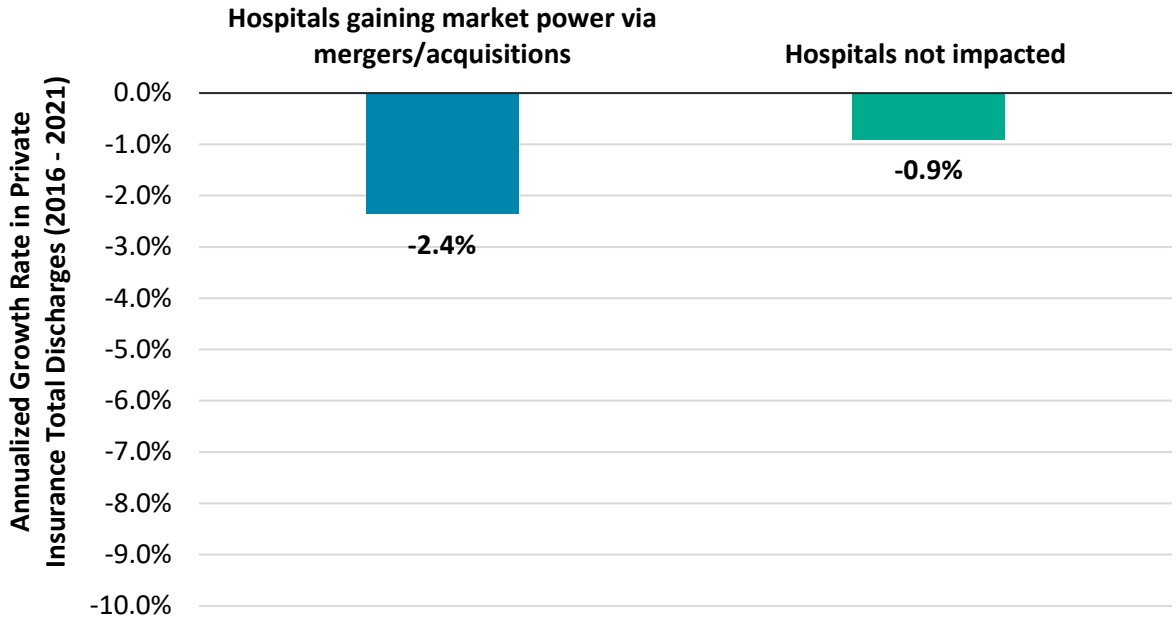
We compared annual growth in the total number of private insurance discharges (most likely to be high-margin patients) and Medicaid discharges (low-margin patients) among hospitals with increased market power and those with no change (low-margin patients). If market power is leading to hospitals pushing their patient mix towards more profitable patients, this would negatively affect access for lower-margin Medicaid patients.

Between 2016 and 2021 total growth in discharges for private insurance payers were slightly declining on average. Among those who have private insurance, service utilization as measured by annual growth in total inpatient discharges, declined by 2.4% in hospitals that increased market power, whereas other hospitals declined by 0.9%, signaling less utilization of hospital inpatient services generally (see **Figure 7**). This trend is consistent with a modestly growing overall private insurance population over this period, but overall decreasing use of inpatient care (due to the transition from inpatient care to outpatient

[19] Whaley, C. M., Briscombe, B., Kerber, R., O'Neill, B., & Kofner, A. (2022). Prices paid to hospitals by private health plans: Findings from round 4 of an employer-led transparency initiative. *RAND Corporation*. https://www.rand.org/pubs/research_reports/RRA1144-1.html

settings for many services).[20] Since the growth in private insurance patient discharges is not greater among hospitals gaining market power compared to those not impacted, hospital market power does not appear to be leading to comparatively larger increases in private insurance patient utilization.

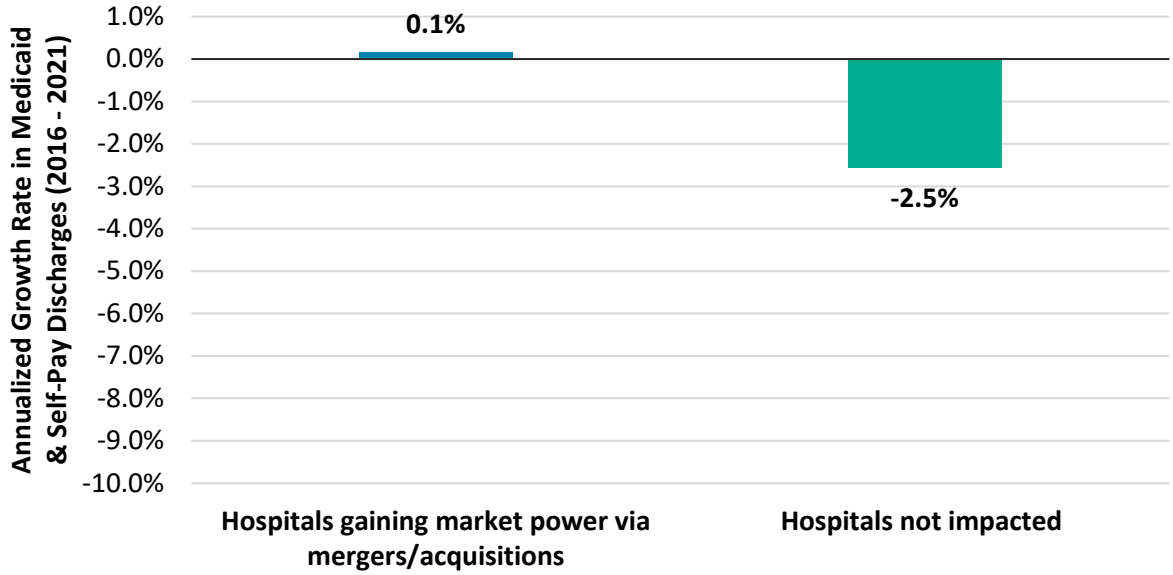
Figure 7: Annualized Growth in Private Insurance Discharges (2016 - 2021)



For Medicaid and self-pay patients, annualized growth in the number of inpatient discharges is similar or even slightly greater for hospitals that gained market power between 2013 and 2019. As noted below, annualized growth in Medicaid and self-pay discharges increased by 0.1% among increased market share hospitals; whereas there was a decrease of 2.5% among other hospitals, indicating that for Medicaid and self-pay patients, increased market consolidation does not appear to be negatively affect access to hospital services in Connecticut over this period (see **Figure 8**).

[20] Kumar, P., & Parthasarathy, R. (2020). Walking out of the hospital: the continued rise of ambulatory care and how to take advantage of it. *McKinsey & Company Healthcare Systems & Services Insights*. https://www.mckinsey.com/industries/healthcare/our-insights/walking-out-of-the-hospital-the-continued-rise-of-ambulatory-care-and-how-to-take-advantage-of-it

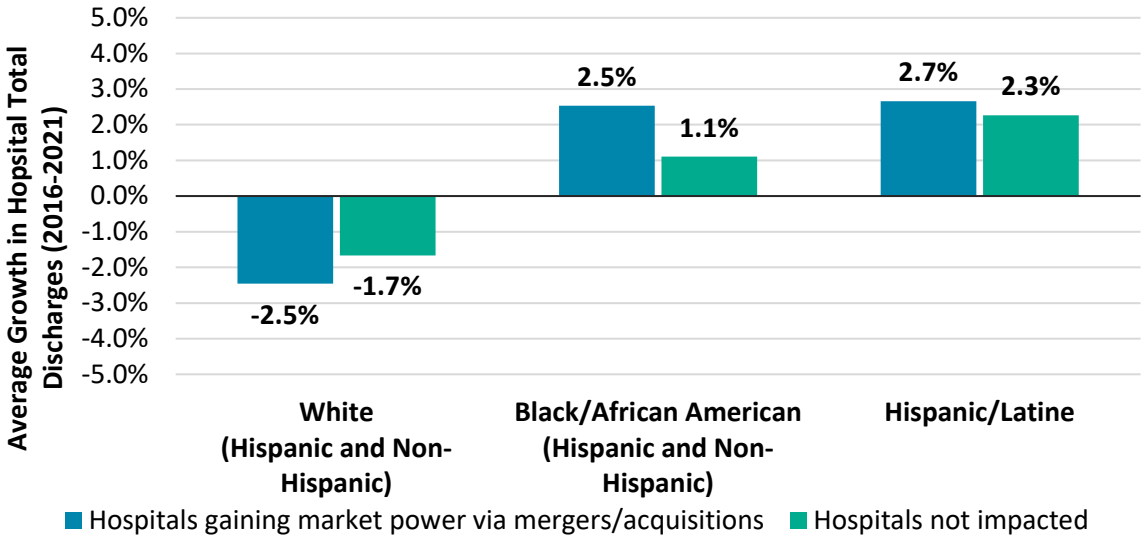
Figure 8: Annualized Growth in Medicaid and Self-Pay Discharges (2016 - 2021)



For individuals covered by Medicaid and those who are uninsured, we do not find evidence in these analyses of market power negatively driving changes for individuals receiving care. Overall, there were no noteworthy changes in access to care in hospitals due to a patient's insurance status because of consolidation.

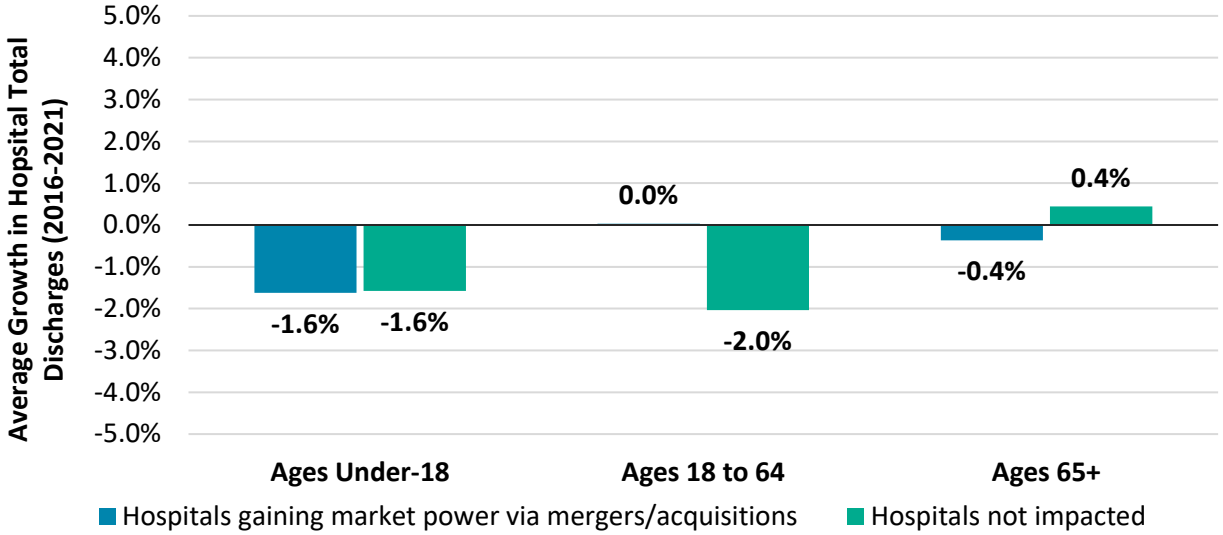
We also analyzed consolidation impacts on access to care for individuals based on race, ethnicity, and age. Considering race and ethnicity, service utilization for individuals who identify as Black/African American and Hispanic/Latine had annualized growth rates of 2.5% and 2.7% among increased market power hospitals as compared 1.1% and 2.3% among other hospitals. Among White patients, utilization decreased (-2.5%) among consolidated hospitals as compared to a lesser decline (-1.7%) in non-consolidated hospitals (see **Figure 9**).

Figure 9: Annualized Growth in Hospital Discharges, by Race and Ethnicity (2016 - 2021)



When considering changes in discharge by age, **Figure 10** shows that changes in discharges for children (under 18) and older adults (over 65) are similar between market power and non-market power hospitals. It also shows that hospitals that gained market power maintained higher levels of discharges for adults ages 18 to 64.

Figure 10: Annualized Growth in Hospital Discharges, by Age Cohort (2016 – 2021)

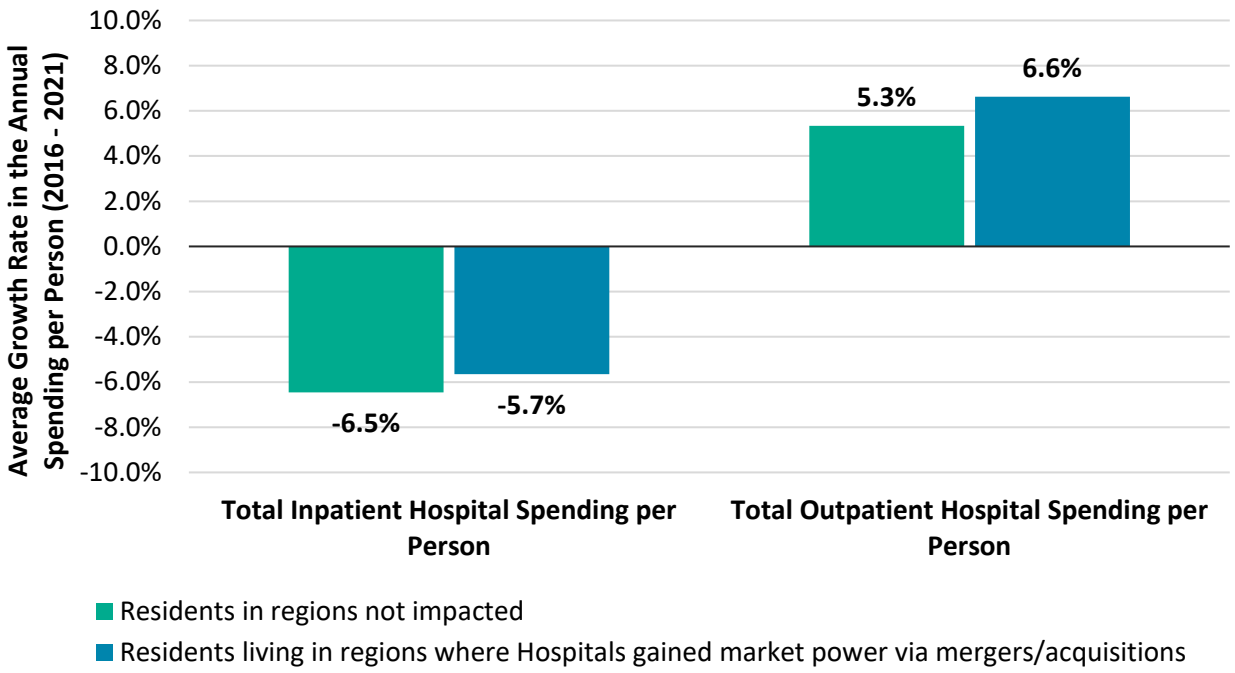


As an additional analysis, we also addressed differences in spending per person on hospital services by region. To understand which patients lived in regions impacted by hospitals with increased market power, we identified the zip codes of patients served as listed in the APCD. We then mapped those zip codes to the corresponding CPR regions Connecticut. We then cross-referenced the regions to those with hospitals in the Consolidation Group and determined which regions had increased market power and those who did not.

We compared the overall growth in spending per person for inpatient and outpatient hospital services and assessed if consolidation impacted broader health care spending trends for residents when analyzed at the population level. Outpatient spending growth increased per person; whereas, inpatient spending decreased among both hospitals with increased market power and not.

Overall, inpatient hospital spending growth for residents in regions where consolidation occurred decreased by a lesser amount (-5.7%) than for residents who lived in non-consolidated areas (-6.5%). Total outpatient hospital spending per person increased at a modestly faster rate for residents living in regions where consolidation occurred (6.6%) compared to other areas (5.3%). Inpatient spending per person shrank at a slower pace for hospitals that gained market power and outpatient spending increased at a faster rate, both of which provide evidence that consolidation could be leading to greater health spending on hospital services in Connecticut. This result is expected given the above findings in this report (**Figures 3-6**) that consolidation led to higher prices and similar utilization. Because spending is driven by the combination of prices multiplied by utilization, increases in prices appear to be causing slightly higher levels of overall hospital spending as well.

Figure 11: Annualized Growth in Total Hospital Spending per Person, by Region and Spending Type (2016 – 2021)



Hospital Services Intensity per Length of Stay and Service Mix Analyses

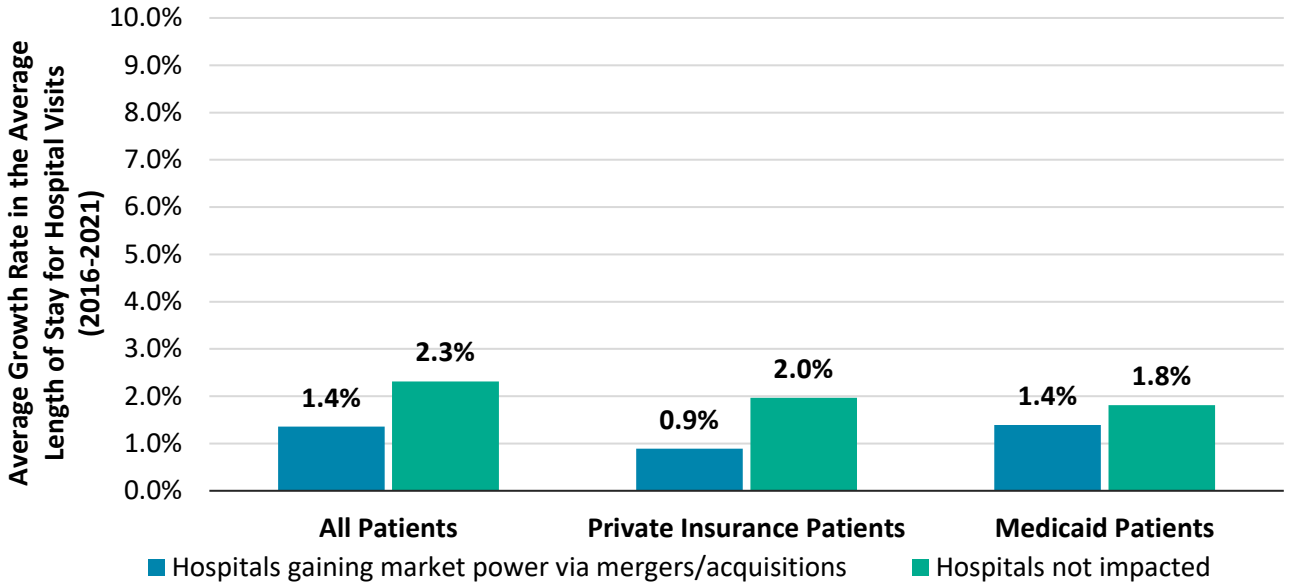
Greater use of some high-profit services and less use of some low-profit services was observed at hospitals impacted by consolidation over time.

Another way in which hospitals could use greater market power is through increasing the average intensity of care provided or by changing the frequency of high-cost, high-margin care compared to less profitable services. This could enhance hospitals' financial performance by increasing the average reimbursement per patient through both longer stays and by providing more profitable services.

To understand the impact of consolidation on service intensity, we examined length of stay for hospital discharges by patient insurance type. Regarding intensity trends (measured in the average length of stay for a hospital visit), overall changes in the average length of stays appeared similar between hospitals that increased their market power and those that did not. When we analyzed trends in the mix of a selection of high-margin and low-margin services, there were no consolidation effects. Hospitals with increased market power had higher average annual growth rates in two examples of high-margin services while having lower average growth rates in two types of low-margin care.

Figure 12 shows the impact of hospital mergers on the average length of stay (as measured in the number of days per visit). Growth in average length of stay over this period was similar and slightly slower in hospitals where mergers or acquisitions occurred. This suggests hospital market power in Connecticut is not leading to increases in the intensity of care provided to patients on average.

Figure 12: Annualized Growth in Average Length of Stay for Hospital Discharges, by Patient Insurance Status (2016 - 2021)



It is also possible that the incentive to increase the intensity of care (measured here by average length of stay) may vary by patient type and primary payer. Because private insurance typically reimburses at higher rates, we might see longer average patient stays for those with private insurance, while the opposite could occur for those with Medicaid or those uninsured. Greater market power hospitals could prioritize longer lengths of stay for more profitable private insurance patients and shorter lengths of stay for Medicaid and self-pay patients. This would increase operating margins and overall financial performance. Despite this potential, there is no evidence that this occurred. The overall average growth in length of stay for patients across different payment sources (private insurance, Medicare, and Medicaid) was similar over this period (**Figure 12**).

Just as a hospital with market power could attempt to adjust its share of patients across different insurance statuses, that same hospital could also try to increase the share and growth in hospitalizations for high-priced, more highly profitable types of visits. We use hospital diagnoses—Major Diagnostic Codes (MDCs)—to assess if hospital market power is affecting access for patients with different types of conditions; and, to determine if hospitals with greater market power are increasing the amount of "high margin care" provided at the expense of lower margin service offerings.

We used data from a recent analysis published in Health Affairs to identify two types of relatively-profitable hospital services (cardiac care and orthopedic care) and two relatively-unprofitable service lines (prenatal and births, and substance use disorder and behavioral health care needs).[21] We compared the average growth rate in the number of services, by type, for both hospitals impacted by consolidation and those that were not over the same period. **Figure 13** shows the results of this analysis for the two

[21] Horwitz, J. R., & Nichols, A. (2022). Hospital service offerings still differ substantially by ownership type. *Health Affairs, 41*(3), 331-340. https://www.healthaffairs.org/doi/abs/10.1377/hlthaff.2021.01115

more highly profitable service lines and **Figure 14** shows the results for the two more unprofitable service lines.

Figure 13: Annualized Growth in Total Discharges in two High-Profit Service Categories (2016 - 2021)

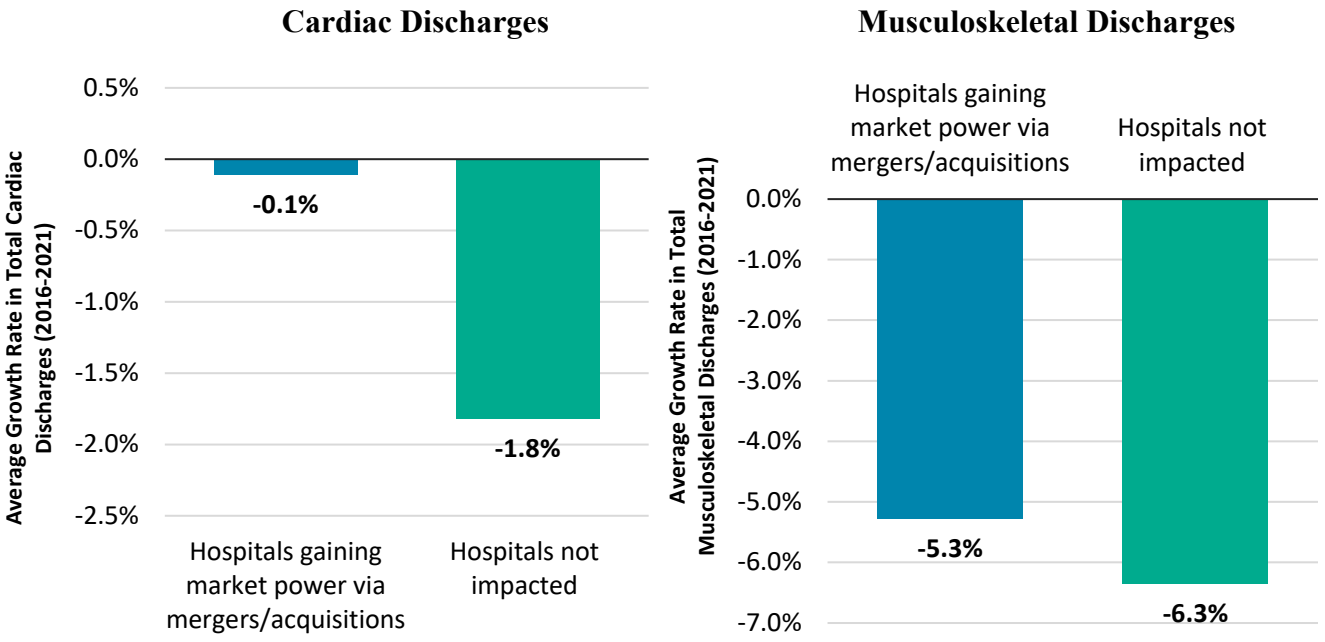
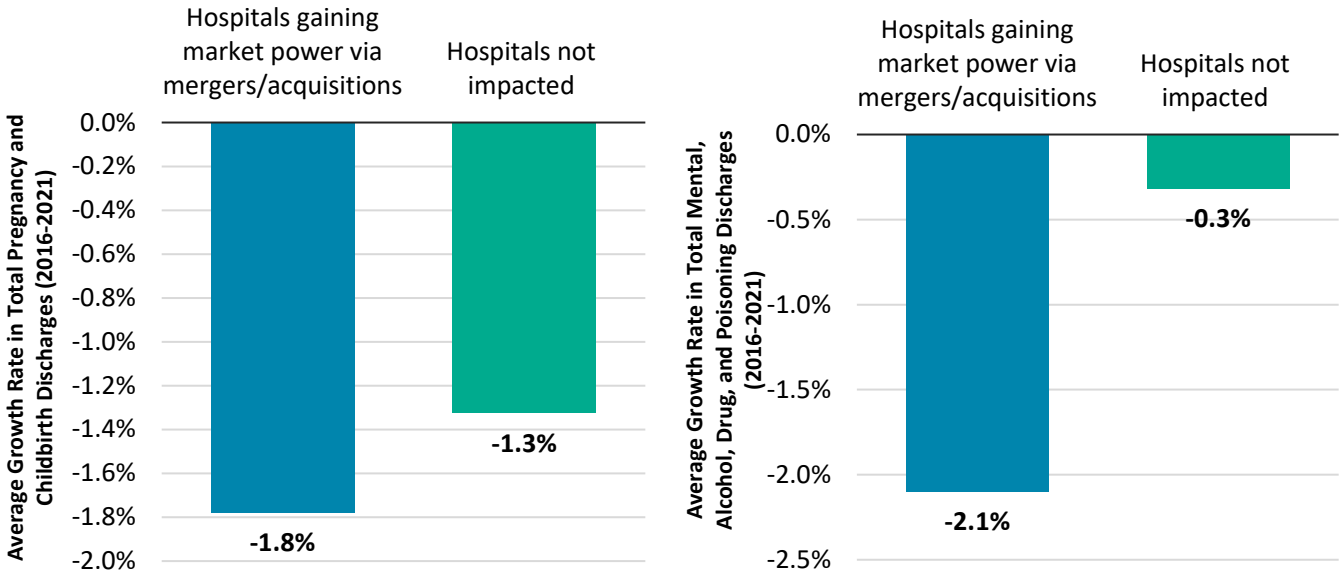


Figure 14: Annualized Growth in Total Discharges in two Low-Profit Service Categories (2016 - 2021)

Pregnancy and Childbirth Discharges **Mental, Alcohol, Drug, and Poisoning Discharges**



The data revealed that hospitals with greater market power had a higher annualized growth in total discharges for cardiac and musculoskeletal services as compared to non-consolidated hospitals—demonstrating less shrinkage in those high margin services. Additionally, greater market power hospitals had greater declines in pregnancy/childbirth and mental, alcohol, drug, and poisoning services compared to non-consolidated hospitals—demonstrating greater shrinkage in those low margin services.

As seen with mental health and substance abuse service lines, there were fewer services provided from hospitals that merged compared to those that did not, suggesting that patients seeking these services may have more limited access within areas with more consolidated hospital systems. This is similar for pregnancy/childbirth services; however, those differences are less stark.

It is important to note that there are likely other underlying factors also contributing to trends in the use of these different hospital services; for example, the impact of an aging population on birth rates and the use of pregnancy-related care. Our approach that compares two groups of hospitals in Connecticut over the same period should help compensate for underlying trends, as the statewide changes would be expected to affect equally the data for the consolidation and non-consolidation hospitals.

Market power impacted the growth rates of use of high-profit and low-profit services over this period. Hospitals that gained market power over the period of study had slightly faster growth for the two examples of high-margin services. However, for both maternity/childbirth and mental health and behavioral health care services, average growth rates for hospitals with increased market power were slightly slower. As noted in **Figures 13 and 14**, these data provide some evidence that hospitals in Connecticut were using greater market power to shift care from low-margin service offerings to high-margin care. This finding has consequences for future access to care for these low-margin services. It

potentially signals patients may have more difficulty accessing these health care services at hospitals with greater market power.

Physician and Professional Services Spending

Neither physician services prices nor spending growth appear to be greater among consolidating entities.

Greater market power for hospitals might also affect trends in physician services provided in hospital settings and by physicians employed by the hospital. Prior work has found increases in prices and spending among physicians working for hospitals and for physician practices acquired by hospitals were greater[22,23,24] and it might be expected that hospital consolidation would also increase prices for professional claims, relative to non-consolidating hospitals.

We analyzed hospital professional claims and billed charges from individual providers to assess consolidations' impacts on physician and professional services. We did not find greater increases in spending or prices among those impacted by consolidation and in fact, there was a 1 percentage point slower price growth rate for professional services at hospitals with greater market power compared to other hospitals between 2016 and 2021 (**Figure 15**).

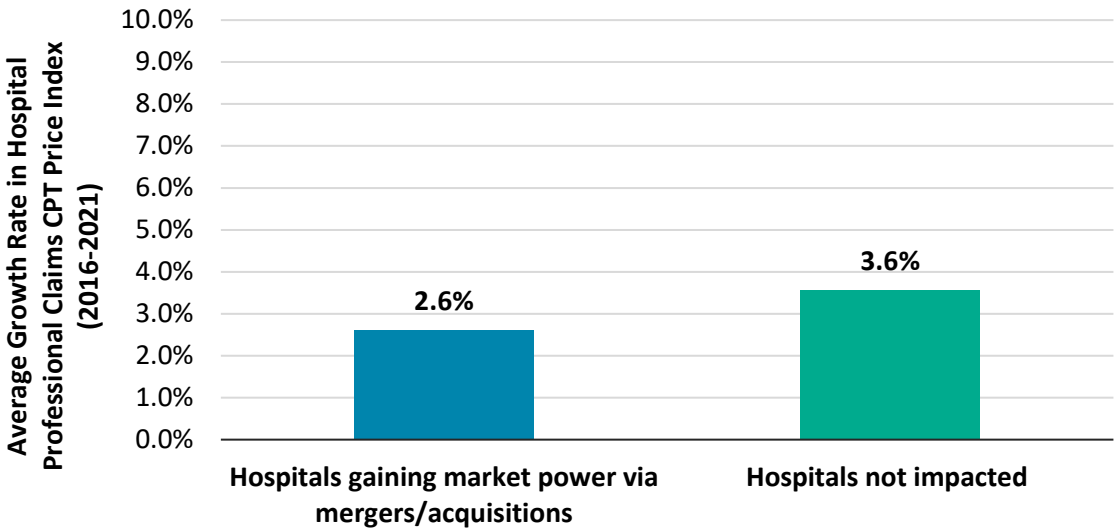
As noted in Figure **15,** which shows the results for changes in average price growth for professional services hospitals gaining market power had moderately slower increases in professional claims price indexes. While there is evidence that hospital market power in Connecticut increases prices for care in the facility component of a hospital's bill, price growth for professional services in hospital settings are within a percentage point across hospitals with different levels of market power suggesting no considerable impact.

[22] Capps, C., Dranove, D., & Ody, C. (2018). The effect of hospital acquisitions of physician practices on prices and spending. *Journal of Health Economics, 59*, 139–52. https://doi.org/10.1016/j.jhealeco.2018.04.001

[23] Scheffler, R. M., Arnold, D. R., & Whaley, C. M. (2018). Consolidation trends in California's health care system: Impacts on ACA premiums and outpatient visit prices. *Health Affairs, 37*(9), 1409-1416. https://www.healthaffairs.org/doi/10.1377/hlthaff.2018.0472

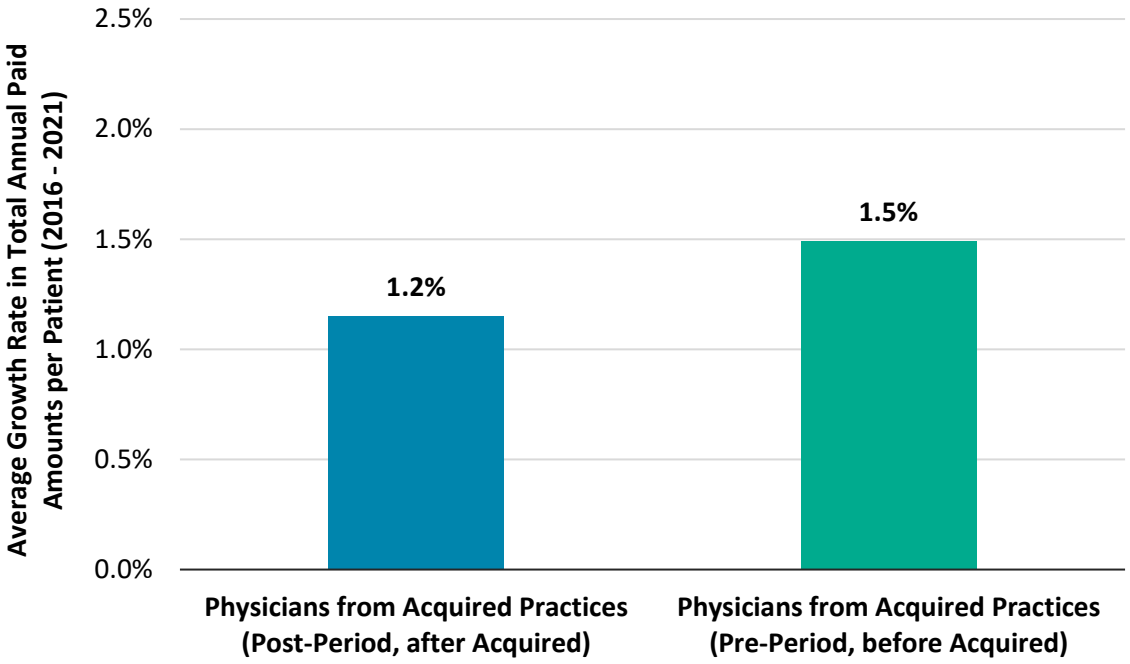
[24] Beaulieu, N.D., Chernew, M.E., McWilliams J.M., et al. (2023). Organization and performance of US health systems. *JAMA*, *329*(4), 325–335. https://jamanetwork.com/journals/jama/fullarticle/2800656.

Figure 15: Annualized Growth in Current Procedural Technology (CPT) Price Indexes for Professional Claims in Hospital Settings (2016 - 2021)



A separate analysis of physician services price growth in **Figure 16** shows the impacts of vertical consolidation on health care price growth. We analyzed claims data in the APCD for approximately 100 physicians that were part of physician groups acquired by larger hospital systems between 2016 and 2021. We compared the average annual total paid amount per patient from the period before the acquisition to the growth in annual average paid amounts per patient after an acquisition. Prior evidence has shown that when physicians are acquired their total average prices for care and total spending increases.[22] However, we did not find evidence for this from the small set of physicians (n=106) in Connecticut. Average growth in annual physician revenue per patient was similar in the pre- and post-period (1.5% vs. 1.2%).

Figure 16: Physician-Level Trends in Total Professional Services Spending Growth per Patient, by Physician Groups Acquired by Larger Hospital Systems, (2016 - 2021)



Hospital Operational and Financial Outcomes

Consolidation appears to have led to mixed outcomes for financial and operating outcomes for hospitals.

Horizontal Consolidation and Hospital Financial and Operating Results

We assessed key hospital financial and operational metrics using the Medicare Cost Reports for Connecticut hospitals between 2016 and 2021. Hospitals that gained market power had more positive changes (slower declines) in hospital operating margins, but similar changes in bed occupancy rates over time. These findings on bed occupancy rates are consistent with prior assessments of discharges and average length of stay analyzed above.

Improved hospital financial performance could occur from greater overall revenues due to providing more high-margin care at higher prices. It could also occur because of slower overall labor cost growth and reductions in the cost of non-operating services. While a hospital merger could theoretically lead to greater bed occupancy rates due to being part of a larger system that could aid in filling empty beds compared to other unaffiliated hospitals, we do not observe large differences in changes in bed occupancy rate over this period for consolidating hospitals.

Figure 17 shows the results of changes in average bed occupancy rate over time between hospitals that gained market power between 2013 and 2019 and those that did not. Hospitals that increased market power over this period had slightly greater average improvements in bed occupancy rates (2.6%) compared to hospitals that did not increase market power (2.1%).

Figure 17: Percentage Point Change in Average Hospital Bed Occupancy Rate (2016 - 2021)

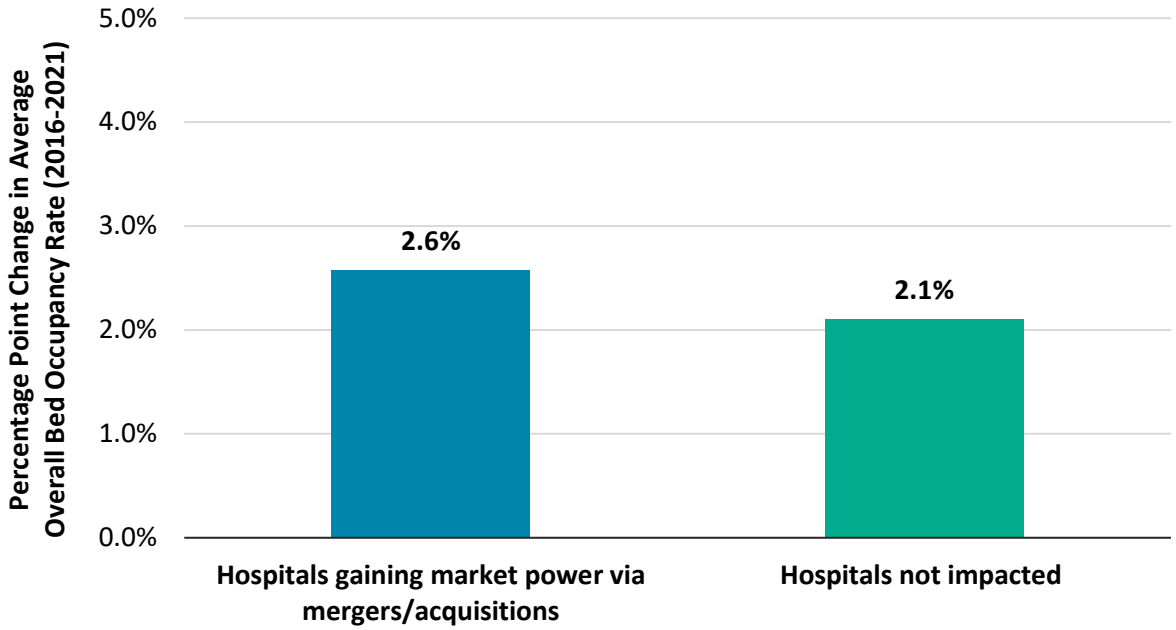
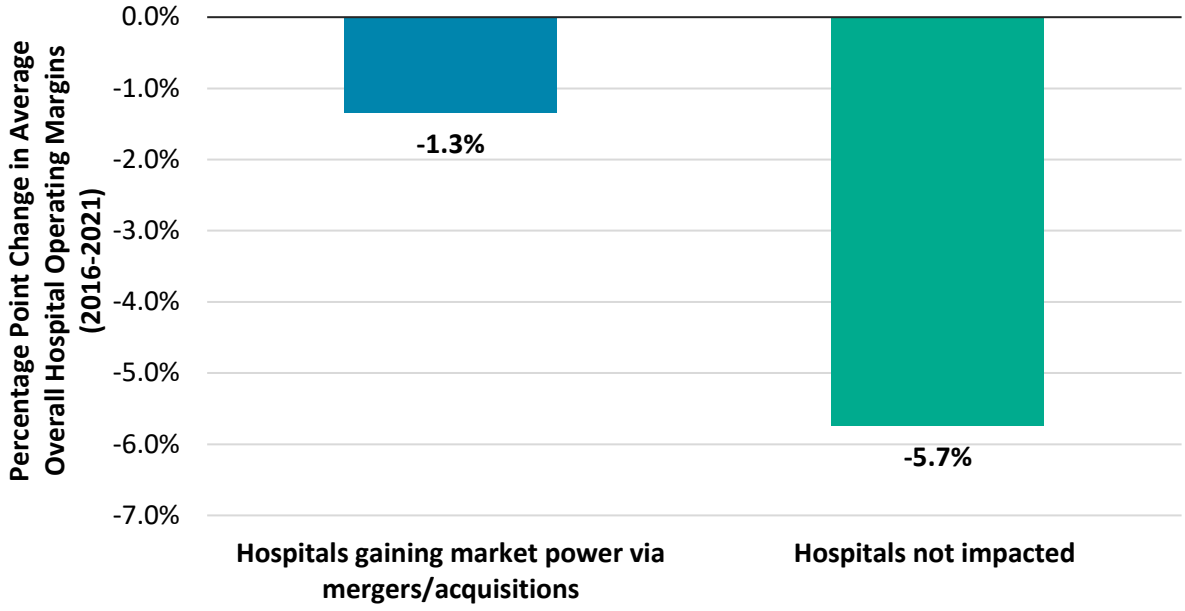


Figure 18 shows overall financial margin impacts, measured as percentage point changes in operating margins between 2016 to 2021 for hospitals that increased market power and those that did not. These results show that financial margins declined more slowly over this period for the hospitals gaining market power (-1.3%). Those that did not, saw on average, greater declines in average hospital operating margins (-5.7%).

Figure 18: Percentage Point Change in Average Overall Hospital Operating Margin (2016 - 2021)



Conclusion

Consolidation in Connecticut that occurred between 2013 and 2019 increased market power for hospitals and systems in seven of the nine regions from 2016 to 2021. Hospitals that gained market power increased prices for health care services faster than comparison hospitals in the rest of the State. This faster price growth occurred for both inpatient and outpatient services. Hospitals with greater market power also had faster relative growth in the number of high-profit services (cardiac and musculoskeletal care), while slower growth in less profitable services like childbirth and behavioral health care services. Hospital consolidation did not result in notable differences related to average bed occupancy, but there were differences in the changes in operating margins over time, which were better among hospitals gaining market power. Consolidation does not appear to have affected the use of or access to care for patients with different racial/ethnic demographics or types of insurance. It has also not contributed measurably to faster growth in physician or professional services prices. Most of these findings are consistent with prior literature reviews[25] and environmental scans[8] on health care consolidation, and demonstrate the need to carefully track and monitor and assess health and economic impacts of health care mergers and affiliations.

[25] Schwartz, K., Lopez, E., Rae, M., Neuman, T. (2020). What we know about provider consolidation. *KFF*. https://www.kff.org/health-costs/issue-brief/what-we-know-about-provider-consolidation/

Appendix A: Descriptions of Data Used for Analysis

Primary Data Sources

We studied the impacts of horizontal and vertical consolidation within the hospital and physician sectors in Connecticut using data from the Connecticut Office of Health Strategy (OHS). We collected and incorporated data on hospital ownership, affiliations, mergers, and acquisitions from Certificate of Need (CON) Notifications and Filings data. We collected and analyzed data on health care utilization, spending, and prices from the Connecticut All-Payer Claims Database (APCD) and Hospital Discharge Databases (HDD) from 2016 to 2021. Patient and physician zip code and hospital location data were collected from the APCD and OHS datasets and Connecticut Planning Region (CPR) geographic identifiers were sourced from the Regional Councils of Governments in Connecticut.

We used these data to analyze the impacts of increased market concentration and hospital purchases on utilization, cost, access, and affordability for Connecticut residents across payer and racial/ethnic demographic groups. We supplemented this information with publicly available data (Medicare Cost Report (MCR) data), on the financial and operating statistics of hospitals within the State over the same period.

The Connecticut HDD dataset contains information on all hospital discharges within the State from 2016 to 2021. It includes discharges from all major acute care hospitals from all three of the major payer types (Medicare, Medicaid, and private insurance). These discharges include data on the reasons for the hospitalization, the type of services provided, the amount charged for care, and information about the patient's age, race/ethnicity, and town of residence. We analyzed the impact of consolidation on the total number of discharges per hospital, the total spending per discharge (measured as total charges per discharge), the average length of stay, the mix of type of discharges, and mix of discharges across payer types.

Data in the HDD dataset only contain health care data on inpatient hospitalizations—a limited, but important category of hospital services. We analyzed other types of care, such as outpatient services using other datasets described below. Key advantages of the HDD data are that they are comprehensive, covering all discharges in the State over the period of study. They also include town-level geographic detail on each patient's residence. A downside of this dataset is that there is limited information on the final paid amount for care, which is typically a smaller share of the initial total charges requested by the hospital.

The Connecticut APCD dataset contains medical, pharmacy, and other health care claims and enrollment data from all three major insurance types (Medicare, Medicaid, and private insurance) for residents in the State between 2016 and 2021. The APCD cover a much broader range of health care products and services (including professional care, outpatient care, and pharmaceutical drugs) than the HDD dataset. An advantage of these APCD data is that they contain both expenditure information as total charges and total paid amounts for care. This allows a comparison of the impacts of consolidation on hospital charges and the actual amount paid after negotiated prices. We used the APCD data for assessments of trends in total paid amounts of care as this information is not available in the HDD dataset (only total charges are available in the HDD).

A limitation of the APCD dataset is that there is not a complete set of medical claims for the privately insured and particularly patients with insurance from their employers. Self-insured employers, who bear the risk of their employee medical costs, are not required to submit medical claims to the APCD. This

leads to a gap in the APCD data. However, the CT APCD includes data on state employees and retirees, and municipalities in the state's Partnership self-insured health plans. Notwithstanding, the perceived gap in the APCD, in general, fully-insured claims are representative of prices in CT. Additionally, the Rand Corporation has determined there is "little evidence that self-insured plans differ systematically from fully insured plans in terms of benefit generosity, price, or claims denial rates."[26]

The Connecticut APCD dataset revealed varied coverage for all the State's Medicare enrollees. Data completeness for all three insurers vary from year to year in the available dataset. This makes analyses over time for payers more difficult. When we use these data to measure impacts across State or regional populations, we adjust for the missing privately insured and Medicare residents. In our analyses we typically show trends in spending or utilization per-enrollee to account for differences in the captured population over time.

[26] Eibner, C., Girosi, F., Miller, A., Cordova, A., McGlynn, E. A., Pace, N. M., Price, C. C., Vardavas, R., & Gresenz, C. R. (2011). Employer self-insurance decisions and the implications of the patient protection and affordable care act as modified by the health care and education reconciliation act of 2010 (ACA). *Rand health quarterly*, *1*(2), 7. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4945181/

Appendix B: Details on Methods and Research Approach

Research Questions and Methodology

These analyses provide Connecticut-specific results on the impacts of mergers, acquisitions, and affiliations by systems in the State that impacted hospital market power. We build on prior studies with data that is available from the APCD and HDD to show similar or new findings for Connecticut. This work shows how hospital mergers and acquisitions have impacted health care spending, prices, utilization, and equitable access.

We used data on hospital location, size, and system ownership to compute hospital market concentration in combination with data from the CT APCD and HDD to measure impacts. We computed hospital concentration measures as HHIs using system-definitions and using HDD data on the number of discharges per region per year as a hospital's size. This means we count hospitals owned by a single system in the same region as partners, not competitors. We measured patient outcomes such as costs of care, access to care, and quality in claims data, linked to hospital geographic regions based on information in the claims data. Where possible, we used National Provider Identifier (NPI) provider and facility indicators to link care outcomes to specific systems and types of care within markets to identify other consolidation impacts.

Overall Analytical Approach

To analyze the impacts of different types of consolidation across many datasets, we separated our analyses into different categories based on the type of data used in the analysis and the type of consolidation. These analyses examined the effect of consolidation on the cost, quality, access, and equity; however, the approaches to each analysis differed slightly from dataset to dataset.

First, we identified and defined the cases of hospital mergers and acquisitions in the State. We identified hospital ownership changes using OHS CON data and then classified each hospital operating region based on the CPR regional definitions. We split hospitals according to the list of recorded mergers, affiliations, and acquisitions into two groups:

- **Group 1 (Consolidation): Hospitals Impacted by Mergers/Acquisitions that Increased Market Power:** when a merger or acquisition leads to increased market power for a hospital or system because it joined a larger system that were already operating within that local market. This group also includes hospitals that were already a part of that system that were previously operating in that market.

- **Group 2 (Comparison): Hospitals Not Impacted by Mergers/Acquisitions or Maintained Similar Market Power:** the remaining set of hospitals whose ownership and system status remained the same during the period of interest. Or hospitals impacted by a merger or acquisition that did not lead to a change in the local market power. A merger does not necessarily lead to greater market power if the acquiring system was not already operating within that hospital's local region.

There is limited evidence that health care utilization and prices will change when mergers do not lead directly to greater market power (a portion of Group 2 hospitals). We compared hospitals that gained market power to the combination of those not impacted by mergers, plus those with mergers that did not change market dynamics (Group 2). When a merger impacted the market power of a system, we

examined the impact on outcomes for the acquired hospital, and for any other hospitals in the local market that were associated with the acquiring system (both placed in Group 1). Increased market power would change the competitive marketplace and outcomes for both the acquired hospital and the larger acquiring system already operating in the local market.

To assess how mergers and acquisitions impacted outcomes over the 2016 to 2021 period, we used comparisons between hospitals that merged, were acquired, or became affiliated with larger systems in local markets to those not experiencing a consolidation event over the same period. It is possible there are fundamental differences between hospitals that consolidated and those that did not within the State. We controlled for these differences by calculating outcomes as average relative growth over time. In this way, each hospital serves as its own control in the baseline period, and we observe changes in hospital use, prices, and costs over time compared to the starting year. Even if there are differences in the types of hospitals that consolidate (e.g., if hospitals that charge higher prices, or serve more privately insured patients, or are more financially sound initially are more likely to consolidate), reporting our outcomes as changes or growth over time accounts for many pre-consolidation differences.

There is an additional benefit of this approach of observing differences in growth between consolidated and non-consolidated hospitals. It helps account equally for the fact that 2020 and 2021 drastically distorted health care utilization trends compared to the previous four years due to the COVID-19 pandemic. If we chose to look only at consolidation hospitals (Group 1) over the 2020-2021 period, it might show an inaccurate picture of consolidation impacts due to the one-time COVID-19 shock. We instead compare the trends between Group 1 (consolidation) and Group 2 (comparison) hospitals each over the same period, alleviating some of these concerns.

We started each analysis of the merged hospitals in the year the merger took place (ranging between 2015 and 2019). We assessed changes in hospital outcomes over time, until the final year of data (2021). We did this because changes in hospital outcomes take some time to appear in data. Also, negotiated contracts with payers need time to reset. For example, if a hospital merger occurred in 2015, we assessed differences in growth rates for prices and spending from 2015 to 2021 for that hospital compared to other hospitals in the State over the same period. We did not just look at the impact on outcomes in the year of the merger.

To interpret the findings from the analyses, we measured differences in the size of the average growth rates between the two groups. The small number of hospital mergers and necessary standardization of data (e.g., creating price indexes) made statistical significance testing poorly suited to testing differences between outcomes.
The figures and tables in this report show average annualized average growth rates for the two groups of hospitals. To interpret findings, compare the difference in average growth rates between the two groups.

Dataset-Specific Methodologies

We used three datasets to assess the impact of hospital mergers, acquisitions, and affiliations on outcomes. We used CT HDD data to assess impacts of horizontal consolidation on hospitalizations and inpatient services. We tracked discharges from individual hospitals using listed hospital identifiers. We used APCD data to supplement the HDD data to assess impacts of consolidation on other types of hospital care.

We used National Provider Identifier (NPI) indicators to observe which physician or facility provided the care. We prioritized the analyses of facility claims in hospital settings for which a hospital billed directly and used their own facility based NPI code. Using these facility-based claims, we assessed impacts of consolidation on hospital outpatient and inpatient care.

We also used the APCD data for a population-level analysis of healthcare spending and utilization, beyond the specific assessment of hospital services. In the previously described analyses, we determined average spending and prices at individual hospitals over time. We then compared trends in growth to Statewide averages between hospitals that have merged or affiliated recently and those that have not. As a result, we limited the analyses to impacts visible in care that the hospitals of interest directly provide.

The final set of analyses include assessments of hospital Medicare Cost Report (MCR) data that provide insights into hospital operating activities, financial outcomes, and costs. In addition to data on total operating income and expenses, the cost report data provide information on average bed occupancy rate, operating and non-operating income, administrative costs, and staff and non-staff hospital costs. These data provide an even higher-level complete picture on the impacts of hospital consolidation on hospital operations. They also provide information on the patient-specific outcomes from the APCD data described above.

Measuring Price Growth in Health Care Services Using Price Indexes

To assess changes in price growth for inpatient hospital visits and outpatient facility claims, it is important to measure changes in prices that account for the mix of different services provided. A price index is a way to measure how prices change over time for a set of services.

We generated price indexes from the most common procedures and diagnosis groups, weighting the overall price growth for each service by the quantity of services provided in the base year (2016). We defined each price as the average paid amount of all services for each CPT (for outpatient care) and DRG code (for inpatient care) provided in each year from 2016 to 2021. We then calculated the relative increase in prices for each of the common services and weighted each service growth rate by the number of services offered in 2016. The final step is aggregating into an annual price index. We benchmarked the index to 100.0 in 2016, with each year representing percentage growth or decline in overall prices from that value.

In the price indexes used in this analysis, we limited the services included to the top 100 for CPT codes to measure outpatient facility prices and the top 500 for DRG groups for inpatient prices. This is to avoid skewed results from less common services that have extremely variant and unpredictable prices. Because there are a greater number of CPT codes (and therefore fewer counts per code for each year), we limited the number of CPT codes to a smaller number than the DRG codes. We excluded any DRG or CPT codes that did not have a valid price (e.g., $0) in any of the years of analysis from the final price indexes.

Physician Group Vertical Consolidation

We used data from the Connecticut OHS Certificate of Need (CON) portal on “Group Practice Material Change in Ownership” filings between 2016 and 2021 to assess the impact of vertical consolidation (where hospitals purchase or affiliate with physician groups). We limited these filings to only those made by existing hospital systems and identified all physicians hired or acquired in the mergers. This

resulted in about 100 physicians that were acquired and began working for one of the existing large hospital systems over this period. To identify any changes in their practice patterns, we used their listed names and service locations to identify their National Provider Identifier (NPI) number in publicly available NPI registry files, and then their associated medical claims in the APCD dataset. We compared average expenditures for care per patient served in a year (total expenditures and average expenditures) prior to an individual provider's acquisition and following the acquisition by the hospital system. Like our analyses of hospitals, this approach used each physician as their own control, where we compared the pre-acquisition period average growth rates to growth rates in the post-acquisition period.

Appendix C: Table of Hospitals in Consolidation and Comparison Groups

Hospital	Reason	First Year Impacted
Consolidation Group		
Charlotte Hungerford Hospital	Partnered with Hartford Healthcare, who was already operating in the Northwest Hills CPR	2017
Danbury Hospital	Impacted by the Western Connecticut Health Network affiliation with Norwalk Hospital, who was already operating in the Western CPR	2014
Hartford Hospital	Impacted by the Hartford Healthcare affiliation with William W. Backus Hospital, who was already operating in the Southeastern CPR	2013
Johnson Memorial Hospital	Acquired by Trinity Health, who was already operating in the Capitol CPR	2015
Midstate Medical Center	Impacted by the Hartford Healthcare acquisition of Saint Vincent's Medical Center, who was already operating in the South Central CPR	2019
Norwalk Hospital	Affiliated with Western Connecticut Health Network, who was already operating in the Western CPR	2014
Saint Francis Hospital	Impacted by the Trinity Health acquisition of Saint Mary's Hospital, who was already operating in the Naugatuck Valley CPR	2015
Saint Mary's Hospital	Acquired by Trinity Health, who was already operating in the Naugatuck Valley CPR	2015
Saint Vincent's Medical Center	Acquired by Hartford Healthcare, who was already operating in the South Central CPR	2019
The Hospital of Central Connecticut	Impacted by the Hartford Healthcare acquisition of Saint Vincent's Medical Center, who was already operating in the Naugatuck Valley CPR	2019
William W. Backus Hospital	Affiliated with Hartford Healthcare, who was already operating in the Southeastern CPR	2013
Windham Community Memorial Hospital	Impacted by the Hartford Healthcare affiliation with William W. Backus Hospital, who was already operating in the Southeastern CPR	2013
Comparison Group		
Bridgeport Hospital	Not impacted by mergers or acquisitions over the period of study	-
Bristol Hospital	Not impacted by mergers or acquisitions over the period of study	-
Day Kimball Hospital	Not impacted by mergers or acquisitions over the period of study	-

Greenwich Hospital	Not impacted by mergers or acquisitions over the period of study	-
Griffin Hospital	Not impacted by mergers or acquisitions over the period of study	-
John Dempsey Hospital	Not impacted by mergers or acquisitions over the period of study	-
Lawrence and Memorial Hospital	While it merged with Yale New Haven Health in 2016, because Yale New Haven Health was not already operating in the Southeastern CPR, market power was not impacted	-
Manchester Memorial Hospital	Not impacted by mergers or acquisitions over the period of study	-
Middlesex Memorial Hospital	While it joined the Mayo Network in 2015, Mayo Network was not already operating in the Lower CT River Valley CPR, market power was not impacted	-
Milford Hospital	Not impacted by mergers or acquisitions over the period of study	-
Rockville General Hospital	Not impacted by mergers or acquisitions over the period of study	-
Sharon Hospital	While part of the HealthQuest and Western Connecticut Healthcare merger that created Nuvance Health, none of the merged hospitals were already operating in the Northwest Hills CPR	-
Stamford Hospital	Not impacted by mergers or acquisitions over the period of study	-
Waterbury Hospital	Not impacted by mergers or acquisitions over the period of study	-
Yale-New Haven Hospital	Not impacted by mergers or acquisitions over the period of study	-