Delivering Amidst Consolidation: Implications of Hospital Mergers on Newborn and Maternal Outcomes

Hyesung Oh & Christopher Whaley

ABSTRACT

Labor and delivery markets remain relatively understudied in the context of hospital mergers and acquisitions (M&As). Existing evidence suggests that hospital M&As are associated with higher hospital prices, slower wage growth, and lower prices for hospital-purchased medical supplies. These changes signal potential reductions in marginal costs and increased hospital profits. However, whether these cost reductions and profit increases translate into other investments in care quality and improved health outcomes for pregnant individuals and infants remains unclear. Given the high costs associated with labor and delivery, it is uncertain whether newly merged hospitals enhance or compromise access to care and care delivery outcomes—particularly considering that over 40% of births involve mothers covered by Medicaid, the lowest-reimbursing public health insurance system in the US.

Using National Vital Statistics System (NVSS) data covering approximately 26 million births in the contiguous United States from 2016 to 2022, we estimate the impact of hospital merger-induced increases in Herfindahl-Hirschman Indices (HHIs) on care access and birth outcomes, paying particular attention to differential impacts on Medicaid and non-Medicaid mothers. Applying difference-in-differences models with continuous treatment effects (de Chaisemartin & D'Haultfœuille, 2024), we find that hospital M&As led to Medicaid mothers being less likely to be attended by a physician during labor and delivery. Additionally, Medicaid mothers became less likely to travel across counties for delivery, whereas non-Medicaid mothers became more likely to do so. While these changes may indicate increased supply-side constraints in maternity care for Medicaid mothers, hospital M&As also resulted in improved birth outcomes, reduced complication rates, and lower infant mortality for Medicaid-covered births. These findings suggest that hospital M&As improve birth outcomes, potentially by reallocating Medicaid patients to more optimal labor and delivery care.

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NBER Children & Families Program

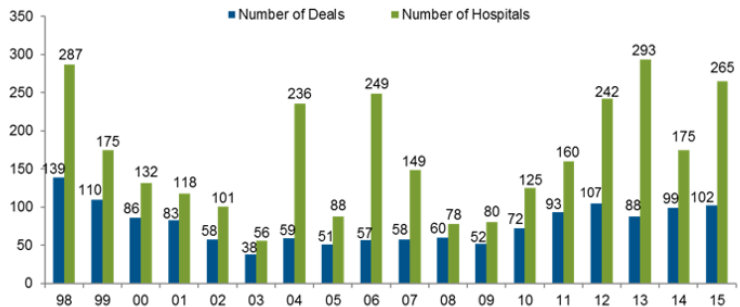
Table of Contents

1. Motivation
2. In This Paper
3. Preview of Findings
4. Data & Empirical Strategy
5. Results
6. Robustness
7. Potential Mechanisms
8. Discussion

Motivation

Hospital Industry Consolidation

- Significant hospital consolidation in the last two decades.
- More than 1,600 hospital mergers since 2000 (Gaynor, 2019).



Source: Irving Levin Associates, Inc. (2016). *The healthcare Services Acquisition Report*, Twenty-Second Edition.

Economic Effects of Mergers (I)

- Higher prices for commercially insured patients (Cooper, Craig, Gray, et al., 2019; Gowrisankaran et al., 2015).
  - **Concerns:** Increasing disparity between commercial prices and Medicaid prices
  - Potential access issues.
- Slower wage growth (Arnold et al., 2024; Prager & Schmitt, 2021) and reduced prices for hospital-purchased medical supplies (Craig et al., 2021).
  - **Implication:** Lower marginal costs for hospitals $\Rightarrow$ Higher profits
  - Better efficiency $\Rightarrow$ Better patient outcomes?

Economic Effects of Mergers (II)

- Fewer studies examine the impact on access, quality, and outcomes (mostly ambiguous, mixed, or inconclusive findings) (Beaulieu et al., 2020; Brot-Goldberg et al., 2024; Ho & Hamilton, 2000; Jiang et al., 2021).

Seems profitable for the hospital – ambiguous for the patient!

Allocative Efficiency and Hospital Mergers

Does hospital consolidation enhance or hinder allocative efficiency?
Allocative Efficency $\Rightarrow$ Patients are receiving a socially optimal quantity of care from an optimal set of providers

- **Market Power Effect:** Larger hospital systems with greater bargaining power may reduce incentives to compete on care quality (Gaynor, 2019).
- **Efficiency Gains Effect:** Consolidation could enhance coordination, information sharing, and care integration, potentially improving patient outcomes.

Do hospital mergers improve patient sorting across markets and within organizations?

Why Focus on Labor and Delivery Outcomes?

- Two of the most vulnerable types of patients: Mothers giving birth and their newborn infants. $\sim$ 3 million annual births.
- Over 40% of births involve Medicaid-covered mothers.
- Providing labor and delivery services and related care are costly and complex for the hospital.
- Major payment disparity between commercial insurance ($\sim$ \$15,150) and Medicaid ($\sim$ \$6400) (Valencia et al., 2022). Over twice the payment for commercial!
- Ideal setting to study merger impacts on care quality – highly inelastic demand for healthcare: When a baby is on the way, they are not waiting for anybody.

Hospital Markets and Maternal Health

- Maternity ward closures have mixed effects: reducing infant trauma but increasing maternal obstetric trauma (Avdic et al., 2024).
- Acquisitions of rural hospitals by systems are associated with higher obstetric unit closure probabilities (Gaynor et al., 2024).
- New York hospital mergers led to increased birth-related visits in public hospitals but lacked evidence on quality effects (Desai et al., 2023).

Gap: No comprehensive national-level study of the impact of hospital mergers on labor and delivery outcomes.

In This Paper

In This Paper

- We examine the impact of hospital merger-induced increases in hospital market concentration on labor and delivery outcomes.

- **Main Contributions:**
  - Examination of the relationship between hospital mergers and labor and delivery outcomes using the universe of all US births from 2016-2022 (approx **26 million** births).
    - Derived from birth certificate data certified by state registrars.
  - Study the supply-side mechanisms that might drive our outcomes.
  - Examine differential effects by Medicaid vs. Non-Medicaid mothers

Preview of Findings

Preview of Findings – Health Outcomes

- General improvement in labor and delivery outcomes.
- Effects mostly driven by Medicaid births.
- Infant Apgar scores (0-10) **increased** by an average of **0.174 points**.
- **1.19% increase** in assisted ventilation for infants.
- **0.44% increase** in infant survival probability ($\sim$65,000 newborns saved).

However: Evidence of restricted access and care supply

Data & Empirical Strategy

Birth Outcomes and Natality Data

- National Center for Health Statistics (NCHS) Restricted Vital Statistics Database (2016–2022) – Labor and delivery data derived from US birth certificates.
  - Birth-level information includes:
    - Birth weight, gestational age, Apgar scores.
    - Infant mortality rates and assisted ventilation.
    - Over 25 million births across the study period.
  - Geographic granularity: County-level data, but no direct hospital identifiers.
  - Various patient privacy measures due to vulnerable population.

Hospital Merger Data

- American Hospital Association (AHA) Annual Survey Database (2016–2022) applying hospital M&A identification methodology developed by Cooper, Craig, Gaynor, and Van Reenen (2019).

Empirical Strategy

- We DO NOT have hospital-level identifiers, but WE DO have county identifiers and can link to Hospital Referral Regions – necessitates a market-level treatment strategy.
- Follow a similar approach as Arnold & Whaley (2024) and Desai et al. (2023):
  - Identify HRRs where the hospital system-level market concentration (measured by HHIs) increased in conjunction with at least one hospital merger within HRR.
- Take the cumulative sum of HHI increases from the first merger/concentration increase through the rest of the study period.

Treatment Groups Summary

- **Treatment group:** Births within HRRs that experienced a hospital merger and a corresponding increase in market concentration (HHI).
- **Control group:** Births within HRRs with no merger activity across study period.
- **Continuous Treatment Variable:** Cumulative positive change in merger-induced HHI.

Healthcare Access Outcomes

- **Attended by a physician?:** Whether an MD or DO was present during the delivery.
- **Mother give birth outside home county:** Whether the mother traveled from a different county to give birth.

Health Outcomes

- **Apgar Score at 5 Minutes:** A standardized assessment of infant health immediately after birth.
- **Assisted Ventilation:** Whether the newborn required assisted ventilation after birth.
- **Infant Survival:** Probability of the infant surviving the birth process.

Empirical Model: Staggered Difference-in-Differences

- Staggered Difference-in-Differences approach with **continuous treatment** (De Chaisemartin et al., 2024)
- Key Feature: Allows for variation in treatment timing and treatment intensity (cumulative HHI increase).
- **Controls:** State dummy variables to account for state-level heterogeneity and policy differences.
- Clustered standard errors at the HRR level.

Advantages of De Chaisemartin & D'Haultfoeuille (2024)

- Accounts for heterogeneous treatment timing: Not all HRRs experience mergers at the same time.
- Continuous treatment modeling: Captures varying levels of changes in market concentration. We can exploit treatment intensity variation.
- Applies robust weighting based on specified groups (HRRs) and time (years).

Formal Model Specification – Event Study View

$$Y_{m,t} = \alpha + \sum_{k \neq -1} \beta_k \Delta HHI_{m,t+k} + \delta_s + \epsilon_{m,t} \tag{1}$$

- $Y_{m,t}$ = Outcome variable (e.g., infant survival, Apgar score).
- $\Delta HHI_{m,t+k}$ = Cumulative merger-induced change in HHI at time $t + k$.
- β_k = Dynamic treatment effect at event time k.
- δ_s = State dummies to control for state-level differences.
- $\epsilon_{m,t}$ = Error term.

Results

Descriptive Statistics

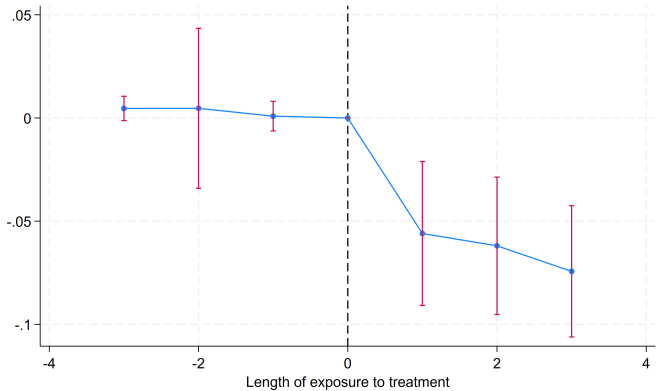
Table: Descriptive Statistics by Treatment Group

Variable	**Entire Sample**	**Control HRRs**	**Treated HRRs**
Births (N)	25,999,319	11,279,302	14,720,017
System HHI	3424	3727	3015
Medicaid	0.42 (0.49)	0.42 (0.49)	0.42 (0.49)
Hospital Birth	0.98 (0.13)	0.98 (0.13)	0.98 (0.14)
Different County Birth	0.33 (0.47)	0.32 (0.47)	0.33 (0.47)
Apgar 5	8.78 (0.82)	8.78 (0.82)	8.77 (0.82)
Birth Weight (g)	3255.62 (589.33)	3254.91 (585.00)	3256.17 (592.63)
Physician Attendance	0.88 (0.32)	0.88 (0.32)	0.88 (0.32)
Prenatal Visits	11.17 (4.21)	11.20 (4.19)	11.14 (4.23)

Results – Access

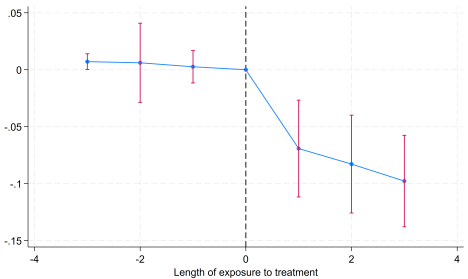
Physician Attendance

- 2.87% decline in physician attendance at birth for every 100-point increase in HHI ($p < 0.01$).
- Mergers may lead to shifts toward non-physician birth attendants.
- Potential cost-cutting measure or reallocation of hospital/physician resources.

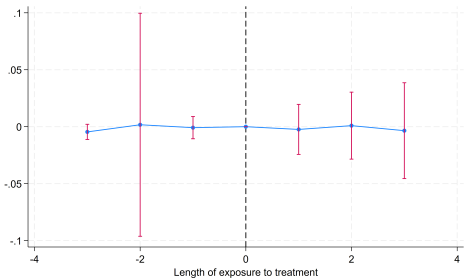


Physician Attendance at Birth by Insurance Type

- How does hospital consolidation affect physician-attended births differently for Medicaid vs. non-Medicaid mothers?



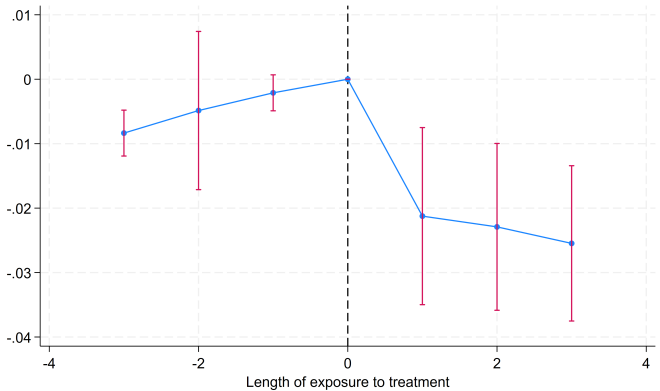
Medicaid Mothers – HRR-Level Treatment



Non-Medicaid Mothers – HRR-Level Treatment

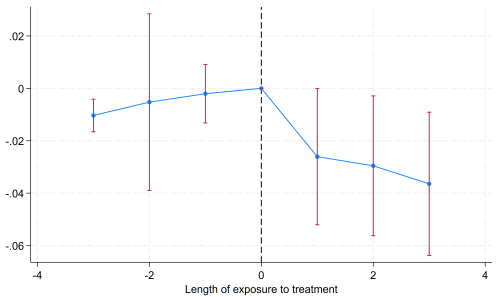
Births by mothers from other counties different than hospital's

- 1.04% decrease in births occurring outside the mother's home county for every 100-point increase in HHI (p¡0.05).
- Suggests potential restrictions on patient mobility or increased regionalization of care.
- Could indicate changes in hospital referral patterns post-merger.

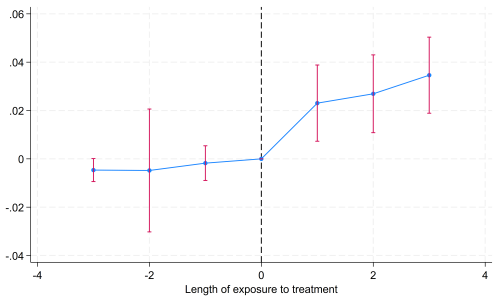


Different-County Births by Insurance Type

- Comparison of birth mobility patterns based on health insurance status.
- Do Medicaid-covered mothers experience **greater restrictions** in hospital choice?



Medicaid Mothers – HRR-Level Treatment

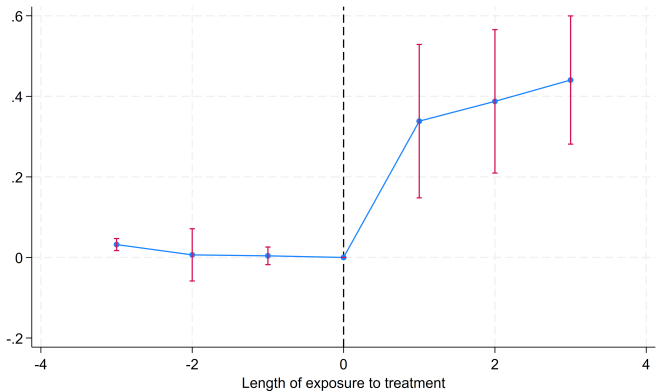


Non-Medicaid Mothers – HRR-Level Treatment

How do these differential trends affect health outcomes?

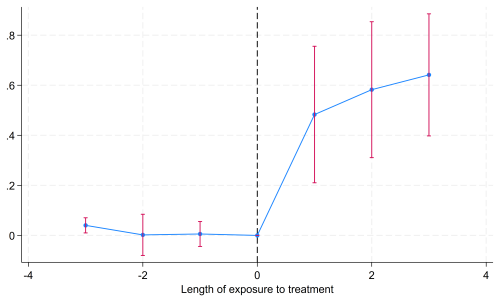
Results – Infant 5-Min Apgar Scores

- Infant Apgar scores increased by 0.174 points for every 100-point increase in HHI ($p < 0.01$).
- Indicates improved newborn health immediately after birth.

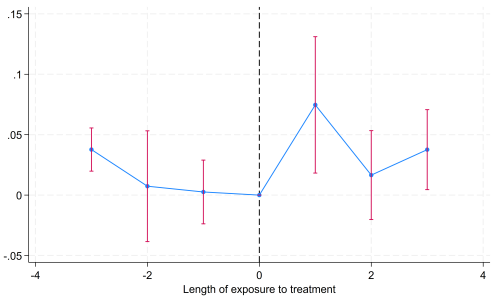


Results – Infant 5-Min Apgar Scores by Insurance Type

- Do hospital mergers impact Medicaid vs. non-Medicaid newborns differently?
- Are improvements in Apgar scores driven by changes in care quality or selection effects?



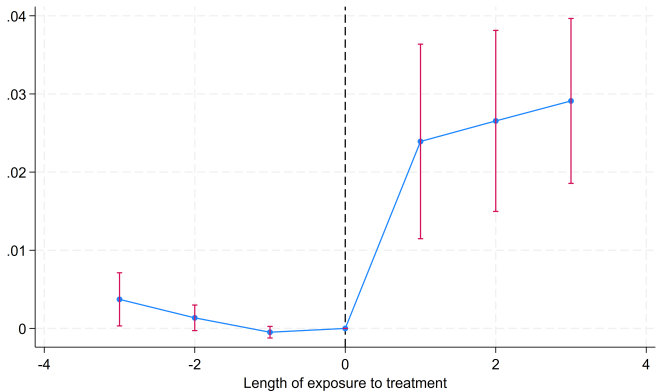
Medicaid Mothers



Non-Medicaid Mothers

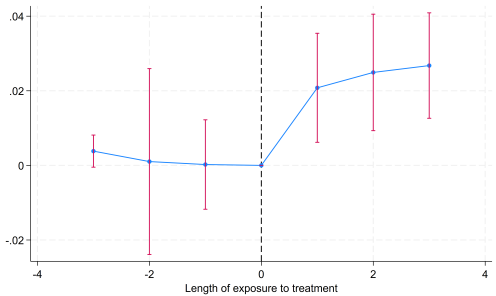
Results – Assisted Ventilation Usage

- 1.19% increase in assisted ventilation usage for every 100-point increase in HHI ($p < 0.05$).
- Could indicate either better neonatal care or increased need for respiratory support.

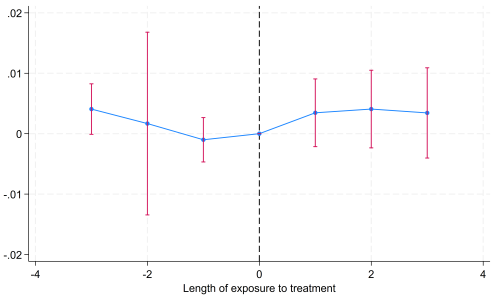


Results – Assisted Ventilation Usage by Insurance Type

- Does ventilation usage differ between Medicaid and non-Medicaid newborns?



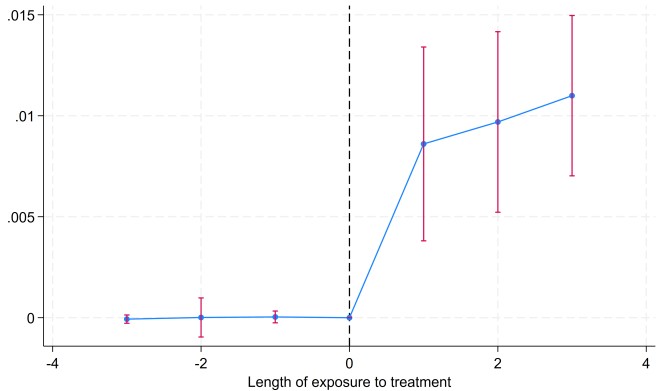
Medicaid Mothers



Non-Medicaid Mothers

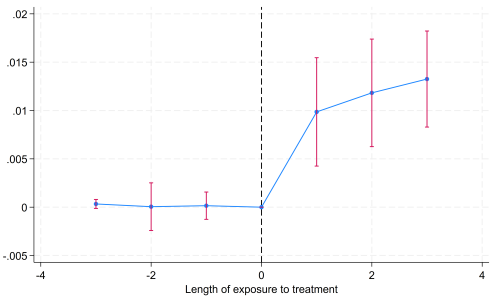
Results – Infant Survival Probability

- 0.438% increase in infant survival probability for every 100-point increase in HHI ($p < 0.01$).
- Suggests improved overall care quality at merged hospitals.
- Potential mechanisms: better equipment, care standardization, or patient selection effects.

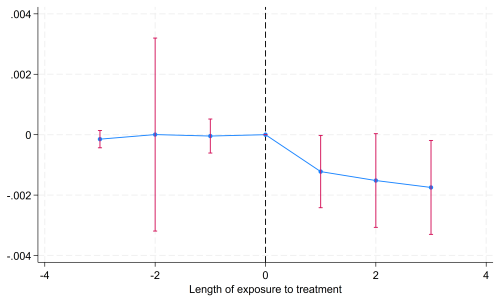


Results – Infant Survival Probability by Insurance Type

- Does the increase in survival probability differ by insurance status?
- Are Medicaid newborns benefiting from improved hospital care post-merger?



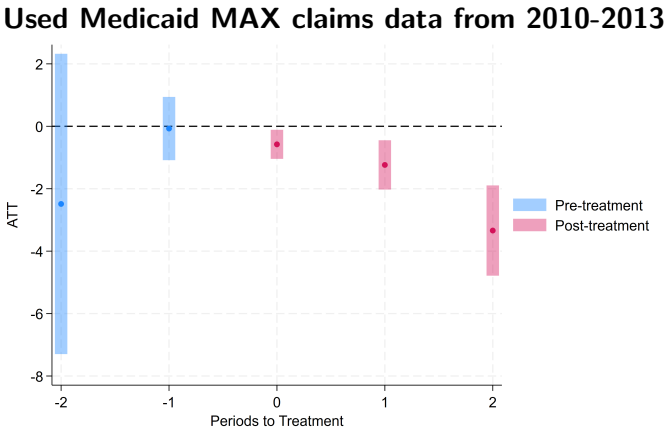
Medicaid Mothers



Non-Medicaid Mothers

Robustness – Medicaid Claims Data

Births by mothers frpm different home counties



Potential Mechanisms – Demand vs. Supply-Side Responses?

Demand-side selection based on patient health characteristics?

Used Medicaid MAX claims data from 2010-2013

- No changes in the average number of Elixhauser comorbidities per beneficiary before/after merger.
- No changes in the average volume of pregnancy-related perinatal complications before/after merger.

Supply-side response due to mergers?

- No change in whether births occurred in hospital or not.
- No changes in the volume of prenatal visits before/after merger.
- **Decrease in labor and delivery visits from mothers who come from a different county to give birth**
  - These mothers are generally healthier (less Elixhauser comorbidities) and younger
- **Less births attended by a physician after merger activity**

Discussion

Discussion: Less volume = Better care?

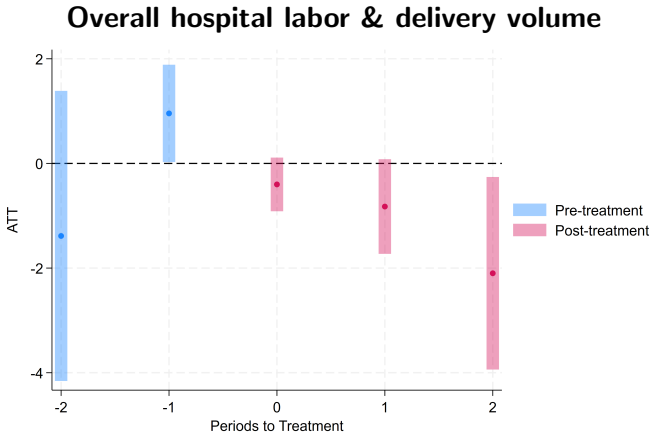


Figure: Callaway & Sant'Anna estimated impact on overall Medicaid hospital labor & delivery volume.

Discussion – Supply-Side Mechanisms(I)

- Mothers in labor cannot be denied care under EMTALA, but mergers may still affect accessibility and quality of delivery services.
- Mothers on Medicaid from other counties (typically healthier and younger) may be less likely to travel for delivery post-merger $\Rightarrow$ Does this reflect supply restrictions?
    - Gaynor et al. (2024) finds maternity ward closures increase after rural hospital acquisitions.

Discussion – Supply-Side Mechanisms(II)

HOWEVER: The average mother on Medicaid experienced benefits

- **Non-physician providers** (e.g., nurse-midwives) may enhance care quality (Johantgen et al., 2012).
- **Reduced travel burden** for deliveries $\Rightarrow$ Positive impact?

Were Medicaid mothers sorted to more optimal care?

Conclusion & Next Steps

- Hospital mergers may lead to improved infant outcomes, but could be driven by supplier-induced restrictions to access.
- Examine hospital-level labor and delivery volume by Medicaid versus Commercial insurance.
- Thank you! Questions?

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References I

Arnold, D. R., Whaley, C. M., Armour, P., Arnold, D., Dworsky, M., Gupta, A., Prager, E., Nikpay, S., Richards, M., Royalty, A., Simon, K., Staiger, B., Town, R., & White, C. (2024). *Who pays for health care costs? the effects of health care prices on wages* [Working Paper].

Avdic, D., Lundborg, P., & Vikström, J. (2024).Does health-care consolidation harm patients? evidence from maternity ward closures. *American Economic Journal: Economic Policy*, *16*(1), 160–189. https://doi.org/10.1257/pol.20200734

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. *N. Engl. J. Med.*, *382*(1), 51–59.

Brot-Goldberg, Z., Cooper, Z., Craig, S. V., Klarnet, L. R., Lurie, I., & Miller, C. L. (2024, June). *Who pays for rising health care prices? evidence from hospital mergers* [Revised December 2024]. http://www.nber.org/papers/w32613

References II

- 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
- Cooper, Z., Craig, S. V., Gray, C., Gaynor, M., & Van Reenen, J. (2019).Variation in health spending growth for the privately insured from 2007 to 2014. *Health Aff. (Millwood)*, *38*(2), 230–236.
- 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://doi.org/10.1111/1756-2171.12365
- De Chaisemartin, C., D'haultfoeuille, X., Méjean, I., Rambachan, A., Roth, J., Sant'anna, P., & Shapiro, J. (2024).Difference-in-differences estimators of intertemporal treatment effects. *Review of Economics & Statistics*. https://doi.org/10.1162/rest_a_01414/2332912/rest_a_01414.pdf

References III

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/https://doi.org/10.1016/j.jhealeco.2023.102770

Gaynor, M., Dranove, D., & Geddes, E. (2024).Expecting harm? the impact of rural hospital acquisitions on access to maternal health services. *American Society of Health Economists (ASHEcon) Annual Conference*.

Gaynor, M. (2019). Diagnosing the problem: Exploring the effects of consolidation and anticompetitive conduct in health care markets [Accessed: 2024-01-29]. https://www.congress.gov/116/meeting/house/109024/witnesses/HHRG-116-JU05-Bio-GaynorM-20190307.pdf

Gowrisankaran, G., Nevo, A., & Town, R. (2015).Mergers when prices are negotiated: Evidence from the hospital industry. *American Economic Review*, *105*(1), 172–203. https://doi.org/10.1257/aer.20130223

References IV

- Ho, V., & Hamilton, B. H. (2000).Hospital mergers and acquisitions: Does market consolidation harm patients? *J. Health Econ.*, *19*(5), 767–791.
- Jiang, H. J., Fingar, K. R., Liang, L., Henke, R. M., & Gibson, T. P. (2021).Quality of Care Before and After Mergers and Acquisitions of Rural Hospitals. *JAMA Network Open*, *4*(9), e2124662–e2124662. https://doi.org/10.1001/jamanetworkopen.2021.24662
- Johantgen, M., Fountain, L., Zangaro, G., Newhouse, R., Stanik-Hutt, J., & White, K. (2012).Comparison of labor and delivery care provided by certified nurse-midwives and physicians: A systematic review, 1990 to 2008. *Women's Health Issues*, *22*(1), E73–E81. https://doi.org/10.1016/j.whi.2011.06.005
- Prager, E., & Schmitt, M. (2021).Employer consolidation and wages: Evidence from hospitals. *American Economic Review*, *111*(2), 397–427. https://doi.org/10.1257/aer.20190690

References V

Valencia, Z., Sen, A., Kurowski, D., Martin, K., & Bozzi, D. (2022, June). Average payments for childbirth among the commercially insured and fee-for-service medicaid [Accessed: 2024-01-31]. https://www.healthcostinstitute.org/research/publications/average-payments-for-childbirth-among-the-commercially-insured-and-fee-for-service-medicaid