December 2025

Do Changes in Hospital Ownership Affect Staffing Ratios?

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INTRODUCTION

Rural hospitals across the United States serve as vital stakeholders in their communities – delivering critical health services to an underserved rural population while functioning as key shareholders in the economic health of rural towns nationwide. These hospitals, however, have been burdened with increasing financial pressures[1] – driven by low payments from insurers,[1,2] deteriorating local economies, clinician shortages, and a shrinking[3] and aging population.[4] It is with this backdrop that rural Americans have seen an increasing number of their hospitals undergo ownership changes, such as transitions from either government or nonprofit facilities into for-profit hospitals. These ownership changes have raised questions about their resulting outcomes – from issues on quality of care to profits,[5] and whether certain ownership end goals and patient outcomes inherently act in opposite directions.

The current literature indicates that transitioning to for-profit status is associated with improved financial performance.[5] Research further indicates that nonprofit hospitals are more likely to offer unprofitable services compared to for-profit hospitals.[6,7] The literature also suggests that changes in ownership status do not necessarily have statistically significant impacts on process of care (e.g., timely administration of antibiotics for pneumonia) or in-hospital mortality rates.[5]

Beyond these findings, the current literature lacks comprehensive evidence on the association of ownership transitions into for-profit status with hospital staffing levels. Staffing ratios, such as full-time equivalents (FTEs) per acute bed, are often studied in relation to the quality of care. Prior research indicates that hospitals operating with lower staffing ratios are associated with worse quality of care.[8] Hospital conversions to for-profit facilities could therefore impact quality of care if such transitions are associated with a change in staffing ratio. Studies indicate that the trade and services crucial to the local economy are tied and are sensitive to spending by the hospital's local workforce.[9] Substantial reductions in staffing could have unintended economic consequences, particularly when a hospital is the sole provider for the region.

Previous research of ownership changes and staffing ratios has documented mixed results. A 1999 study found that nonprofit to for-profit transitions were associated with a decrease in staffing ratios.[10] Additionally, studies that focused on nursing services in particular found that for-profit facilities have lower staffing numbers compared to

SUMMARY AND KEY FINDINGS

- We used data from the Centers for Medicare & Medicaid Services (CMS) Healthcare Cost Reporting Information System (HCRIS) to examine the association between hospital ownership changes and staffing ratio.
- Among 1,917 hospital-year observations of 162 unique rural hospitals experiencing a switch from government or nonprofit ownership to for-profit ownership (or vice versa) between 2011 – 2023, we found for-profit ownership was associated with lower staffing ratio, potentially reflecting reduced patient quality of care.
- However, additional analysis of rural and urban hospitals found that a switch from government or nonprofit ownership to for-profit ownership was *not* significantly associated with staffing ratio.
- The mixed findings and small number of sampled hospitals require a cautious interpretation of the results; ownership conversions may not translate to staffing changes in general.
- Future research should explore whether additional contextual factors, including prior hospital financial performance or the reason for the hospital ownership change, moderate the impact on staffing ratio.

nonprofit facilities.[11,12] However, a recent study specifically focusing on rural hospital mergers and acquisitions found no statistically significant association with changes in the number of full-time employees.[13]

Consequently, as rural hospitals continue to face changes in ownership,[1,14] there is a critical need to expand knowledge on the potential impacts of such changes on quality metrics, including hospital staffing ratio.

METHODS

Data

We used data from the Centers for Medicare & Medicaid Services (CMS) Healthcare Cost Reporting Information System (HCRIS)[15] to examine the association between hospital ownership changes and staffing ratio. HCRIS includes annual cost report data for Medicare-certified hospitals, including information on hospital ownership (government versus nonprofit versus for-profit; measured on cost report worksheet S-2, Part I, Column 1, Line 21), number of acute care beds (measured on cost report worksheet S-3, Part I, Column 2, Line 14), and full-time employees (measured as FTEs on cost report worksheet S-3, Part I, Column 10, Line 27). We merged HCRIS data with CMS Provider of Services files[16] to obtain additional information on hospital location and then identified observations for all short-term general hospitals for calendar years 2011 – 2023. Observations for specialty hospitals (e.g., cancer treatment hospitals), federal hospitals, and Indian Health Service hospitals were removed from the data under the rationale that these hospitals focused on serving specific patient populations and are also prone to missing cost report data. We also removed cost reports covering a period of less than 360 days or more than 370 days because the data may not be representative of a single full year. Furthermore, we matched each remaining cost report observation to the closest calendar year. Cost report periods are based on hospital financial years that may not align with calendar years, so for these reports we calculated which calendar year represented the majority of days in the reporting period. For instance, a cost report covering the period from October 1st, 2022 to September 30th, 2023 would be matched to calendar year 2023.

Next, we recorded the rural status of each hospital using criteria established by the Federal Office of Rural Health Policy in the Health Resources & Services Administration in fiscal year 2025.[17] Namely, we considered a hospital to be rural if the facility was located in a nonmetropolitan county OR metropolitan Census tract with a Rural-Urban Commuting Area (RUCA) code between 4 – 10, OR a large area metropolitan Census tract of at least 400 square miles in area with a population density of 35 or less per square mile and a RUCA code between 2 – 3, OR an outlying metropolitan county without an urbanized area, OR a metropolitan Census tract with a Road Ruggedness Scale value of 5 and RUCA code between 2 – 3 that is at least 20 square miles in area.

Linear Regression

We fit a longitudinal linear regression model to examine the association between hospital staffing ratio (outcome variable calculated as number of hospital FTEs divided by number of acute care beds) and rural hospital ownership (government or nonprofit versus for-profit). Alternative staffing ratio measures – such as FTEs per adjusted occupied bed[18] – were also considered. However, we viewed FTEs per adjusted occupied bed as primarily a measure of workforce efficiency rather than a marker of quality of care and thus used the simpler FTE:bed ratio instead. We also decided to focus the regression analysis on rural hospitals that experienced an ownership change over the study period, either a switch from government or nonprofit ownership to for-profit ownership or vice versa. We included hospital fixed effects to control for time-invariant (unchanging) hospital characteristics that could confound the association between staffing ratio and ownership. Furthermore, we included hospital Medicare inpatient payer mix, operating margin, and outpatient to total revenue mix as time-varying hospital covariates to further minimize confounding and clustered model standard errors at the hospital level.

Examination of the data showed several hospital-year observations with extreme outlier values for staffing ratio. For instance, the mean staffing ratio among the sample equaled 6.84 (median = 4.94), but several observations had staffing ratios equal to 50 or greater (in one case, a hospital-year observation had a staffing ratio of 1,604, possibly reflecting an error in the hospital's cost report). As a sensitivity analysis, we refit the linear regression model after trimming the sample to exclude: 1) observations with staffing ratios less than the 1% quantile or greater than the 99% quantile or 2) observations with staffing ratios less than (25% quantile – 3*(interquartile range)) or greater than (75% quantile + 3* (interquartile range)). This latter approach is a conservative application of the interquartile range (IQR) method.[19]

Difference-in-Differences

To complement the linear regression model, we completed a separate difference-in-differences analysis of staffing ratio and ownership using hospital ownership change as the "treatment" of interest. We used hospitals that had government or nonprofit ownership status throughout the study period as our control group. Furthermore, hospitals that transitioned from nonprofit or government ownership to for-profit ownership were included in the treatment group.

A difference-in-differences study design consists of a control and treatment group studied across pre-and-post-treatment periods, with the assumption that the two groups would have had the same average change in outcomes in the absence of the treatment (i.e., parallel trends assumption). In a traditional difference-in-differences design, treatment occurs at the same time for all participants in the treatment group. In cases where treatment occurs across varying times, recent research has shown that difference-in-differences estimators should account for possible heterogeneity in treatment effects across time (e.g., differences in the "year one" effects versus "year two effect) or cohort (e.g., differences in effect trajectories for hospitals that became for-profit in 2015 versus 2020) to reduce risk of misleading findings.[20]

Considering the recommendations of previous research, we used Callaway and Sant'Anna's (2021) difference-in-differences estimator[21] to account for the staggered treatment timing within our study sample. The Callaway and Sant'Anna estimator assumes that treatment is an "absorbing state" and, once treated, units continue to be treated for the remainder of the study period. With this context we dropped hospitals that switched from for-profit ownership status to nonprofit or governmental ownership since for-profit ownership was considered the treatment for this study. Additionally, we dropped any hospital that had for-profit ownership throughout all years of the study, considering that these hospitals had no "baseline" year with which to perform pre-post comparisons. The difference-in-differences analysis also focused on hospitals with complete data across the study period. This step was taken to create a balanced data set, as recent work by Deb and colleagues[22] highlights the importance of maintaining a balanced sample when using the Callaway and Sant'Anna estimator.

The Callaway and Sant'Anna estimator allows for the inclusion of control variables to adjust for differences between the treatment and control groups. Our difference-in-differences analysis controlled for baseline hospital Medicare inpatient payer mix, operating margin, outpatient to total revenue mix, ownership status (government-owned or nonprofit-owned), and rurality.

The sample inclusion and exclusion criteria specified above – although important – resulted in a small treatment group, reflecting a common data challenge of rural health research. Thus, we expanded the difference-in-differences sample to also include urban hospitals. The addition of urban hospitals limits the specificity of our difference-in-differences findings but allows for additional inference on hospital ownership change and the resulting effect on staffing ratio. Given the inclusion of urban hospitals and the remaining small treatment group size, the results of the difference-in-differences analysis should be viewed as exploratory.

RESULTS

Linear Regression

The sample for the linear regression analysis included 1,958 hospital-year observations of 162 unique rural hospitals experiencing a switch from government or nonprofit ownership to for-profit ownership (or vice versa) during the study period (Table 1). On average, rural hospitals in the sample had 56 acute beds, 323 FTEs, a 6.8 FTE:bed ratio, 51% Medicare inpatient payer mix, –2% operating margin, and 70% outpatient to total revenue mix.

Table 1. Descriptive Characteristics of Rural Hospitals Included in Linear Regression Analysis (n = 1,958 Hospital-Years)[a]

Characteristic	*n*	Percentage
Ownership		
Government	240	12.3%
For-Profit	1,011	51.6%
Nonprofit	707	36.1%
	Mean	**SD**
Acute Beds	55.8	45.7
Full-Time Equivalents	323.4	1,326.3
Staff Ratio[b]	6.8	36.4
Medicare Inpatient Payer Mix	51.1%	18.4
Operating Margin	–1.9%	16.2
Outpatient to Total Revenue Mix	69.7%	12.7

Abbreviations: SD = Standard Deviation.
[a] Study sample included 162 unique rural hospitals.
[b] Calculated as number of Full-Time Equivalents divided by number of acute beds.

Running the regression model on the full sample (Table 2), we found that for-profit ownership initially showed a negative, but statistically nonsignificant, association with staffing ratio (β = –2.58, Std. Error = 1.96, p = .19). However, after trimming the sample to exclude outliers with staffing ratios less than the 1% quantile or greater than the 99% quantile, we found that for-profit ownership showed a negative and statistically significant association with staffing ratio (β = –0.62, Std. Error = 0.19, p = .002). Fitting the regression model after applying the interquartile range trimming method yielded similar statistically significant findings (β = –0.52, Std. Error = 0.18, p = .003).

Table 2. Linear Regression Model of Rural Hospital Staffing Ratio as a Function of Hospital Ownership and Financial Characteristics

Characteristic	β	Std. Error	p-Value
Full Sample (n = 1,958 Hospital-Years)			
Ownership			
Government or Nonprofit (Ref.)			
For-Profit	–2.58	1.96	.19
Medicare Inpatient Payer Mix[a]	–0.70	0.61	.25
Operating Margin[a]	–2.52	2.53	.32
Outpatient to Total Revenue Mix[a]	1.42	1.02	.17
Trimmed Sample #1 (n = 1,917 Hospital-Years)			
Ownership			
Government or Nonprofit (Ref.)			
For-Profit	–0.62*	0.19	.002
Medicare Inpatient Payer Mix[a]	–0.10	0.15	.51
Operating Margin[a]	0.06	0.08	.43
Outpatient to Total Revenue Mix[a]	0.08	0.13	.54
Trimmed Sample #2 (n = 1,926 Hospital-Years)			
Ownership			
Government or Nonprofit (Ref.)			
For-Profit	–0.52*	0.18	.003
Medicare Inpatient Payer Mix[a]	–0.06	0.14	.69
Operating Margin[a]	0.09	0.08	.27
Outpatient to Total Revenue Mix[a]	0.03	0.12	.79

Notes: Model included hospital fixed effects and clustered standard errors by hospital. Trimmed sample #1 excluded observations with staffing ratios less than the 1% quantile or greater than the 99% quantile. Trimmed sample #2 excluded observations with staffing ratios less than (25% quantile – 3*(interquartile range)) or greater than (75% quantile + 3*(interquartile range)).
[a] Measured in standard deviation units.
* p < .05

Difference-in-Differences

The sample for the difference-in-differences analysis included 34,346 hospital-year observations of 19 treatment group hospitals (hospitals that switched from government or nonprofit ownership to for-profit ownership) and 2,623 control group hospitals (hospitals that maintained government or nonprofit ownership throughout the study period) (Table 3).

At baseline, the majority of treatment group hospitals (89.4%) and control group hospitals (70.5%) were nonprofit. In contrast, 26.3% of treatment group hospitals were in a rural area and 55.8% of control hospitals were in a rural area. On average, treatment group hospitals had 243.0 acute beds, 1,141.8 FTEs, a staffing ratio of 5.5, a Medicare inpatient payer mix of 44.2%, an operating margin of 0.1%, and an outpatient total revenue mix of 50.4%. The average control group hospital had 155.7 acute beds, 1,140.9 FTEs, a staffing ratio of 7.5, a Medicare inpatient payer mix of 48.8%, an operating margin of 2.5%, and an outpatient to total revenue mix of 58.9%.

Table 3. Baseline Descriptive Characteristics of Hospitals Included in Difference-in-Differences Analysis (n = 2,642 Hospitals)[a]

Characteristic	*Treatment Group*		*Control Group*	
	n	**%**	***n***	**%**
Ownership				
Government	2	10.5	774	29.5
Nonprofit	17	89.5	1,849	70.5
Rural	5	26.3	1,463	55.8
	Mean	**SD**	**Mean**	**SD**
Acute Beds	243.0	297.54	155.7	197.0
Full-Time Equivalents	1,141.8	1,177.62	1,140.9	2,434.2
Staff Ratio[b]	5.5	2.30	7.5	10.4
Medicare Inpatient Payer Mix	44.2%	14.4	48.8%	18.8
Operating Margin	0.1%	14.5	2.5%	11.3
Outpatient to Total Revenue Mix	50.4%	15.7	58.9%	16.7

Abbreviations: SD = Standard Deviation.
[a] Study sample included 19 treatment group hospitals and 2,623 control group hospitals.
[b] Calculated as number of Full-Time Equivalents divided by number of acute beds.

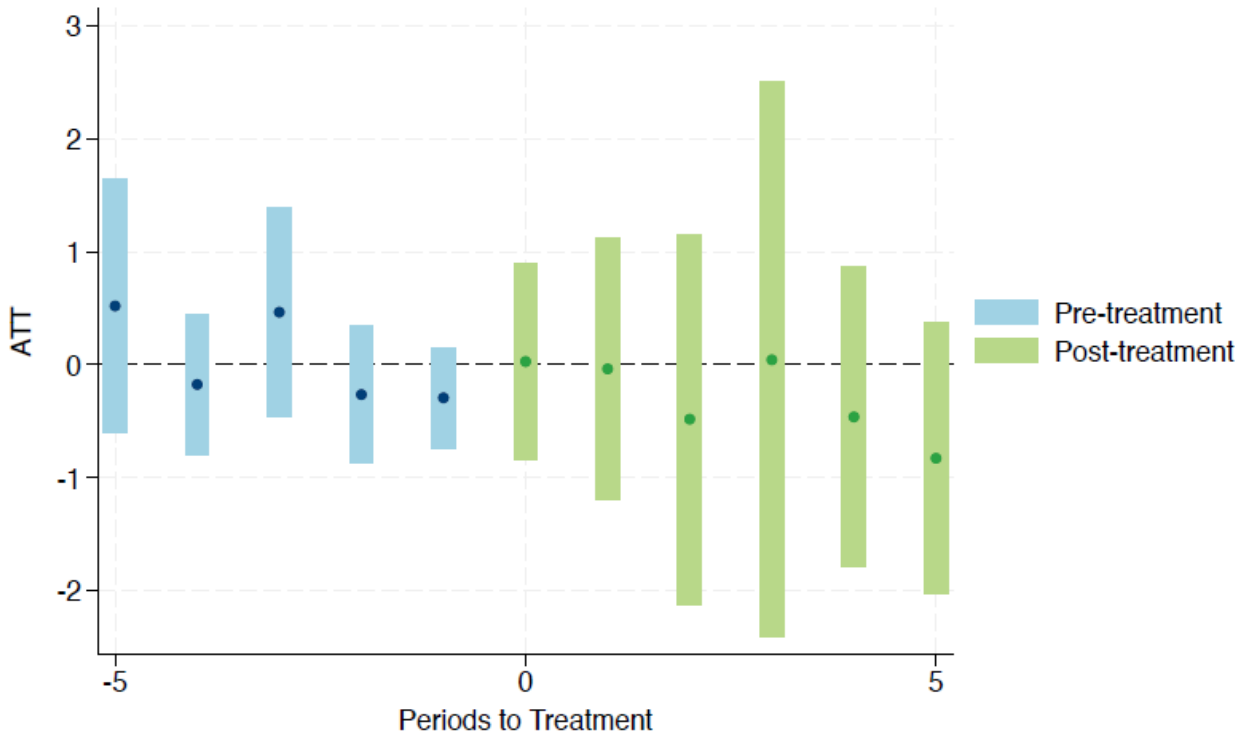
Controlling for baseline hospital Medicare inpatient payer, operating margin, outpatient to total revenue mix, ownership status (government-owned or nonprofit-owned), and rurality, the Callaway and Sant'Anna estimator found that a switch to for-profit ownership was associated with a statistically nonsignificant relative decrease in staffing ratio (Average Treatment Effect on Treated = –0.29, Std. Error = 0.49, p = .55) (Table 4). Further examination of treatment effects by year relative to ownership change showed that no pre-treatment effects reached statistical significance. Nonsignificant pre-treatment effects provide support for the difference-in-differences parallel trends assumption, although anticipatory effects of ownership change on staffing cannot be ruled out entirely (Table 4, Figure 1). A sensitivity test that excluded extreme staffing ratio outliers produced results that were similar to our original findings.

Table 4. Difference-in-Differences Estimates of the Effect of For-Profit Ownership on Hospital Staffing Ratio

Period Relative to Treatment	ATT	Std. Error	*p*-Value
Pre-Period Average	0.05	0.16	.74
Post-Period Average	–0.29	0.49	.55
5 Years Before Treatment	0.52	0.57	.36
4 Years Before Treatment	–0.17	0.32	.59
3 Years Before Treatment	0.46	0.47	.33
2 Years Before Treatment	–0.26	0.31	.40
1 Year Before Treatment	–0.29	0.23	.20
Year "0" (Year of Treatment)	0.03	0.44	.95
1 Year After Treatment	–0.04	0.59	.95
2 Years After Treatment	–0.48	0.83	.57
3 Years After Treatment	0.04	1.25	.97
4 Years After Treatment	–0.46	0.67	.49
5 Years After Treatment	–0.83	0.61	.18

Notes: Estimator controlled for baseline hospital Medicare inpatient payer, operating margin, outpatient to total revenue mix, ownership status (government-owned or nonprofit-owned), and rurality.
Abbreviations: ATT = Average Treatment Effect on Treated

Figure 1. Difference-in-Differences Treatment Effect Estimates by Year Relative to Ownership Change



Abbreviations: ATT = Average Treatment Effect on Treated.

DISCUSSION

This research adds to the current literature on rural hospital ownership – specifically, by studying transitions from government or nonprofit ownership to for-profit status and how this switch impacts staffing ratio, a critical indicator for quality of care and the local economy. Overall, we found mixed evidence linking for-profit ownership to changes in staffing ratio. The main specification of our linear regression model and the findings from our difference-in-differences analysis both suggested nonsignificant effects of for-profit ownership. However, follow-up linear regression analysis on a refined sample of rural hospitals yielded statistically significant evidence that for-profit ownership was associated with a reduction in hospital staffing ratio.

The results from the current study reflect the mixed findings of previous research on hospital organizational restructuring and its potential impact on quality of care. Previous research concluded that hospital conversion from nonprofit to for-profit status was associated with reductions in staffing ratios.[10] In contrast, Noles and colleagues found rural hospital mergers did not lead to statistically significant changes in full-time employees,[13] and Joynt and colleagues found conversions to for-profit status were not associated with quality process measures or in-hospital mortality rates.[5]

Despite concerns regarding the potential undue influence of for-profit ownership on a hospital's workforce, the lack of consistent statistically significant findings may indicate that conversion to for-profit status does not necessarily translate into meaningful workforce or staffing ratio changes. However, given potential concerns surrounding for-profit conversions, there is still an important need to explore other organizational characteristics that may change post-conversion. Future research should also investigate whether the potential impact on staffing ratio is moderated by contextual factors, including a hospital's prior financial performance or the type of acquirer, including the role of private equity firms.

LIMITATIONS

There are some limitations to our study. First, the linear regression analysis is not sufficient to determine causality. The difference-in-differences study design is generally better suited for providing causal estimates, but our specific difference-in-differences study sample had few treatment group hospitals. The limited size of the treatment group was

driven by several factors, including a preference for a balanced data set where each included hospital had observations for all years of the study period. Recent research suggests that a balanced data set is particularly important when implementing the Callaway and Sant'Anna estimator.[22] Nevertheless, the limited number of treatment group hospitals may reduce variation within the sample and assign large influence to a small number of facilities when estimating average treatment effects. In addition, while the current study primarily focuses on rural hospitals, the difference-in-differences analysis incorporated data from both rural and urban hospitals given sample size concerns. The inclusion of urban hospitals may capture additional contexts that are specific to urban environments and do not necessarily reflect the impact of rural hospital ownership changes. For the above reasons, the findings from this research should be viewed as exploratory.

CONCLUSION

Changes in hospital ownership may have important effects on hospital quality of care. In this study, we analyzed how conversions from government or nonprofit ownership to for-profit status influence hospital staffing ratio. Using regression techniques and difference-in-differences estimation, we found mixed evidence suggesting for-profit ownership is associated with reductions in hospital staffing ratio. Importantly, these findings were observed among a small number of hospitals, and ownership conversions may not translate to workforce changes in general. Future research should focus on whether additional contextual factors, including prior hospital financial performance or the reason for the hospital ownership change, moderate the impact on staffing ratio.

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Suggested Brief Citation

Manandhar A, Malone T. *Do Changes in Hospital Ownership Affect Staffing Ratios?* NC Rural Health Research Program, UNC Sheps Center, December 2025.

This study was supported by Arnold Ventures. The information, conclusions and opinions expressed in this brief are those of the authors and no endorsement by Arnold Ventures or The University of North Carolina is intended or should be inferred.