

Rural Hospitals in Pennsylvania in the Context of Healthcare Market Consolidations

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Abstract: Rural hospitals play a central role in delivering health care to residents and families in rural areas. A large proportion of rural hospitals, including many in Pennsylvania, face significant financial and operational challenges, partly driven by the aging and declining rural population. Meanwhile, the healthcare sector has been experiencing an increasing number of mergers, acquisitions, and health system affiliations, leading to market consolidation and reduced competition, with potentially negative impacts on consumers. In this project, we used mixed methods to provide an overall assessment of rural hospitals in Pennsylvania, comparing them to urban hospitals, and examined factors potentially associated with mergers, acquisitions, and health system affiliations. We conducted interviews and virtual site visits with selected hospitals and collected and analyzed secondary quantitative data from 2016 to 2023 from four different sources, including key measures of utilization, quality, cost, financial performance, and patient experience. Our findings showed that rural hospitals have significantly lower utilization, occupancy, and average hospital charges (without any discounts or contractual adjustments) per admission. We also found that rural hospitals had higher mortality rates but lower readmission rates for four clinically important medical conditions (heart failure, chronic obstructive pulmonary disease, acute kidney failure, and stroke). In 2023, for hospitalized patients with acute kidney failure in Pennsylvania, rural hospitals on average had lower charges per admission, lower 30-day readmission rates, and higher mortality rates than urban hospitals. Our logistic regression analyses did not find statistically significant predictors of mergers, acquisitions, or health system affiliations. Similarly, the difference-in-difference analyses did not find significant impact of consolidations on quality outcomes.

Key Words: Rural Health, Market Consolidation, Quality, Cost, Sustainability

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Executive Summary

Hospitals in rural areas are hubs of healthcare delivery for rural residents and families. Since 2005, 193 rural hospitals in the U.S. have either completely or partially closed (Cecil G. Sheps Center, 2024). Among those still operating, many face serious financial challenges and resource constraints (Carroll et al., 2023). During the same period, there has also been an increasing trend of healthcare market consolidations, with substantial impact on rural hospitals. These consolidations can take various forms such as mergers between hospitals; acquisitions of physician practices by hospitals; acquisitions of hospitals, physician practices, and insurance companies by health systems; and increased (multi-hospital) health system affiliation by previously independent hospitals (Heeringa et al. 2020; Carroll et al., 2022). Between 2005 and 2016, 326 rural hospitals (11 percent of the rural hospitals) were part of mergers, with financial distress being one of the major contributing factors (Williams et al., 2020). As a result of hospital mergers and closures, rural communities often face reduced access to needed care and potentially decreased quality of care (Henke et al., 2021; Levins 2023).

The primary aim of this project is to provide an understanding of mergers and acquisitions of hospitals in rural Pennsylvania in recent years, as well as potential strategies to make these hospitals sustainable and health care accessible to the rural population. We focus on general acute care hospitals that are included in the annual hospital reports by the Pennsylvania Department of Health (DOH) from 2016 to 2023. Studying rural hospitals and market consolidation in Pennsylvania is particularly relevant because of the significant rural population in the state, as well as the hospital mergers, acquisitions, and closures that have happened over the past decade. In 2023, about 26 percent of the population in Pennsylvania (3.36 million people) lived in the 48 rural counties of the state, with 63 rural hospitals serving these areas.

Methods

This project employed a mixed-methods approach that combined qualitative and quantitative analyses. The qualitative component included six key informant interviews with hospital executives and rural health leaders, followed by virtual site visits with two rural hospitals representing different organizational models. These interviews explored the experiences of rural hospitals before and after ownership changes, the challenges they face, and potential policy responses. The quantitative analyses integrated four statewide data sources from 2016 through 2023, including the DOH, Pennsylvania Health Care Cost Containment Council (PHC4), CMS Care Compare, and Hospital Change of Ownership records. The analyses examined hospital utilization, service availability, financial performance, patient experience, clinical quality, and ownership changes among rural and urban hospitals. Logistic regression models were used to examine predictors of ownership changes, and generalized difference-in-differences models evaluated changes in hospital performance following mergers, acquisitions, and health system affiliations.

Results

Structural Challenges

Rural hospitals consistently operated with fewer physicians, fewer registered nurses, lower patient volumes, lower occupancy rates, and lower overall utilization than urban hospitals. Declining and aging populations further contribute to workforce shortages and reduced demand for inpatient services, creating ongoing challenges for financial sustainability.

Limited Access to Specialized Hospital Services

Compared with urban hospitals, rural hospitals offered significantly fewer specialized service lines across most measures examined. The most pronounced gap involved neonatal intensive care services, with only about one in five rural hospitals providing Level II or higher neonatal intensive care compared with approximately one-half of urban hospitals. These findings reflect broader workforce and resource limitations affecting rural hospitals.

Differing Pattern of Quality Outcomes

Across heart failure, chronic obstructive pulmonary disease, acute kidney failure, and stroke, rural hospitals consistently exhibited higher mortality rates but lower 30-day readmission rates than urban hospitals. These findings suggest that quality measures commonly used to evaluate hospitals may warrant additional examination within rural settings, where patient populations, access challenges, and patterns of care differ substantially from urban hospitals.

Highly Contextual Ownership Changes

The qualitative findings demonstrated that mergers, acquisitions, and health system affiliations occurred under diverse circumstances and were often initiated proactively by hospitals seeking long-term stability rather than immediate financial rescue. Participants described important benefits of health system affiliation, including access to financial resources, specialized services, and administrative support, while also expressing concerns about reduced local decision-making and community engagement following some ownership changes. The quantitative analyses did not identify statistically significant predictors of ownership changes or consistent improvements in quality or financial outcomes following consolidation. Together, these findings suggest that the success of ownership changes depends less on consolidation itself than on the planning, implementation, governance, and local relationships that accompany those transitions.

Pricing and Payment Data Limitations

The project identified important limitations in the availability and accessibility of hospital payment and pricing data needed to fully evaluate the effects of market consolidation. Improving statewide health data infrastructure would strengthen future

research and provide policymakers with better evidence to evaluate hospital performance and long-term policy outcomes.

Policy Considerations

Preserve Access to Essential Rural Hospital Services

The findings suggest that maintaining access to essential health care services should remain a primary objective of rural health policy. Because many rural hospitals face persistent workforce shortages and limited patient volume, maintaining every service at every hospital may not be feasible. Instead, policymakers and hospital leaders should prioritize preserving those services that are most critical to the communities each hospital serves while strengthening regional care networks and referral relationships where appropriate.

Strengthen the Rural Health Care Workforce

Recruitment and retention of physicians, nurses, and other health professionals emerged consistently as one of the most significant challenges affecting rural hospitals. Continued investment in workforce development, rural training partnerships, loan repayment programs, and technical assistance supporting Critical Access Hospital designation and related federal initiatives may improve the long-term sustainability of rural health care.

Support Strategic Health System Partnerships While Preserving Local Decision-Making

The findings indicate that health system partnerships can improve access to financial resources, specialized expertise, and administrative capacity, but successful affiliations depend heavily on governance, implementation, and continued responsiveness to local communities. Policies that support voluntary partnerships while preserving meaningful local leadership and accountability may better position rural hospitals to benefit from system-level resources without sacrificing community priorities.

Improve Access to Care Beyond Hospital Operations

Transportation barriers and long travel distances remain important obstacles to health care access in many rural communities. Coordinated transportation strategies that improve access to emergency and non-emergency care may also strengthen the long-term viability of rural hospitals by reducing barriers to care and supporting sustainable utilization of local health services.

Continue Evaluating Quality Measures in Rural Settings

The study found that rural hospitals consistently exhibited higher mortality rates but lower 30-day readmission rates than urban hospitals across the four clinical conditions examined. These findings suggest that additional research is warranted to better understand how commonly used hospital quality measures should be interpreted within

rural settings and how they may be influenced by quantity of data available, differences in patient populations, access to care, and patterns of service delivery. The inclusion of additional factors, such as patient distance to hospitals, would provide a more comprehensive understanding of the range of factors influencing rural patient outcomes.

Strengthen Pennsylvania's Rural Health Data Infrastructure

Improving the accessibility, consistency, and standardization of statewide hospital data would strengthen future research and evidence-based policymaking. Enhanced collaboration among hospitals, state agencies, and researchers could improve the ability to evaluate hospital performance, monitor the long-term effects of ownership changes, and provide policymakers with more robust information to support decisions affecting rural health care.

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Introduction

Total healthcare spending in the U.S. accounted for 16.7 percent of gross domestic product (GDP) in 2023, with almost one-third attributed to hospital-based care (Fiore et al., 2024), significantly higher than the spending on physician and clinical services (21 percent), or prescription drugs (8 percent). At the same time, the high and increasing cost of hospital care has taken place against a backdrop of the fast-changing healthcare delivery landscape in the U.S. More specifically, the significant and ongoing trend of market consolidation (i.e., mergers and acquisitions) that started in the late 1990s. Such a trend is particularly relevant because the U.S. healthcare system is heavily market-based and private, an important distinction from most other high-income OECD countries such as the United Kingdom and Canada, where universal health care has been implemented using public funding. As a result, hospitals in the U.S. are often the primary targets of federal and state health care regulations.

Based on the well-established economic understanding of market forces, consolidation tends to reduce competition, increase market power and prices, and lower consumer welfare (Varian, 1992; Morris, 2012). The theory further states that, in an ideal scenario, highly competitive markets naturally incentivize the firms within them to offer the best products or services at the lowest possible prices (i.e., perfect efficiency). Competition is expected to play an essential role in maintaining a healthy and efficient market, which in turn should benefit consumers. However, often due to socio-demographic and geographic factors, a high level of competition is not always a practical solution in the healthcare market. For example, in rural areas with low population density, it may be unrealistic to sustain multiple hospitals financially, creating a situation where the traditional market would not function well for consumers without policy interventions or proper regulations by the federal and state governments (Carroll et al., 2024). Two additional factors influence the behavior of both consumers and healthcare providers, and thus further complicate the competition issues in the healthcare market. First, unlike some other markets (e.g., groceries or cars), consumers usually do not pay the full price of healthcare services when they have health insurance coverage. Second, when choosing hospitals and physicians, consumers often do not have accurate information on price and quality. These factors make it even more difficult to maintain an adequate level of competition in the healthcare market, compared to other segments of the economy where payments are simpler and more direct, and price and quality are more transparent (Finkelstein, 2018; Rao et al., 2022).

Hospitals in rural areas are hubs of health care delivery for rural residents and families. Since 2005, 193 rural hospitals in the U.S. have either completely or partially closed (Cecil G. Sheps Center, 2024). Among those still operating, many face serious financial challenges and resource constraints (Carroll et al., 2023). During the same period, there has also been an increasing trend of healthcare market consolidations, with substantial impact on rural hospitals. These consolidations can take various forms such as mergers between hospitals, acquisitions of physician practices by hospitals,

acquisitions of hospitals, physician practices, and insurance companies by health systems, and increasing numbers of (multi-hospital) health system affiliations by previously independent hospitals (Heeringa et al., 2020; Carroll et al., 2022). Between 2005 and 2016, 326 rural hospitals (11 percent of total rural hospitals in the U.S) were part of this trend, with financial distress being one of the major contributing factors (Williams et al., 2020). As a result of hospital mergers and closures, rural communities often face reduced access to needed care and potentially decreased quality of care (Henke et al., 2021; Levins, 2023).

In 2023, about 26 percent of the population in Pennsylvania (3.36 million people) lived in the 48 rural counties of the state, with 63 rural hospitals serving these areas. Since 2005, Pennsylvania has had at least five closures and a significant number of mergers and acquisitions involving rural hospitals (Cecil G. Sheps Center, 2024). One important goal of the Pennsylvania Rural Health Model, a joint effort by the Pennsylvania Department of Health and the Centers for Medicare and Medicaid Services (CMS) that started in 2017 and completed its sixth performance year in 2024, is to “provide predictable hospital finances, prevent hospital closures, and avoid the loss of hospital services and jobs” (Centers for Medicare and Medicaid Services, 2024a). According to a report by the Center for Healthcare Quality and Payment Reform (2024), 53 percent of the rural hospitals in Pennsylvania were operating at a financial loss and 30 percent were facing risks of closure. The increasing trend of consolidation in the healthcare market in recent years, characterized by the formation of large health systems through mergers, acquisitions, and affiliations has raised serious concerns among consumers, policymakers, and researchers (Godwin et al, 2024). Although, some argue that consolidations may enhance efficiency and promote more coordinated care (Levinson et al. 2024). As stated in a recent report released by the Kaiser Family Foundation: “Consolidation has the potential to increase efficiency and help some struggling providers to keep their doors open in relatively underserved areas, but it can also reduce market competition and ease pressure on providers to lower prices or invest in quality improvements” (Hulver and Levinson, 2023).

There is a significant body of literature on the topic of healthcare market consolidation (i.e., mergers, acquisitions, and system affiliations), with overwhelm (Dranove and Satterthwaite, 2000; Gaynor, 2006; Gaynor and Town, 2011; Dafny et al., 2019). Such effects have been documented at both the national and state levels (Schwartz et al., 2020; Gale, 2015), including mergers involving geographically separated markets (Arnold et al., 2024). These effects have negative implications for consumers, policymakers, and payers, including employers, private insurers, and federal and state governments. While there are studies reporting efficiency gain and quality improvement after mergers and acquisitions, evidence for the opposite has also been found. The link between market consolidation and quality of care is unclear (Carroll et al., 2023). Granted, there are important nuances to be considered when interpreting these findings comprehensively. Among the key factors that result in differential impacts are the

contextual and implementation details during mergers and acquisitions (Knapp et al., 2017; Damberg, 2023). For example, full integration of leadership, prompt data analysis and monitoring, effective transition in health information technology, and accountability at the local level for quality outcomes may influence how well a hospital functions after being merged (Wang et al., 2022). However, for most hospitals, such contextual and implementation details are not easily accessible to external researchers and thus are difficult to measure and examine quantitatively.

In Pennsylvania, there are perceived concerns with the healthcare market among consumers and policymakers (Levins, 2023). The issue of hospital mergers and acquisitions has been an active and ongoing priority of policy and legislative discussion (Borowski, 2024; Averbach et al., 2024). Based on a survey in 2023, the majority of consumers in Pennsylvania, across party lines, were worried about increased cost and reduced access due to hospital consolidation and were supportive of government actions (Altarum, 2023).

In rural areas, empirical evidence surrounding hospital consolidation has supported consumer perceptions. Consolidations have been associated with improved financial performance, but also with reduced access to care and lowered quality outcomes (O'Hanlon et al., 2019). In many cases, access to care decreased due to the reduction or discontinuation of certain medical services after mergers and acquisitions. In particular, such reduced access has significant impact on vulnerable populations (e.g., women and children). For example, Dranove et al. (2025) found that rural hospitals are more likely to close their obstetric units after being merged, reducing access to maternity care. However, rural hospitals involved in consolidations are often under financial distress, and for some of them, to be merged with a large health system or another financially strong hospital may be the only practical option to stay open (Alexander et al., 1996; Williams et al., 2018).

A recent study also found that Critical Access Hospitals (CAH) in rural Pennsylvania faced declining margins and increased costs (Pai et al., 2023). However, there are also studies reporting evidence that contradict the mainstream understanding of competition in health care market. For example, Kim et al., (2021) found that competition was associated with lower hospital efficiency in Pennsylvania. As a result, how to sustain hospitals, and thus maintain consumer access to care, in rural Pennsylvania, is a challenging and complicated question. Market competition is important, but not always attainable in rural areas, and there may be a need for multi-faceted policy design that supports new budget and payment models for hospitals such as the Rural Emergency Hospitals designation (Centers for Medicare and Medicaid Services, 2024b) and the Transforming Episode Accountability Model (Shashikumar et al., 2025).

Some rural hospitals may actively seek to partner with a financially strong hospital or health system, in the form of merger, acquisition, or affiliation to stay open (Asser, 2024). However, consolidation does not always result in financial sustainability, and some hospitals may face increased risks of closure after joining a health system. This

risk is likely due to the challenges in their integration into the new system or decisions that prioritize business over community needs (Jiang et al., 2022). In other cases, it may be financially impractical to keep a full-service hospital open. Even when consolidation leads to stabilized operations, important services and departments in rural hospitals may be cut to sustain or improve financial performance (Henke et al., 2021). Adding to these challenges are shrinking and aging populations in many rural areas (Johnson and Lichter, 2019; Johnson, 2022; Cohen and Greaney, 2023). Another emerging challenge is the growing tendency of rural residents to seek care at hospitals other than the closest facility, even when the needed services are available locally, a phenomenon known as hospital bypass (Zhang et al., 2023). Health system affiliation is a potential contributing factor to such bypass. Hospital bypass can further decrease the patient volume and the financial stability of rural hospitals, preventing them from providing the intended level of services (Friedman and Holmes, 2022).

Overall, prior studies mostly suggested that consolidations in the healthcare market have negative impacts on rural populations by increasing cost to consumers and reducing access without generating meaningful improvement in the quality of care. However, mergers, acquisitions, and health system affiliations also helped some rural hospitals to improve their financial stability and remain open through increased efficiency and lowered cost for hospital operations. On the other hand, the existing literature on this topic with a focus on Pennsylvania is limited. This project contributes to the understanding of health care in rural Pennsylvania by focusing on analyzing hospital market consolidations within the state from 2016 to 2023 using a mixed-methods approach that adds depth to the findings. It is with the above motivations and considerations that this study investigates rural hospitals in Pennsylvania by focusing on their sustainability, cost, and quality. This study also investigates the impact of healthcare market consolidations, specifically hospital mergers, acquisitions, and health system affiliations in this context.

Objectives and Significance

The primary aim of this project is to provide an understanding of mergers and acquisitions of hospitals in rural Pennsylvania in recent years, as well as potential strategies to make these hospitals sustainable and health care accessible to the rural population. We focus on general acute care hospitals that are included in the annual hospital reports by the Pennsylvania Department of Health from 2016 to 2023.

Studying hospital market consolidation in rural Pennsylvania is particularly relevant because of the significant rural population in the state, as well as the hospital mergers, acquisitions, and closures that have happened over the past decade.

This project has the following specific objectives:

- Identify key factors leading to mergers and acquisitions.
- Evaluate the impact of mergers and consolidations on outcomes in Pennsylvania hospitals.

Methods

Objectives are obtained with the following methods:

1. Key informant interviews (KII) were conducted with relevant stakeholders to obtain an in-depth understanding of the contexts and consequences of hospital mergers and acquisitions in rural Pennsylvania.
2. Virtual site visits were completed with relevant stakeholders from two selected rural hospitals (one independent, one recently acquired by a larger health system) to obtain further understanding of their experiences and challenges in providing care in the corresponding service areas.
3. Quantitative data analysis was done to quantify the key factors contributing overall to the mergers and acquisitions of rural Pennsylvania hospitals.
4. Quantitative data analysis was used to compare the outcomes among five groups of hospitals in Pennsylvania: 1) *all Pennsylvania hospitals*; 2) *all rural Pennsylvania hospitals*; 3) *all rural Pennsylvania hospitals involved in mergers, acquisitions, or changes of affiliation*; 4) *all urban Pennsylvania hospitals*; and 5) *all urban Pennsylvania hospitals involved in mergers, acquisitions, or changes of affiliation*.

To accomplish the specific objectives above, the research team (we) used a mixed-methods approach, including both qualitative and quantitative data analyses. The qualitative analyses were based on six key informant interviews (KII) conducted at the beginning of the project, along with two virtual site visits with selected hospitals at the final stage of the project. The quantitative analyses combined four different secondary data sources and focused on three categories of hospital performance measures: 1) service availability and utilization; 2) quality of care; and 3) financial strength, including sustainability.

Qualitative Analyses 1: Early-Stage Key Informant Interviews

In consultation with the project staff from the Center for Rural Pennsylvania (CRP), the research team first identified six key informants who have served or are currently serving in leadership roles in health care within various rural communities in Pennsylvania, including five (current or former) hospital executives (e.g., president and chief medical officer) and one director of a Population Health Center (a collaborative resource with the mission of improving population health and disease prevention). All interviewees had prior experiences with mergers and acquisitions involving rural hospitals in Pennsylvania. The interviews were between 60 and 90 minutes long, following a semi-structured format and using a questionnaire developed by the research team. The discussions focused on three aspects of rural hospitals: 1) the communities they serve; 2) the key factors and challenges before and after mergers or acquisitions; and 3) the potential government policies that may improve the sustainability of rural hospitals. All interviews were conducted, recorded, and transcribed with Zoom or

Microsoft Teams via Penn State University's portals. The semi-structured interview protocol is included in Appendix 1.

Upon completion and transcription, a research staff member validated the transcripts by comparing the texts with the audio recordings and made corrections when the errors were evident. Then, each validated interview transcript was reviewed by the project director and another research staff independently. The transcripts were coded manually by sections and sub-questions based on the interview questionnaire, with three broad themes: 1) positive perspectives, 2) negative perspectives, and 3) policy perspectives. Summaries were then generated to highlight the learnings from the key informants, with follow-up meetings between the project director and the research staff to discuss convergent themes, the different perspectives of the interviewees, and to reconcile any differences in interpreting the respondents' key points. The qualitative findings from these interviews were later combined with the quantitative analyses to form a holistic understanding of the main issues surrounding rural hospital consolidations and policy recommendations. More specifically, we identified both convergence and divergence across the results of qualitative and quantitative analyses, in the areas where the two had overlapping information.

Quantitative Data Collection and Analyses

Secondary data were collected from four sources: 1) Pennsylvania Health Care Cost Containment Council (PHC4), 2) Care Compare database from the Centers for Medicare and Medicaid Services (CMS), 3) Pennsylvania Department of Health (DOH) Annual Hospital Reports, and 4) Hospital Change of Ownership (CHOW) data, which were requested and acquired directly from DOH staff. The needed measures were obtained for all general acute care hospitals in the annual hospital reports by the Pennsylvania Department of Health, including critical access hospitals. All the measures were collected annually at the hospital level. However, not every hospital in our study sample reported all these measures each year, and therefore the sample size may vary across different measures. (For example, for clinical quality measures, certain hospitals might not have enough patients with that medical condition, such as stroke, in a specific year to be eligible for reporting.)

The first three data sources are publicly accessible from their corresponding websites, whereas the CHOW records from the Pennsylvania Department of Health were made available to the research team via coordination with CRP staff. CHOW data include hospital name, location, health system affiliation, date of transaction, and broad types of transactions (merger, acquisition, affiliation change). A merger typically unites two hospitals or health systems of relatively similar size, to create a new, combined entity. An acquisition, on the other hand, often involves a large hospital (or health system) purchasing and absorbing a relatively small hospital (or health system). In mergers, the two (or more) merging organizations often share ownership and governance of the newly formed entity. In acquisitions, the acquiring organization (the

buyer) often holds the decision-making power and majority ownership. Change of affiliation is a kind of new partnership where a hospital seeks collaboration or assistance from a large health system, without giving up independent ownership and managerial control. Legally speaking, change of affiliation does not change ownership. However, such changes are analyzed in conjunction with mergers and acquisitions because affiliation changes are often intended to pool resources, create more advantageous purchasing contracts, and develop better referral networks.

Because coherent and unique numeric identification numbers for hospitals across different data sources and overtime were not available, and the names of hospitals may be recorded with significant variations in spelling and formatting, we combined the multiple sources of quantitative data by manually matching the hospitals using their names and locations.¹ Our final study sample represents 97 percent of all general acute hospitals (Table 1) included in the publicly available annual reports by the DOH. As noted previously, the exact sample size for each measure depends on how many hospitals reported that measure in a specific year, which may vary between 85 and 97 percent during the study period. Based on the Hospital Changes of Ownership (CHOW) records from DOH, we identified hospitals involved in mergers, acquisitions, or changes of affiliation to health systems from 2016 to 2023. Hospitals were considered rural if they were located in a rural county in Pennsylvania, using the definition from the Center for Rural Pennsylvania.

We decided to include data from 2016 to 2023 for three main reasons. First, the data from 2023 were the most currently available when the project started. Second, an eight-year study period would provide a longitudinal perspective, while still manageable analytically. Third, consolidations of rural hospitals prior to 2016 have already been studied substantially in the existing literature.

The list of measures used in our analyses, and their definitions, are listed by source in Appendix 5. The study uses five types or categories of variables, each from a particular source. The first type of measures includes standard measures of hospital quality and cost related to such factors as charges for admission, and mortality or readmission rates for major categories of illnesses. High readmission rates potentially indicate inadequate quality of care in the hospital, post-discharge planning, or care coordination (Nash et al., 2025). A second category of measures includes what are labelled utilization measures; hospitals report these on an annual basis. This list includes admissions, patients' length of stay, occupancy rates, and number of emergency room visits.

¹ Difficulty in aligning data by hospital name occurred between the financial data and the quality/utilization data, as well as within the same data across different years, to different extents. If we consider that PHC4 and DOH are both state data sources, the hospital data are not integrated for analysis. The CMS data have no numerical linkage to Pennsylvania hospital data, and the spelling of hospital names is more varied. This project did not require linking the CMS data to state data. However, if we want to analyze the patient experience measure in a single model, that integration would be needed.

Hospital characteristics are included in a third set of measures and capture various aspects of a hospital's capacity to provide services. These factors range from number of beds and employed registered nurses, to services available, such as specialty care and levels of neonatal intensive care. The fourth set is financial and offers a variety of indicators to explain a hospital's revenue and the sources of that revenue. A final set of variables incorporates patients' reported experiences with staff, care and the hospital.

Table 1: Hospital Study Sample

Number of General Acute Hospitals	2016	2017	2018	2019	2020	2021	2022	2023
Study Sample	156	156	154	147	151	147	147	146
PA-DOH Annual Reports	169	169	168	152	164	151	151	172
Percentage Represented	92%	92%	92%	97%	92%	97%	97%	85%

As a first step, using the study sample, we descriptively examined longitudinal trends of each of the included measures and compared the trends among five groups of hospitals in Pennsylvania: 1) all Pennsylvania hospitals; 2) all rural Pennsylvania hospitals; 3) all rural Pennsylvania hospitals involved in mergers, acquisitions, or changes of affiliation (a subset of group 2); 4) all urban Pennsylvania hospitals; 5) all urban Pennsylvania hospitals involved in mergers, acquisitions, or changes of affiliation (a subset of group 4). In particular, we focused on the urban-rural comparison as well as any differential trends associated with mergers, acquisitions or affiliation changes. For each of the measures, we calculated the average across all hospitals within the specific group, without using any weights.

To examine potential predictors of consolidations, we employed a standard logistic regression model, using a binary indicator (yes=1, no=0) for hospital ownership change (mergers, acquisitions, or affiliation changes) as the outcome, and a set of hospital characteristics (number of beds, number of admissions, number of emergency room visits, number of employed physicians, number of employed registered nurses, and if the hospital is in a rural county) and financial measures (net patient revenue (NPR)), operating margin, Medicare share of NPR, and Medicaid share of NPR) as independent variables (predictors), with year fixed-effects (i.e., year-to-year changes unrelated to hospital ownership changes were accounted for; one binary indicator for each year). The independent variables included in the logistic regression were used as key predictors of hospital mergers and acquisitions, as noted in prior literature (Noles et al., 2015). The year indicators captured the potentially unobserved (or unmeasured) factors affecting all hospitals similarly within each year, but differently over time. For example, from 2020 to 2023, the COVID pandemic started, peaked, and then declined. During the same period, the overall economy also fluctuated year by year, which would greatly impact the financial data irrespective of any changes in ownership. Including year indicators would allow us to control such factors, which are not directly included in the model, and hence generate more reliable results targeted specifically at what outcomes are most likely due

to a change in ownership. These outcomes are included as key variables in the analysis, such as operating margin and number of employed physicians. To address the potential problem of multicollinearity (high correlations among multiple, closely related predictors), we performed correlation analyses among the predictors included in the model and computed Variance Inflation Factors (VIF) to determine if a single predictor overlaps too much with the other predictors to be informative to the analysis.

In addition to the baseline model, which is estimated with contemporaneous, independent variables from all years, we performed two sensitivity analyses (i.e., “stress testing” the results). First, we estimated using the same model, but with a one-year lag. This would allow us to understand if hospital characteristics and financial performance from the previous year predict ownership change in the current year. Second, we excluded the data from 2020 to 2023, the years during the COVID pandemic. The baseline model results are included in Table AVIII-A in Appendix 4.

Finally, to analyze the potential impact of hospital ownership changes on quality measures, we conduct a set of difference-in-difference models (DID) using the ownership change (mergers, acquisitions, or affiliation changes) as the binary treatment indicator (yes=1, no=0). Since we have a longitudinal dataset (unbalanced panel), we use a generalized version of the DID model with two-way fixed effects along with time-varying hospital characteristics as covariates to estimate the main effects of hospital ownership change. The inclusion of hospital-level fixed effects and year fixed effects allows us to control for unobserved time-invariant characteristics (confounding factors) that are steady over time (e.g., organizational culture, managerial strength, or quality improvement practices that may persist over time in certain hospitals) and thus enhance the robustness of the results. For each hospital, the binary indicator measuring consolidation was set to “0” in ALL years before the first ownership change in our data period, and the indicator switches to “1” for ALL years after that. In this approach, each hospital in the data that went through ownership changes was separated into two time periods, the pre-consolidation period and the post-consolidation period. By including hospital fixed effects (the “permanent” portion of the outcome of each hospital over the whole study period) and the year fixed effects (the “equal” portion of the outcome across all hospitals within the same year), the estimated coefficients of the model would reflect the “remaining” variation in the outcome associated with the variations in the independent variable. In particular, the coefficient on the binary indicator for ownership change would capture the change in the outcome associated with the change in ownership, conditional on other independent variables included in the model. Also, any variables, even observed, could not be included in the model if they do not change over time (e.g., being in a rural county), since they would be “absorbed” into the hospital fixed effects. The key requirement for this model to generate reliable results is that the unobserved confounding factors (the factors that we could NOT measure or include in the model) are constant over time.

In addition to the baseline model, we performed two sensitivity analyses. First, we estimated the same model, but with the ownership change indicator switched “on” with a one-year lag. This would allow us to understand if a hospital ownership change has delayed effects on quality and cost. Second, we exclude data from 2020 to 2023, the years during the COVID pandemic. Since consolidation happened throughout the study period, including in 2016, we do not test pre-treatment trends as in a standard DID model. The hospital level fixed effects absorb all time-invariant factors within the same hospitals over time, which partly address the pre-consolidation trends. The baseline model results are summarized in tables AVIII-B and AVIII-C in Appendix 4. More details on specifications of the logistic regression and the DID analyses are included in the Technical Appendix (Appendix 4) at the end of this report.

Qualitative Analyses 2: Late-Stage Virtual Hospital Site Visits

Based on the analyses of financial measures, and the CHOW records, we identified two rural hospitals at which to conduct virtual site visits.² The selection of hospitals at this stage was also in consultation with project staff from CRP and based on several considerations. First, to avoid information redundancy and overburden, we only selected hospitals that were not involved in any of the key informant interviews (KIIs) previously. Second, to potentially capture different perspectives, we selected one independent hospital facing financial challenges and another one that was recently merged into a large health system with solid financial performance. The site visits were completed with six different participants from the two selected hospitals, including four discussion sessions (two sessions with each hospital). The same questionnaire from the previous KII was used for the site visits. However, with the same questions, when relevant, the interviewer directed the discussions in these virtual site visits to be more focused on hospital resources, challenges, and perspectives on being independent or being part of a health system. For example, when discussing the consequences of hospital consolidation based on section C(iii) of the questionnaire, the interviewer asked the respondents to provide more in-depth information about the resources used in the integration of the hospital after merger, new resources available to the hospital, and any major changes in their decision-making processes. The analyses and the findings from the site visits were integrated into the analyses of KIIs at the earlier stage.

Results

Overall, the results from both qualitative and quantitative data analyses indicate that rural hospitals in Pennsylvania face serious challenges, and market consolidation might have nuanced implications in healthcare delivery by these hospitals in the rural communities they serve.

² To protect the confidentiality of the respondents from these hospitals, we do not include the name or location of the hospitals for site visits.

Findings from Key Informant Interviews and Virtual Site Visits

Several themes emerged from the six interviews and two virtual site visits with insights on several important aspects of rural hospitals. Interview and site visit participants consistently commented on the challenging socio-economic and demographic environments in rural Pennsylvania and the resulting difficulties in providing care in these areas. They also frequently mentioned the specific challenges in attracting and retaining healthcare professionals, the existing or predicted financial stresses that threaten the survival of rural hospitals (and other rural health care delivery organizations), the need for alternative payment models, transportation barriers, the connection with local communities, and the importance of leadership and governance in rural hospitals. In addition, the discussions during the two site visits provided further insights into the contexts of hospital consolidation, the integration (or lack of integration) after ownership changes, the possible role of a rural hospital in the local community, and assistance that could be key to the sustainability of rural hospitals.

First, all respondents mentioned that the declining and aging population created unique and significant challenges for healthcare delivery in rural areas. The aging population reduced the size of eligible workforce at the local level for hospitals and physician services, causing difficulties in staffing and maintaining healthcare provision. Attracting providers from other areas could be equally challenging, due to the demographic and economic conditions in these areas. Expectations for quality of life that providers and their household members might have could be difficult to meet in some rural communities; this could include job opportunities for household members, diverse restaurants and grocery stores, and other community resources or amenities. Even when recruitment efforts succeed, they could incur higher costs for rural hospitals than those in urban areas (e.g., higher salary and better relocation package to attract suitable job candidates).

In addition to workforce challenges, a population with a high proportion of elderly patients means that hospitals often faced “double squeezes” on both revenue and cost. Elderly patients tend to be in worse health status with more complicated conditions and therefore were more costly to treat. At the same time, the share of patients covered by commercial or private insurance plans (which tend to have higher reimbursement rates) also decreases as the population gets older, leading to reduced revenue. For example, one interview respondent discussed the specific financial challenges of their hospital due to the demographic trends in the service region:

The bottom line is the demographics of our area are such that it's really, really, really hard for any hospital to make a margin of any significance, and we're very similar with most of the markets locally. My payer mix was, 50 percent Medicare. So, 50 percent was over 65. And then I had about 13 to 15 percent Medicaid. So about 65 percent of my payer mix was Medicare and Medicaid. But when you have 30 percent of your payer mix being commercial it's really hard. You can barely break even.

Since the demographic trend is unlikely to change anytime soon, these challenges will probably persist for the foreseeable future. In some sense, rural hospitals are (and will be) facing difficulties due to broader economic and demographic factors that would require solutions from outside health care (e.g., better overall economic development in rural areas).

Second, for most respondents, market competition was less relevant for hospitals in rural areas than in urban areas, since most rural areas had difficulties in sustaining only one or a limited number of hospitals due to low patient volume. Even when competing hospitals did exist in the region, they were often in neighboring counties with considerable distance between them. However, the respondents also said that consolidations did lead to important changes in rural healthcare delivery. When a hospital became part of a health system, through either a full merger or partial affiliation, it often had access to resources and providers at the system level that would otherwise be unavailable. One interview participant explicitly mentioned the importance of resources for innovation at the system level:

Another reason for joining with a system like that is the access to innovation. You just don't have the resources when you're standalone as a community hospital, to innovation and things that can improve the way the work gets done. And they [the health system] have the resources and the initiatives to look at how they're using them.

On the negative side, consolidations with a larger health system in some cases also led to less control by the rural hospital in decision making and reduced its interest and engagement with the local community. For example, a board of directors for a rural hospital often includes members from local community and prioritizes community needs whenever possible. However, once becoming a part of a large health system, the governance and the decision making of the hospital are more likely to be taken to the health system, leaving the board with reduced ability to make locally tailored decisions. Another participant described such impact:

But the mergers they all like, I mean ... It was a freestanding facility with a fiduciary board and then we became part of a large system, which was a system with an advisory board, not a fiduciary board. The fiduciary sits at the system level, not at the local level. So it changed things from a governance perspective. It changed things from a managerial perspective, just, you know, from me. Personally, I already had been through that 2 or 3 times.

In addition, respondents suggested that market consolidations could have significant impact on patient referrals in rural areas. Many rural hospitals had limited facilities and capacity, especially in providing specialty services. Therefore, they often were referral sources for other hospitals prior to integration with a health system. Once they became part of a health system, they were more likely to refer patients to other hospitals within the system network. Past research shows this could potentially require patients to travel longer distances to get the needed care (Desai et al., 2025). The respondents' comments

on the changes of referral patterns and hospital consolidations were consistent with the existing research (Levinson et al., 2024; Fuse Brown, 2024). For example, Nakamura (2010, p.226) found that when hospital mergers happened, “low or average quality acquirers exploit their targets' monopoly power to steer patients to the acquirers”. Such changed referral patterns would practically increase the market power of the health system and potentially also increase the cost for patients due to higher prices (Cooper et al. 2019; Whaley and Zhao 2024).

Third, mergers and acquisitions happened under very different financial circumstances and often needed long periods of planning before the transaction as well as significant efforts of integration afterwards. Respondents with direct experience or knowledge of hospital mergers reported that mergers in rural areas most often occurred when hospitals facing financial challenges proactively sought partnerships to address those difficulties. They also noted that some financially stable hospitals pursued mergers because they anticipated future financial pressures or wanted to further strengthen their financial position. Hostile takeovers involving rural hospitals have rarely happened. For example, one respondent mentioned:

Our hospital was financially in a pretty good place. So we could make a decision without our backs against the wall. We could have stayed as a stand-alone operating facility and still broke even, but we made the decision for the betterment of our patients that to provide them higher level of care and to be part of a more financially sound system for the long term.

They also mostly agreed that the actual collaboration and integration in governance, management, and decision making is key to the success of such mergers. If successful, the integration can lead to more efficient operations and lower operational costs for hospitals. The consensus was that rural hospitals typically realize cost savings after integration, such as lower costs for medical equipment and employee health plans through the parent organization. They are also often able to expand the medical services they offer, for example by sharing specialty care providers across hospitals within the same health system, although some service lines may be consolidated at other hospitals in the system. The indication was that while certain services might be cut from individual hospitals, the patient might have access to an expanded range of services offered by the health system via multiple hospitals. Most respondents did not think that quality of care would change significantly after mergers, at least not in the short term.

Fourth, a consistent theme was the emphasis on the importance of a close relationship between rural hospitals and the local communities. Understanding the specific needs at the local level and making residents feel “welcome and connected” were important factors in sustaining rural hospitals (e.g., sponsoring or at least participating in local community events; offering health centered educational sessions). Such connections required active engagement and outreach efforts by hospital leadership. One respondent commented on the significance of the board of directors being part of the community:

You know, most of these hospitals that exist in the nonprofit sector are governed by a board of directors. Typically, business leaders and community leaders from the community sit on those boards. So there are people used to always say, you know, we were an entity with almost half a billion dollars budget. But who owns this thing [the hospital]? And we would say the community owns it.

Similarly, for health systems to be successful, government policymaking at all levels also needed to involve local stakeholders with in-depth knowledge and understanding of the communities.

Fifth, in terms of specific government policies, the respondents highlighted three areas that they believed the federal and the state governments could prioritize and make meaningful differences for rural hospitals in Pennsylvania: 1) training, recruitment, and retention of health care professionals; 2) implementing payment models (e.g., the Pennsylvania Rural Health Model and the Rural Emergency Hospital Model) that can guarantee at least a basic level of financial security regardless of patient volume; and 3) allowing rural hospitals some flexibility in their compliance with the existing regulations. Participants were generally consistent about the potential impact of such policies in their discussions of workforce training, payment reform, and regulatory flexibility. One respondent commented:

Support from a training standpoint: connecting with our young folks regionally to identify opportunities for these professions and a huge one is loan forgiveness for folks that are practicing in rural areas. Think legislatively how do we get more folks trained that aren't coming out with hundreds of thousands of dollars in debt.

Another respondent specifically discussed payment models as a way to make a meaningful difference for rural hospitals in Pennsylvania:

So we're on a global budget, because we're a merged entity. ... I will tell you in the global budget that [our hospital] participated in, you know they kept coming back and cutting because our volumes were down. But let's just use the ER as an example. If your volume drops, I can't downsize the ER. I only have, you know, a small number of staff anyway, and I have to staff it to that level, whether there's, you know, 50 patients that day or 100 patients or two patients. And so, you know, you can't do the fee for service calculation there and say that that's what your global budget should be. But I think there has to be some kind of, you know, global budget payment that covers the essential services regardless of volume and based on the population, so that, you know, we're providing what we need to provide to take care of the people in that area.

Finally, the two site visits were conducted virtually with two vastly different hospitals in rural counties in Pennsylvania. One was an independent community hospital that faced financial difficulties and undergone leadership changes in recent years. The other was a financially strong hospital and was later acquired by a multi-hospital health system. Regarding the rural health care workforce, payment models, and the key challenges facing rural hospitals, participants in the two virtual site visits generally

shared the perspectives expressed during the key informant interviews. They also provided additional insights into strategies that could help rural hospitals overcome these challenges and sustain their operations. For example, one participant discussed the important links between community, workforce, and financial strength, in the sense that establishing long term connections with the local community could help attract local talent and save money in hiring and retaining health care workers. Without that connection, not only does delivering services become expensive, but the quality could also be negatively affected since the workforce potentially had little vested personal interest in the community and everything was just about business.

It is noteworthy that while the participants from the two hospitals expressed quite different views on the key issues, likely due to their varied experiences and the different conditions of the two hospitals, their comments often pointed to similar considerations. For example, one participant from an independent community hospital experiencing financial difficulties acknowledged the greater access to resources available through a large health system but nevertheless expressed a clear preference for the hospital to remain independent.

The advantage of being independent, and run by our community, is that we maintain that control to provide care in our community, the way that we see fit in our community. So we're able to meet the needs of our community specifically. More of an actual family environment. Because of that, people don't come into this hospital and feel like they're just a number. Our hospital is run by members that live in this community, that their families live in this community. And that advantage for me outweighs the cons quite significantly. We can work around, you know, not having as much access to resources. That's not an uncommon thing for us.

In contrast, participants from the other hospital viewed its acquisition by a health system as a great success. They cited not only improved access to resources but also the flexibility and willingness of the corporate leadership to allow the hospital to operate in a manner that met the needs of the local community. Based on the discussions during the virtual site visits, both hospitals wanted to serve the local community, and both had managed to do so. However the independent hospital, which was in a much weaker financial position, had to approach that goal with much more limited resources.

Another insight from these two hospitals is the importance of financial monitoring and evaluation. The participants from the financially strong hospital mentioned the frequent assessment of revenue, expenses, and cashflow, as well as timely detecting and addressing issues, as a key factor in maintaining the hospital's financial health. On the other hand, a participant from the independent hospital attributed its financial difficulties partly to the lack of monitoring and failure to understand the issues until it was too late. The same person also discussed the importance of assistance with financial monitoring and evaluation by external entities if the hospital itself lacked such capacity:

They [the consultants from an external agency] are basically a team of experts from everyone who's got prior CEO or CFO experience or project management all come together and help you like, manage what you're going through, come up with a strategic plan to move forward and get your facility to [financial] sustainability. ... I almost feel like [other] rural hospitals should have to go through a similar process as we did. If states [state governments] could help hospitals with an assessment, like, where are your gaps? What do you need to fix? Almost an evaluation. Is this sustainable? Will that make you sustainable? If the state would help with that [assessment], it would probably be instrumental.

Both case study hospitals see the importance of financial monitoring; responses from one suggest that the hospital was not in a position to do so, but if it had received proactive assistance, it would be in a stronger position to serve its rural community.

Findings From Quantitative Data Analyses

The qualitative data collection and analyses were designed in conjunction with the quantitative analyses, allowing the triangulation of findings on several important issues for rural hospitals, such as financial challenges, workforce retention, and service provision. The participants in KII and site visits consistently highlighted several major barriers to rural hospitals' sustainability. In this section, we discuss the results from quantitative analyses, which revealed important patterns in the key measures, as well as differences and similarities across the subgroups of hospitals. Some of these patterns were consistent with the qualitative findings, whereas others seem to be more nuanced. The basic hospital characteristics of our study sample are presented in Tables AI in Appendix 2.

Availability of Beds, Staffing, and Services

Consistent with the existing literature, the average size of the rural hospitals in the study sample was significantly smaller than urban hospitals, with fewer licensed beds, fewer physicians, and fewer nurses. Among rural hospitals, those involved in ownership changes (mergers, acquisitions, or changes in affiliations), consistently throughout the study period, had more beds, but employed fewer physicians and registered nurses. The differences were stable over time. This might indicate that rural hospital consolidations were potentially associated with physician and nursing capacities. One possibility is that relatively large and understaffed rural hospitals are more likely to be targets of mergers and acquisitions. See figures 1A, 1B, 1C below:

Figure 1A: Average Number of Beds in Rural Hospitals With and Without Change of Ownership (CHOW)

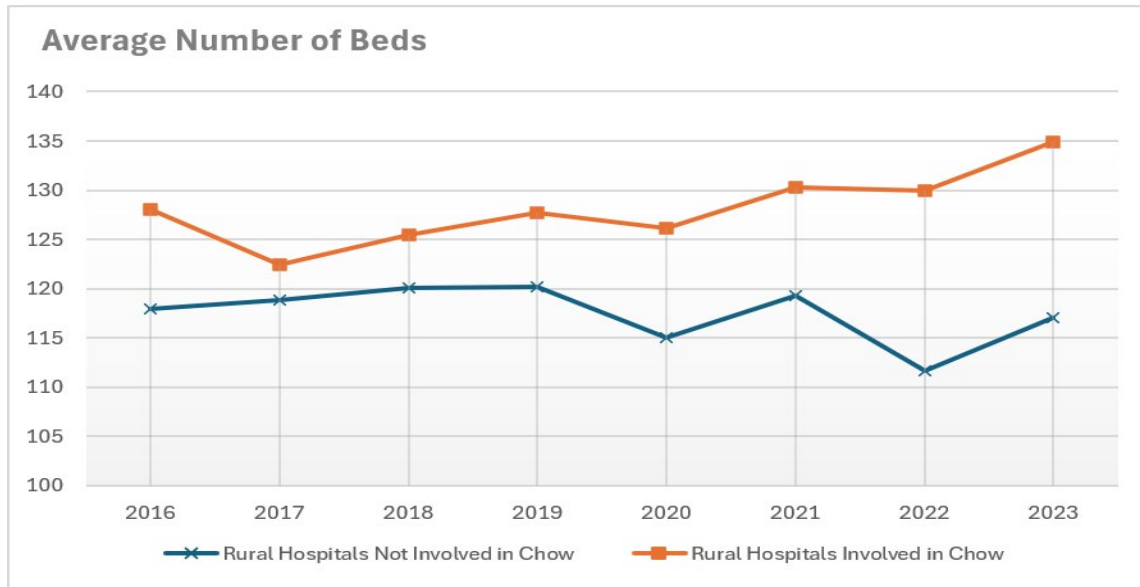


Figure 1B: Average Number of Employed Physicians in Rural Hospitals With and Without Change of Ownership (CHOW)

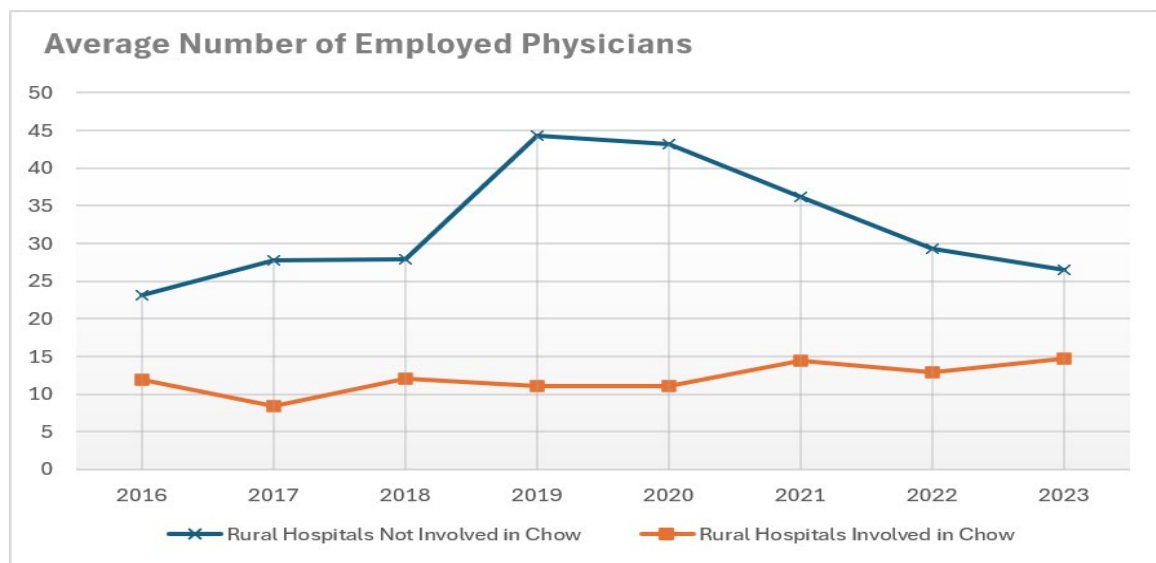
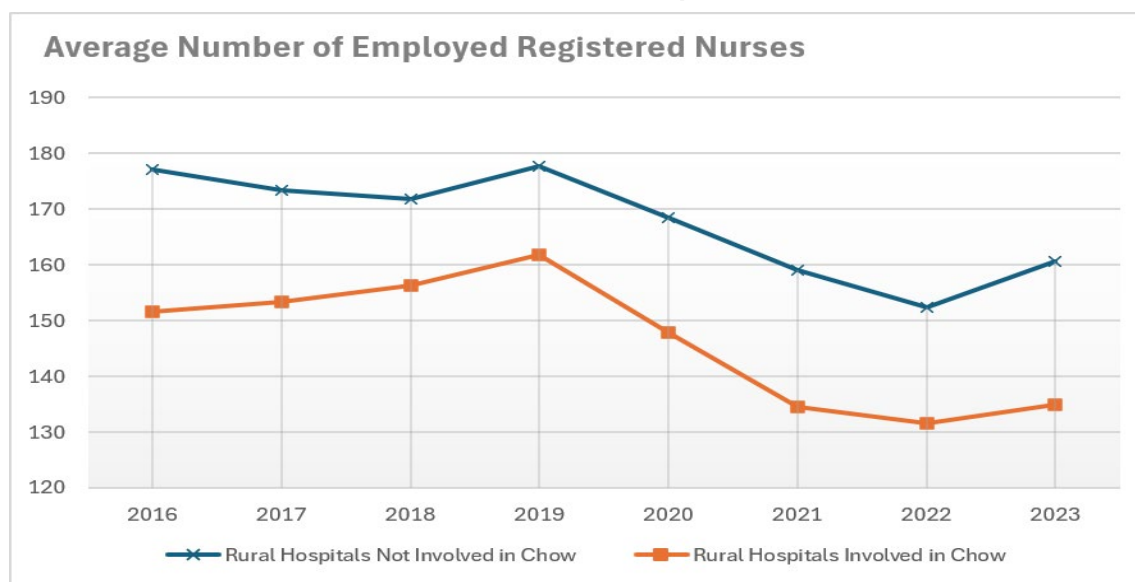
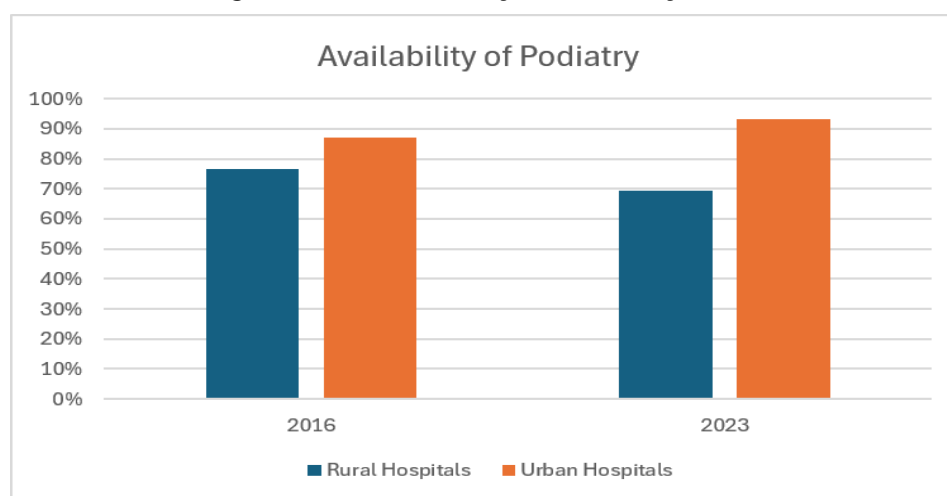
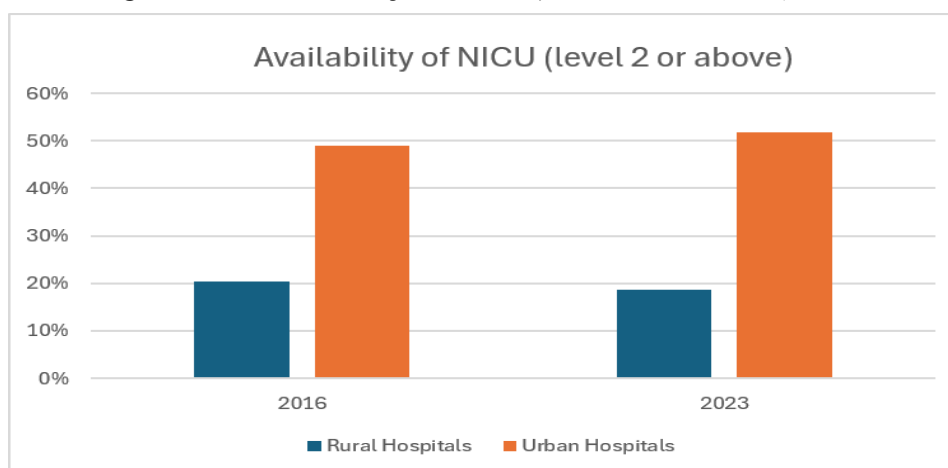


Figure 1C: Average Number of Employed Registered Nurses in Rural Hospitals With and Without Change of Ownership (CHOW)

Even after adjusting for the number of beds, rural hospitals, especially those involved in ownership changes, had a considerably lower number of physicians and nurses per bed. This finding supported the challenges in maintaining rural health care workforce frequently mentioned by KII respondents.

Our data showed consistent and significant availability gaps between rural and urban hospitals in six of the eight service lines included in the analyses (Appendix 2-Tables AII). It is particularly worth noting that the gaps in the availability of neonatal intensive care unit (NICU), crucial in the cases of premature, low-birth-weight, or critically ill newborns, were consistently large over the whole study period (2016-2023). While about half of the urban hospitals had NICU at level 2 or higher, only about one in five rural hospitals offered the same service. However, there did not seem to be meaningful and consistent differences between rural hospitals with ownership changes and those without. The service gaps between rural and urban hospitals observed in the quantitative data were consistent with the shortage of specialty care providers and the closure of service units (departments) in rural hospitals discussed in by participants of KII. Moreover, the general concerns by KII respondents that rural hospitals would face increasing difficulties to meet the needs of the population seem to be warranted, based on the quantitative data analyzed. For podiatry and neonatal care (NICU level 2 or above), the availability of services declined over time, and the rural-urban gaps widened (Figure 1D and 1E).

Figure 1D: Availability of Podiatry**Figure 1E: Availability of NICU (Level 2 or Above)**

On the other hand, our data showed improvements in the availability of life support and intensive/critical care among rural hospitals, although the rural-urban gap widened in the case of intensive/critical care (Figure 1F and 1G).

Figure 1F: Availability of Life Support (Basic or Advanced)

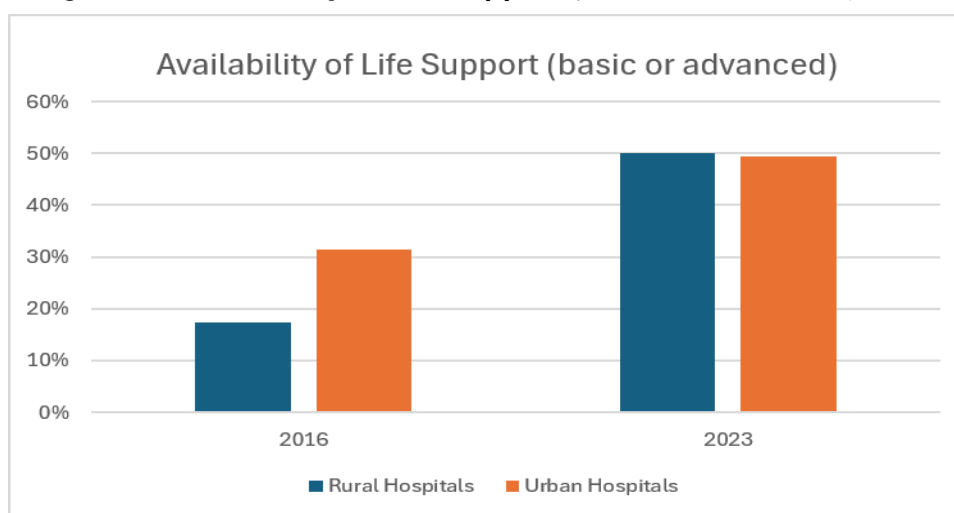
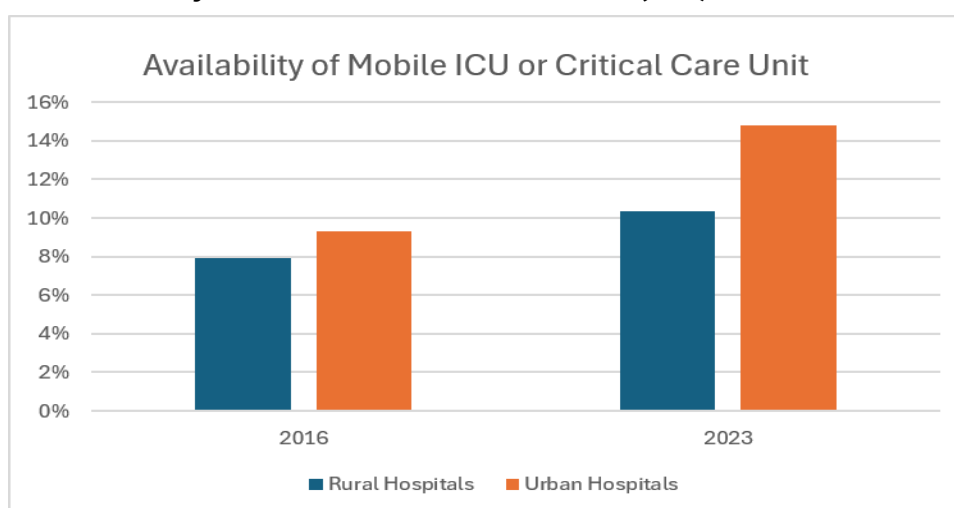


Figure 1G: Availability of Mobile Intensive Care Unit (ICU) or Critical Care Unit

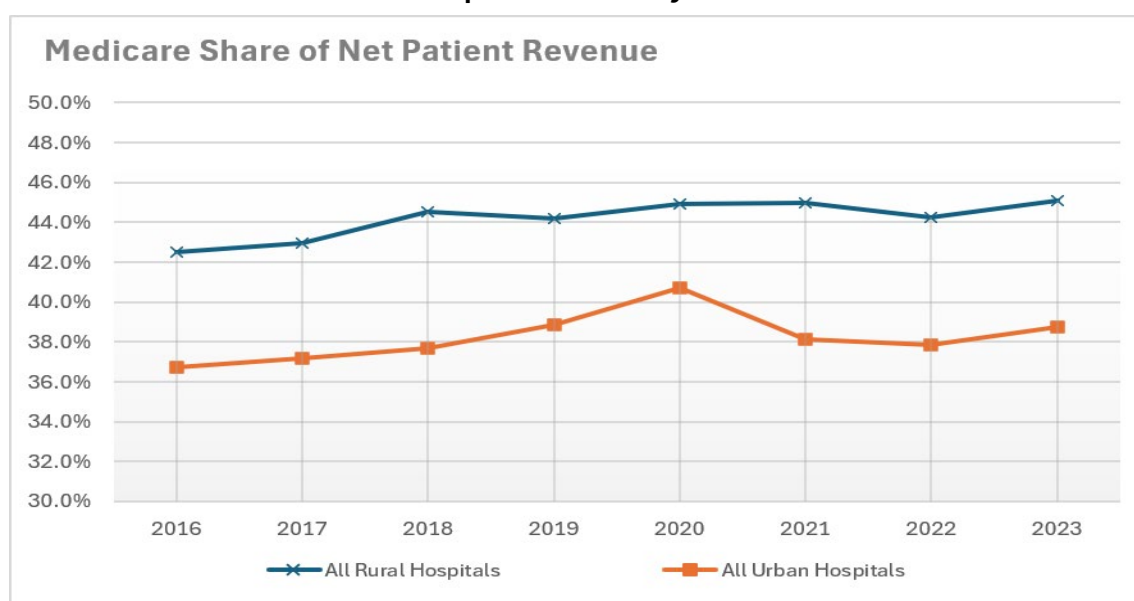


Quality Measures and Hospitals Financial Performance Measures

In terms of quality measures and hospital charges (Appendix 2-Tables AIII), there are several important observations from these results. First, for all four conditions (Heart Failure, COPD, Acute Kidney Failure, and Stroke), the average charges per admission by rural hospitals were only about half of the average charges by urban hospitals (See Appendix 2 – Tables AIII). Second, compared with urban hospitals, rural hospitals had higher mortality rates along with lower readmission rates for patients with all four major health conditions. Third, mostly consistent with recent literature on this topic, ownership changes did not seem to make a significant difference in the quality measures (Beaulieu et al. 2020; Burns et al. 2026). The gaps in charges might speak to the differences in payer mix and insurance coverage between rural and urban population (e.g., larger

proportions of Medicare patients in rural areas, shown in Figure 2A). This finding is consistent with what we found in the qualitative data, in which participants described how an aging population contributes to higher volumes of Medicare patients and, consequently, lower reimbursement levels compared to the commercially insured population. However, since hospital charges are based on list prices without any discounts or adjustments, they are often significantly different from the actual payments or reimbursements. Further analysis using actual payment/reimbursement data is needed to better understand the gaps observed here.

Figure 2A: The Difference in Medicare Share of Net Patient Revenue between Rural and Urban Hospitals in Pennsylvania



Mortality Rates and Readmission Rate for Heart Failure, COPD, Acute Kidney Failure, and Stroke

The combination of higher mortality rates and lower readmission rates in rural hospitals are concerning and should warrant further investigations or even reconsideration of how we understand and assess hospital readmissions in rural areas. Lower readmission rates are generally considered a positive signal for hospital quality, yet higher readmission rates among Medicare patients are financially penalized by CMS. It is possible that what we observed from these data may reflect barriers to care rather than better outcomes. For example, rural patients may receive insufficient care in their initial admission or may face challenges in accessing subsequent acute inpatient care when readmission is needed. A previous study (Laudicella et al., 2013) pointed out that the interpretation of readmission rates could be confounded by differential patient survival rates due to unobserved patient characteristics. Hospitals with low mortality rates might have a greater number of medically complex patients who survive their

initial hospitalization and are more likely to be readmitted. Even with risk adjustments, such confounding is likely to persist. We also note that mortality rates of heart failure increased sharply from 2019 to 2020 in all hospital groups, likely due to the initial infection and limited treatment methods during the first year of COVID pandemic, when mortality rates spiked among COVID patients with preexisting (or coexisting) chronic conditions (Murphy et al., 2021).

Using the subsample of rural hospitals involved in ownership changes between 2016 and 2023, we compared their mortality rates and readmission rates of the four clinical conditions (COPD, Heart Failure, Acute Kidney Failure, and Stroke) before and after the ownership changes (Figures 2B-2I). Since the ownership changes occurred in different years throughout the study period, we realigned these hospitals using the years of ownership changes as year zero and combined different hospitals based on the time (number of years) before and after the ownership changes. For example, if a hospital went through a merger in 2021, then it would be considered year -1 in 2020, year 0 in 2021, and year 2 in 2023.

Figure 2B: COPD Mortality Rates Before and After Ownership Changes in Rural Hospitals in Pennsylvania

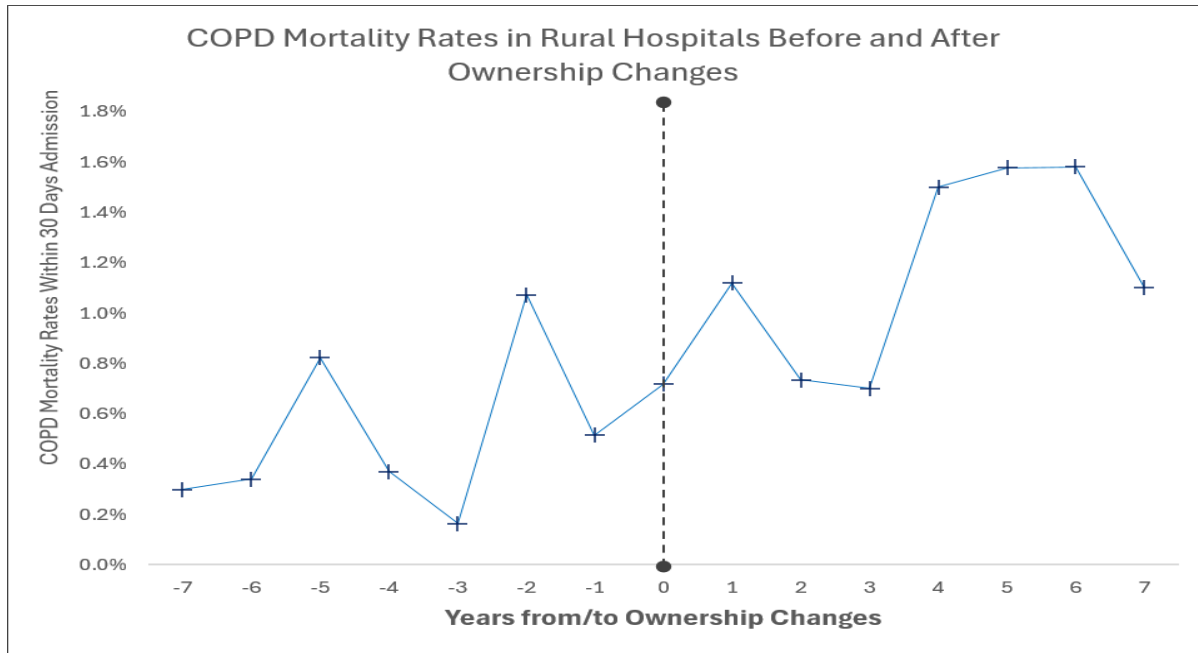


Figure 2C: COPD Readmission Rates Before and After Ownership Changes in Rural Hospitals in Pennsylvania

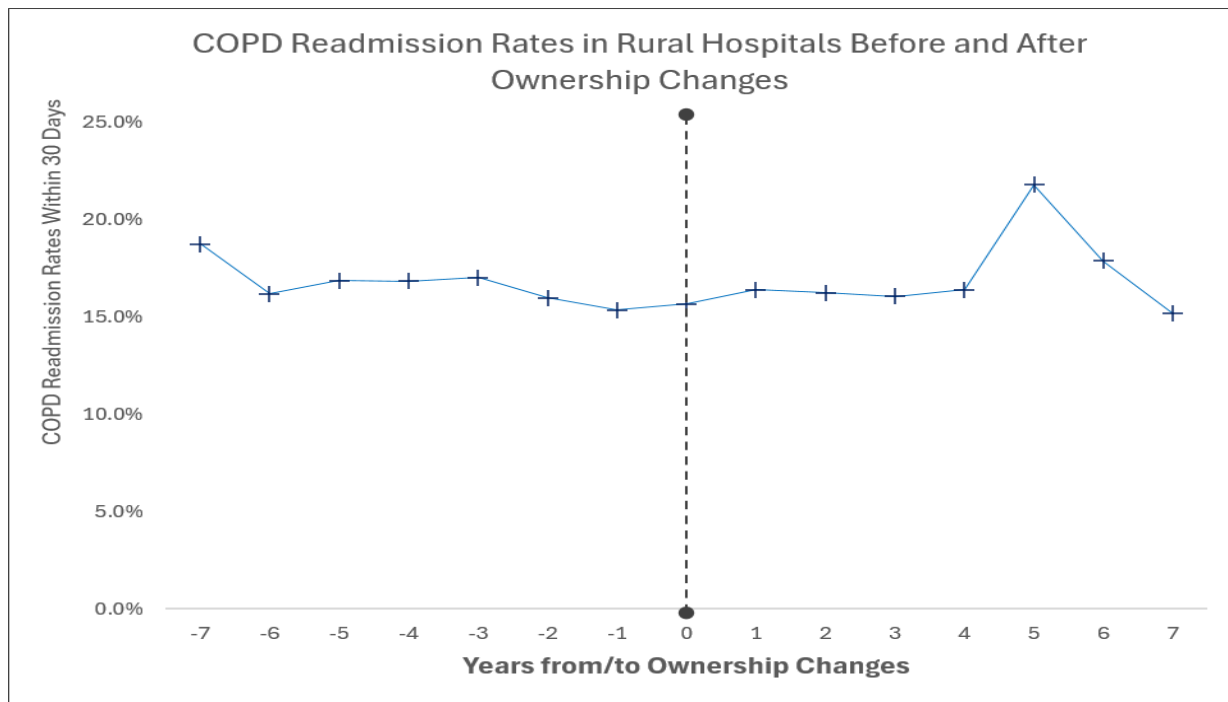


Figure 2D: Heart Failure Mortality Rates Before and After Ownership Changes in Rural Hospitals in Pennsylvania

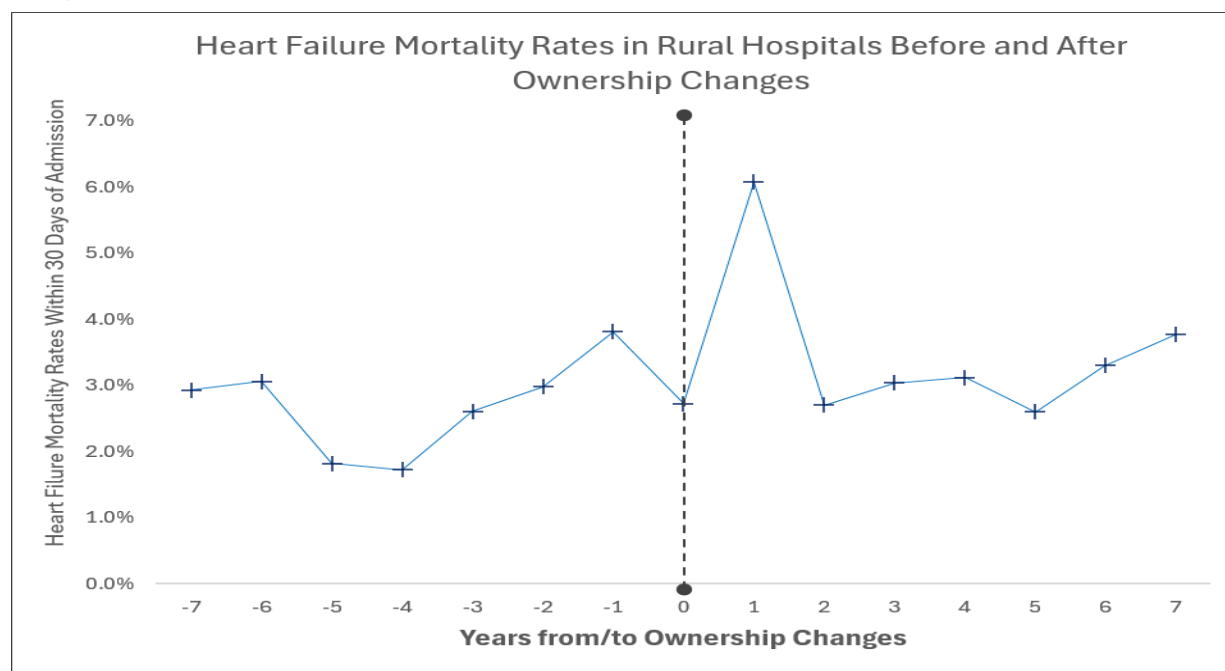


Figure 2E: Heart Failure Readmission Rates Before and After Ownership Changes in Rural Hospitals in Pennsylvania

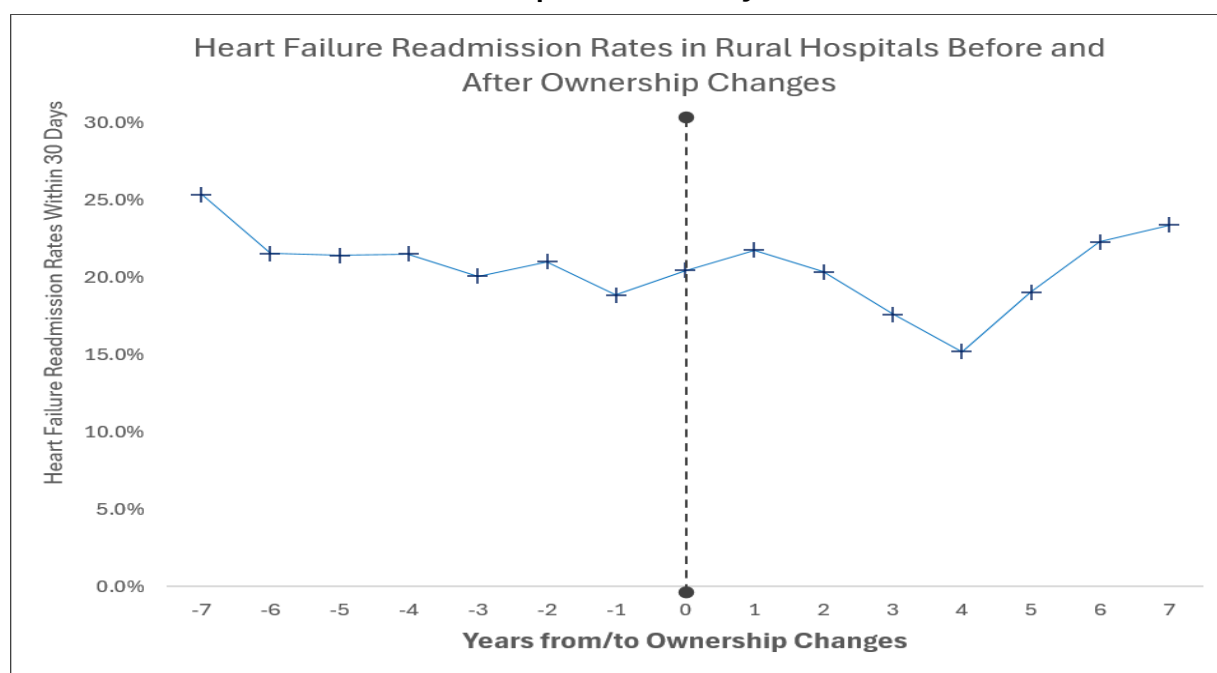


Figure 2F: Acute Kidney Failure Mortality Rates Before and After Ownership Changes in Rural Hospitals in Pennsylvania

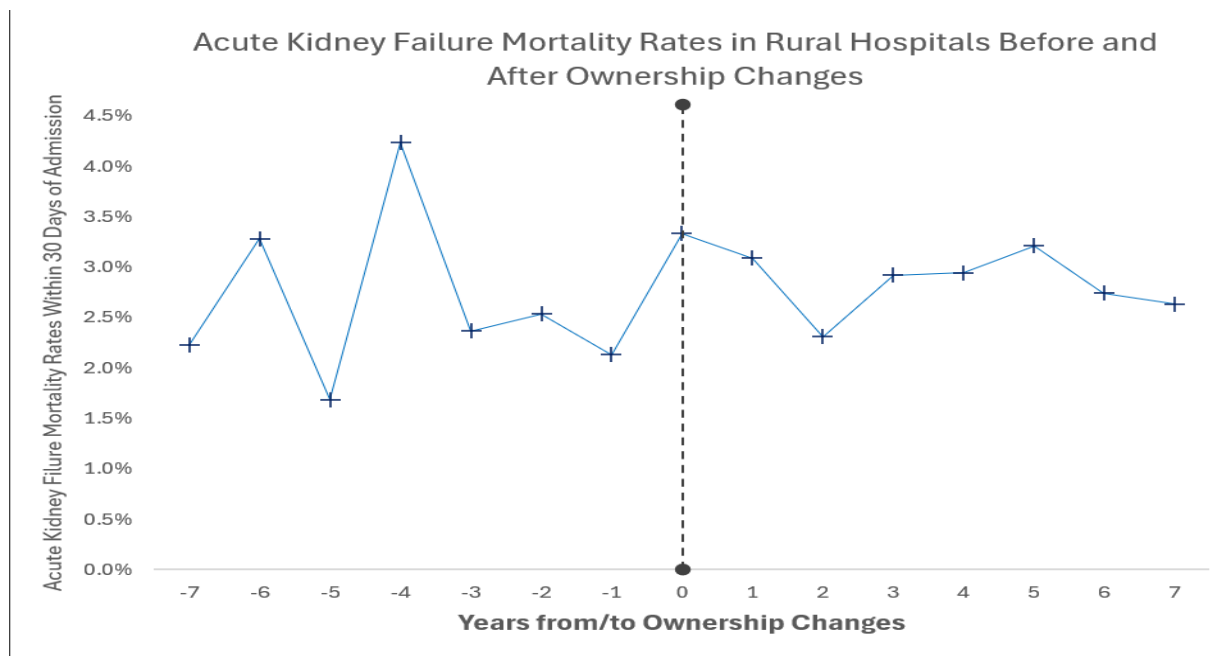


Figure 2G: Acute Kidney Failure Readmission Rates Before and After Ownership Changes in Rural Hospitals in Pennsylvania

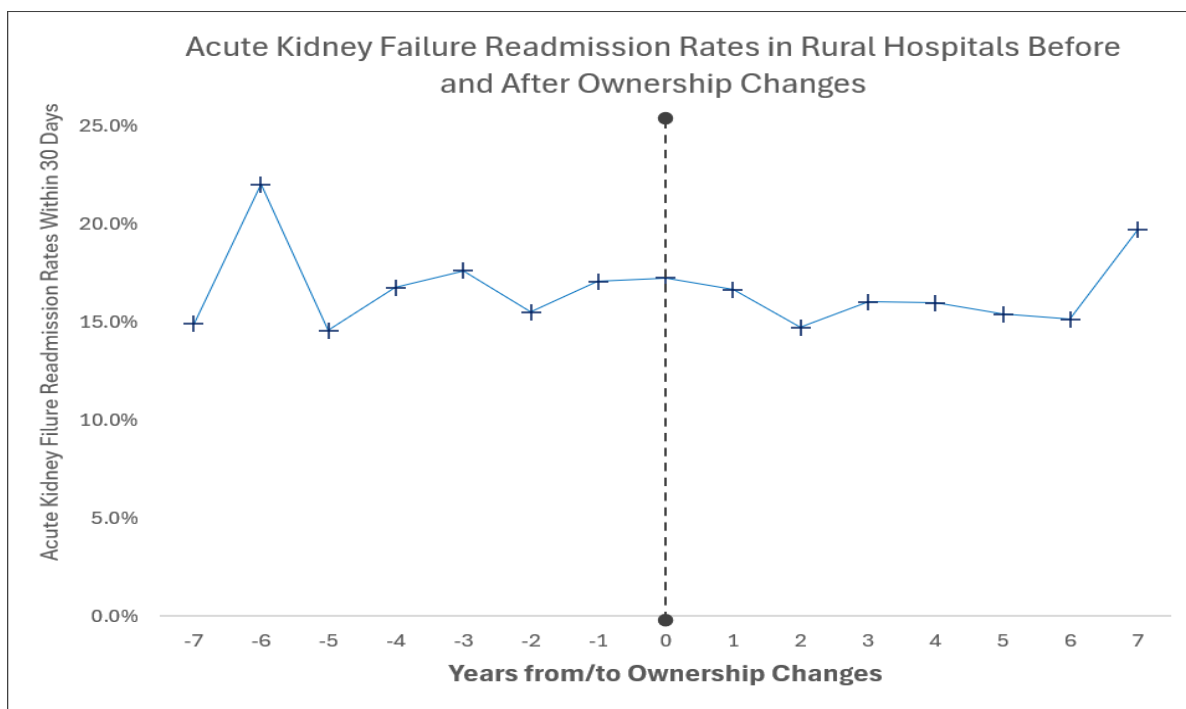


Figure 2H: Stroke Mortality Rates Before and After Ownership Changes in Rural Hospitals in Pennsylvania

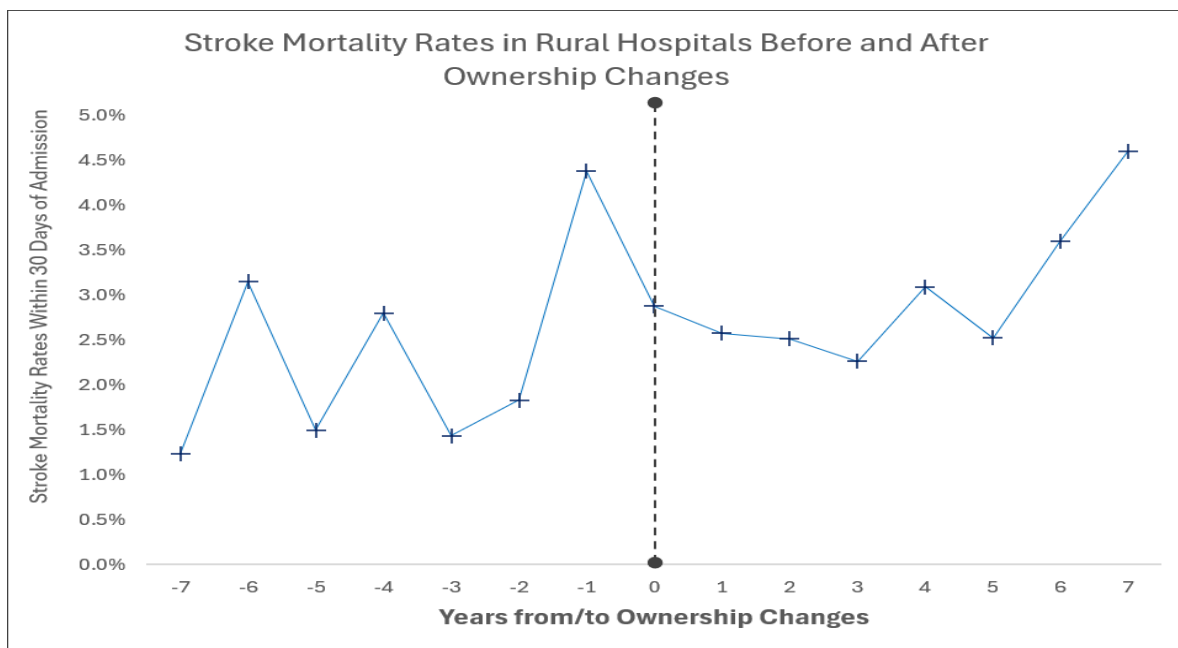
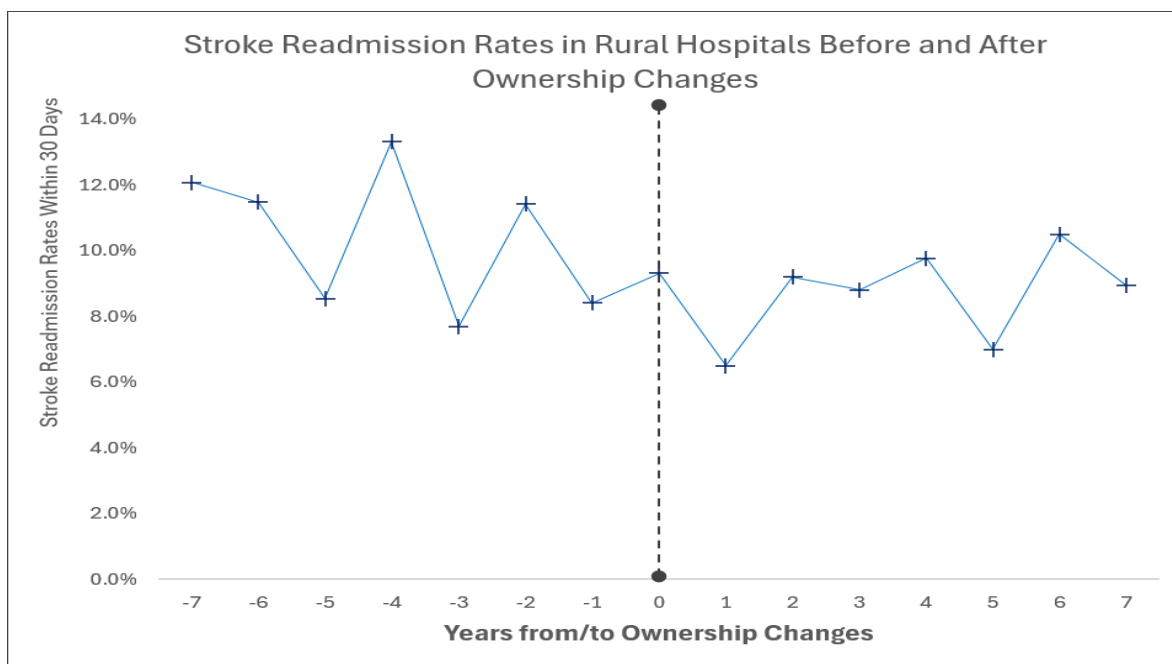


Figure 2I: Stroke Readmission Rates Before and After Ownership Changes in Rural Hospitals in Pennsylvania



Despite the observed variation over time, we did not find indications that the mortality rates or the readmission rates of the 4 clinical conditions were different before and after ownership changes.

Hospital Financial Performance Measures

Based on the financial performance measures (Appendix 2-Table AIV), rural hospitals were significantly lower in their revenues and expenses compared to urban hospitals (Figure 3A). This is expected since rural hospitals were much smaller on average. We also observe that while operating margin varied significantly over time, rural hospitals generally showed higher average operating margins (operating income as a percentage of revenue) than urban hospitals. Operating margin is one of the most important measures of hospital financial strength, highlighting hospitals' ability to financially sustain their core operation (Bazzoli et al., 2008; Ly et al. 2011). This might seem counter-intuitive, since rural hospitals also had consistently higher proportions of revenue from Medicare patients (Figure 2). The shares of Medicaid patient revenue were similar. One possible explanation is that despite the common financial difficulties faced by rural hospitals, a subset of urban hospitals might be even worse financially.

Figure 3A: The Difference in Operating Revenue between Rural and Urban Hospitals in Pennsylvania

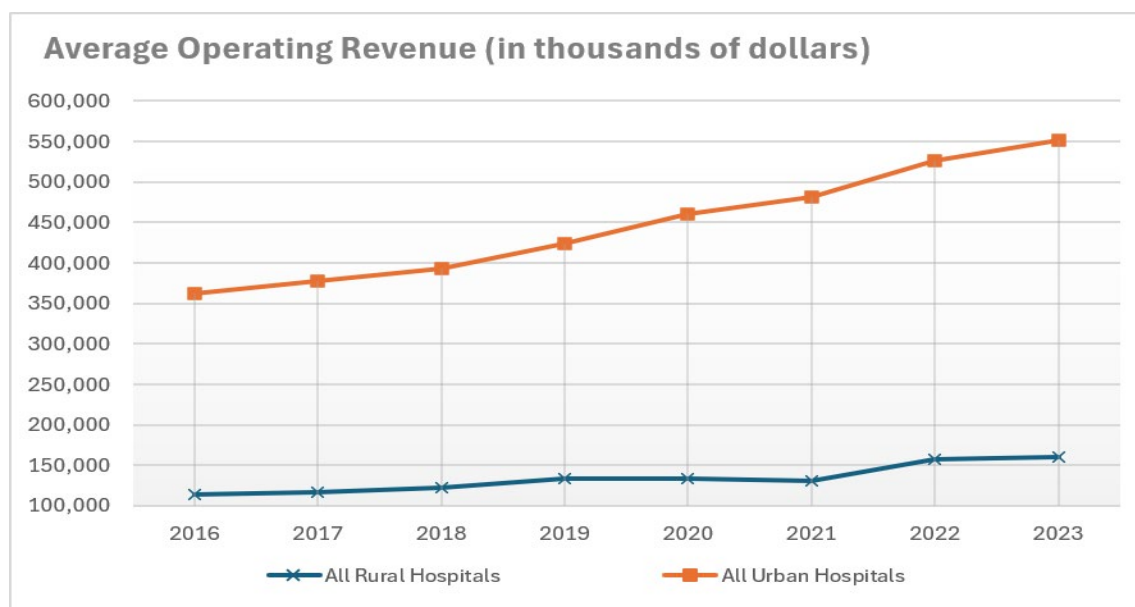
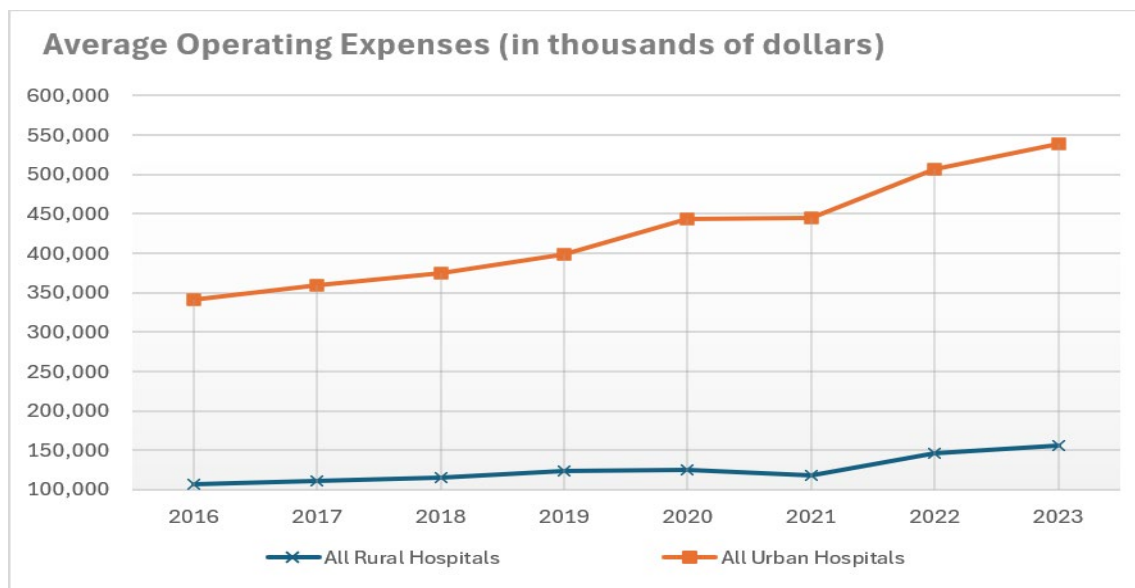
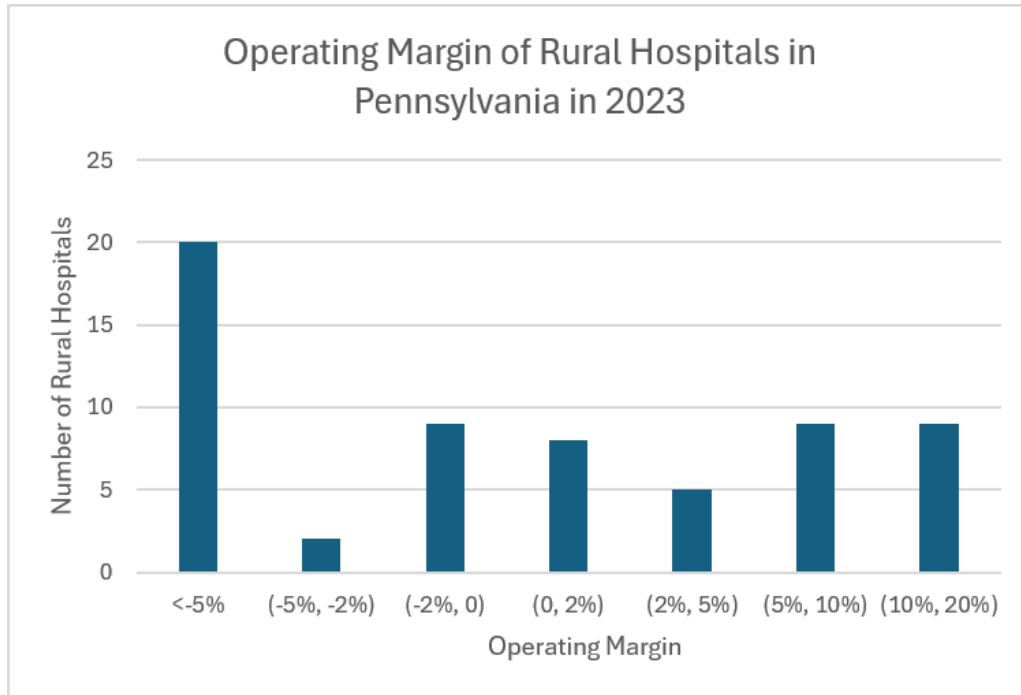
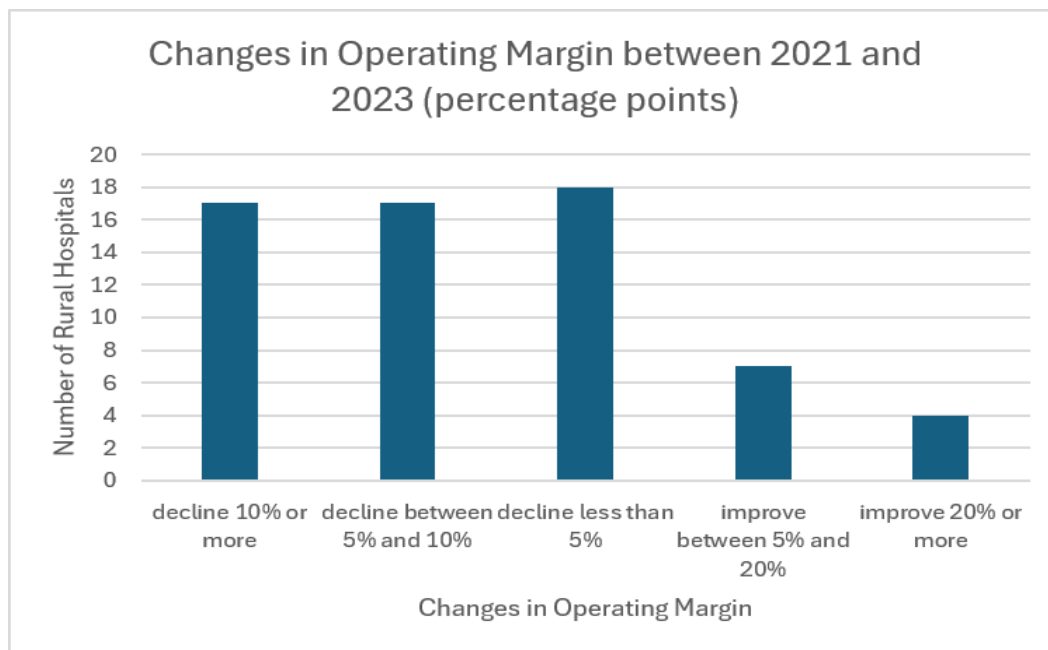


Figure 3B: The Difference in Operating Expenses between Rural and Urban Hospitals in Pennsylvania

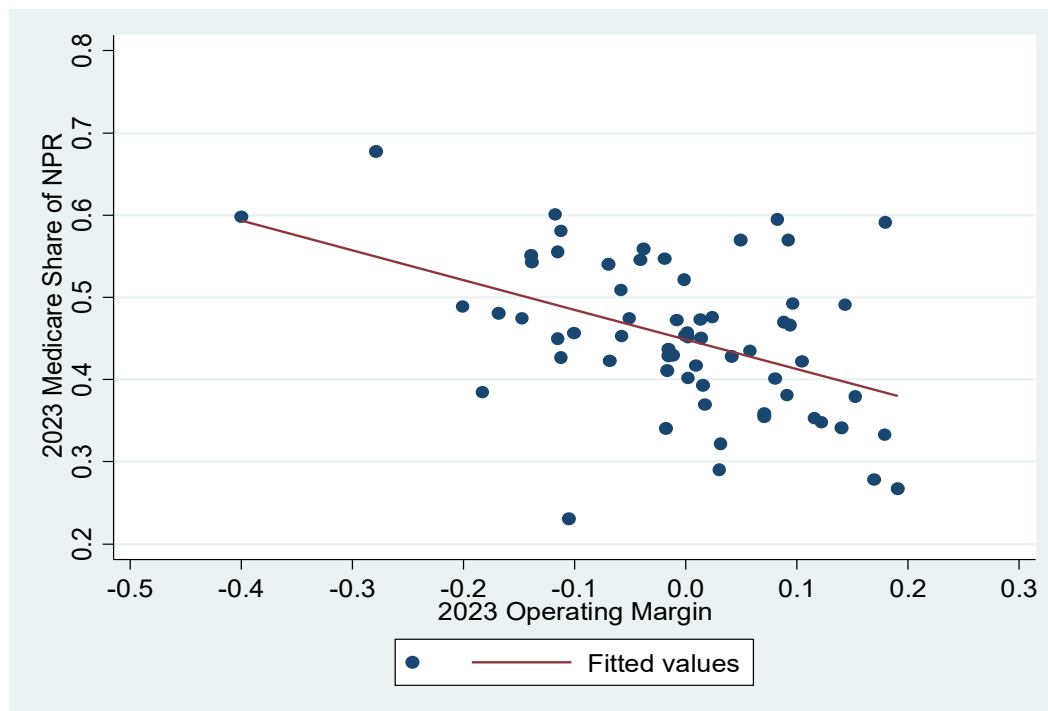


Although rural hospitals in our data, on average, did not show lower operating margins than urban hospitals, there was great variability and changes in operating margin across these rural hospitals over time (Figures 3C and 3D).

Figure 3C: Operating Margins of Rural Hospitals in Pennsylvania in 2023**Figure 3D: Percentage Point Changes in Operating Margins of Rural Hospitals in Pennsylvania between 2021 and 2023**

In 2023, half of the rural hospitals in Pennsylvania had negative operating margins, a warning signal of financial stress indicating insufficient revenue to cover these hospitals' expenses required to operate these hospitals. In particular, 20 hospitals were operating with a loss of five percent or more. No less concerning was the fact that only 11 hospitals improved their operating margins between 2021 and 2023, whereas 17 hospitals deteriorated over that period by 10 percentage points or more. We also found a negative and statistically significant correlation between Medicare Share of Net Patient Revenue and Operating Margin ($r=0.447$, $p<0.001$, Figure 3E).

Figure 3E: Correlation between Medicare Share of Net Patient Revenue and Operating Margin of Rural Hospitals in Pennsylvania in 2023



For the subsample of rural hospitals that underwent ownership changes between 2016 and 2023, we compared three key financial measures: operating margin, Medicare share of net patient revenue, and Medicaid share of net patient revenue before and after the ownership change (Figures 3F–3H). As with the clinical quality measures, we realigned hospitals according to the year of ownership change, treating that year as year zero.

Figure 3F: Operating Margins of Rural Hospitals in Pennsylvania Before and After Ownership Changes

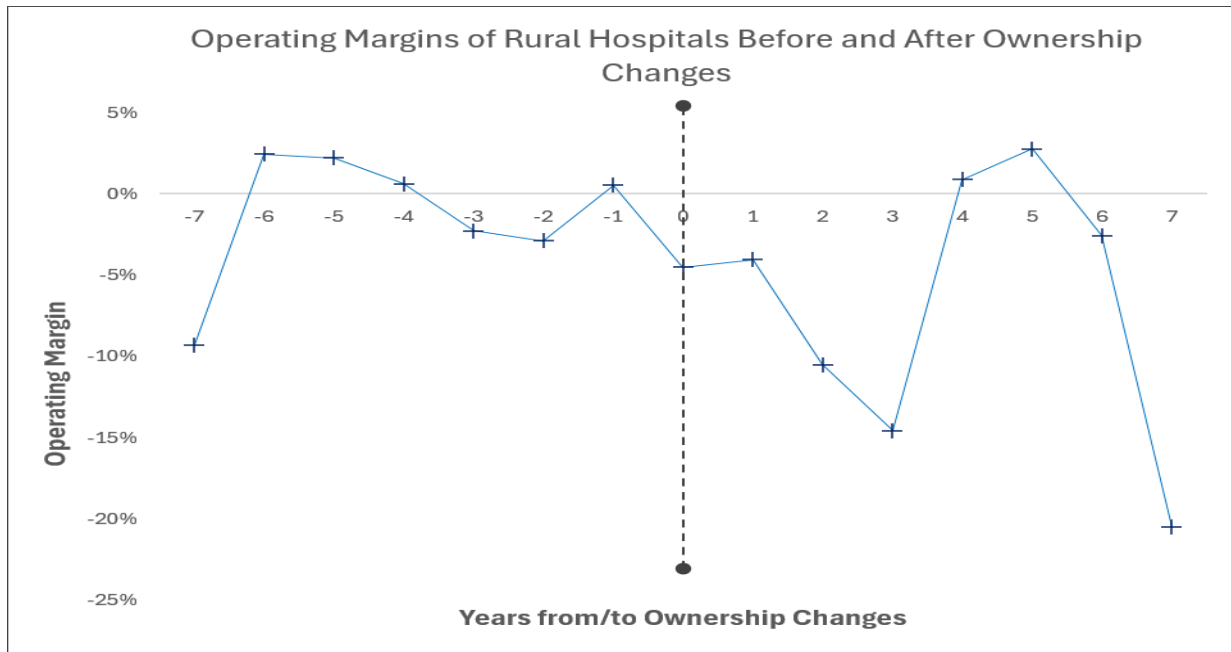


Figure 3G: Medicare Share of Net Patient Revenue of Rural Hospitals in Pennsylvania Before and After Ownership Changes

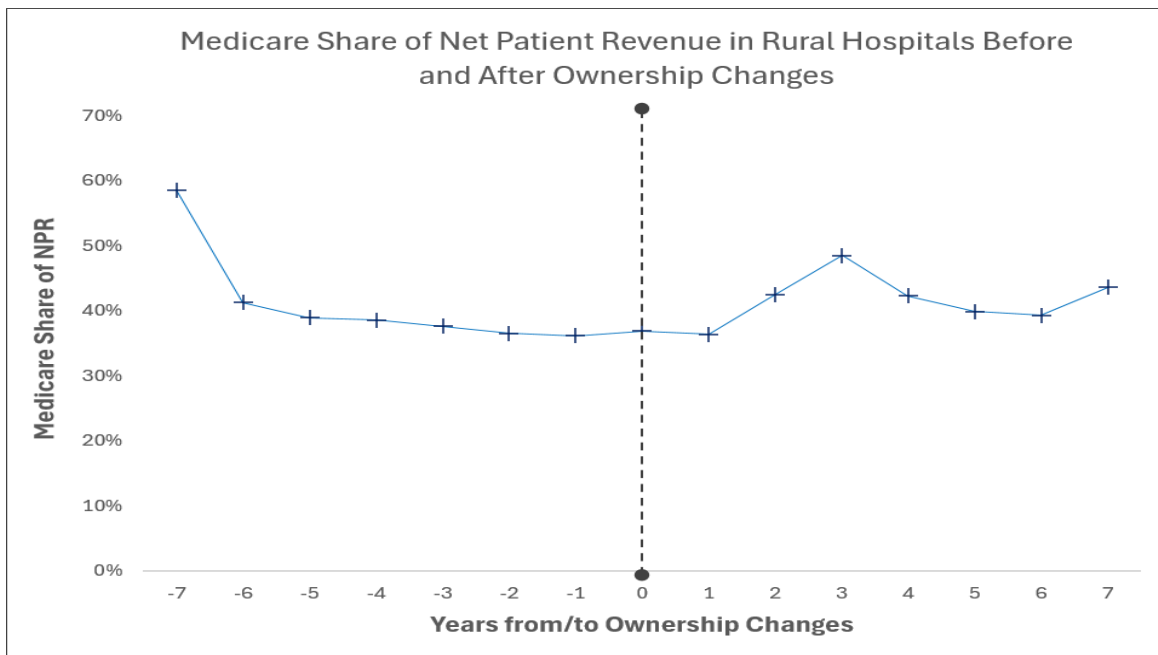
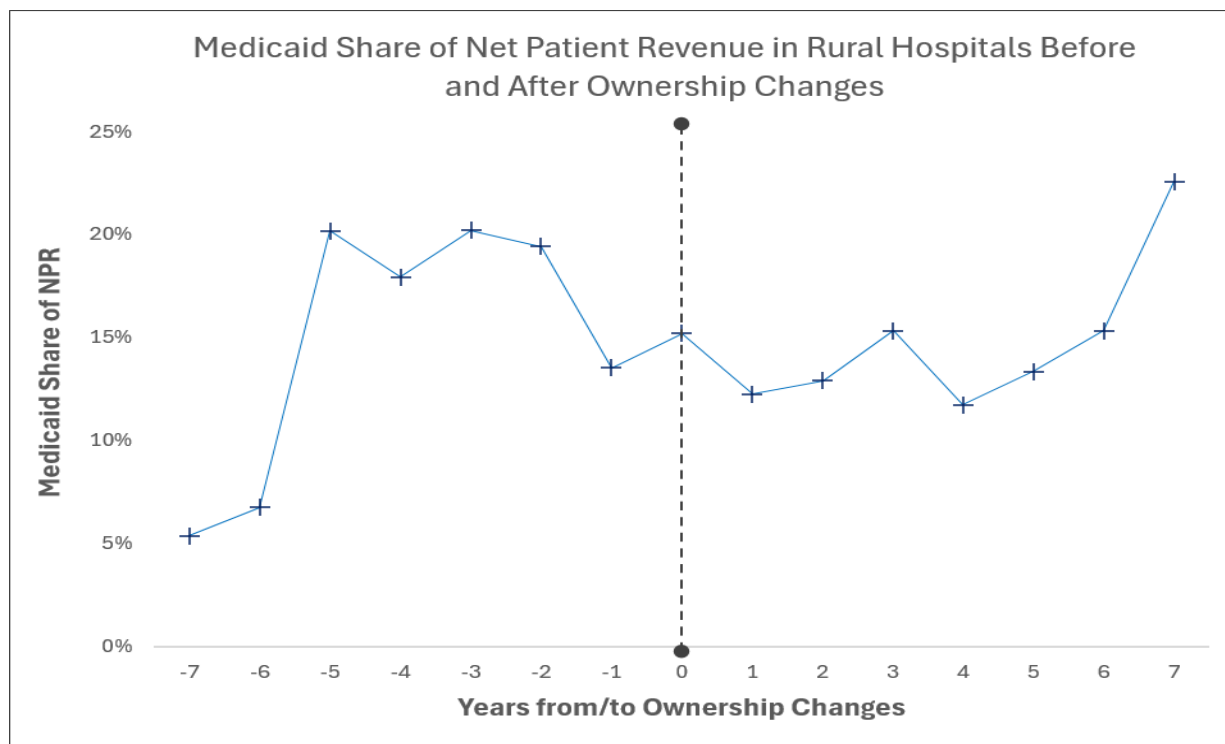


Figure 3H: Medicaid Share of Net Patient Revenue of Rural Hospitals in Pennsylvania Before and After Ownership Changes

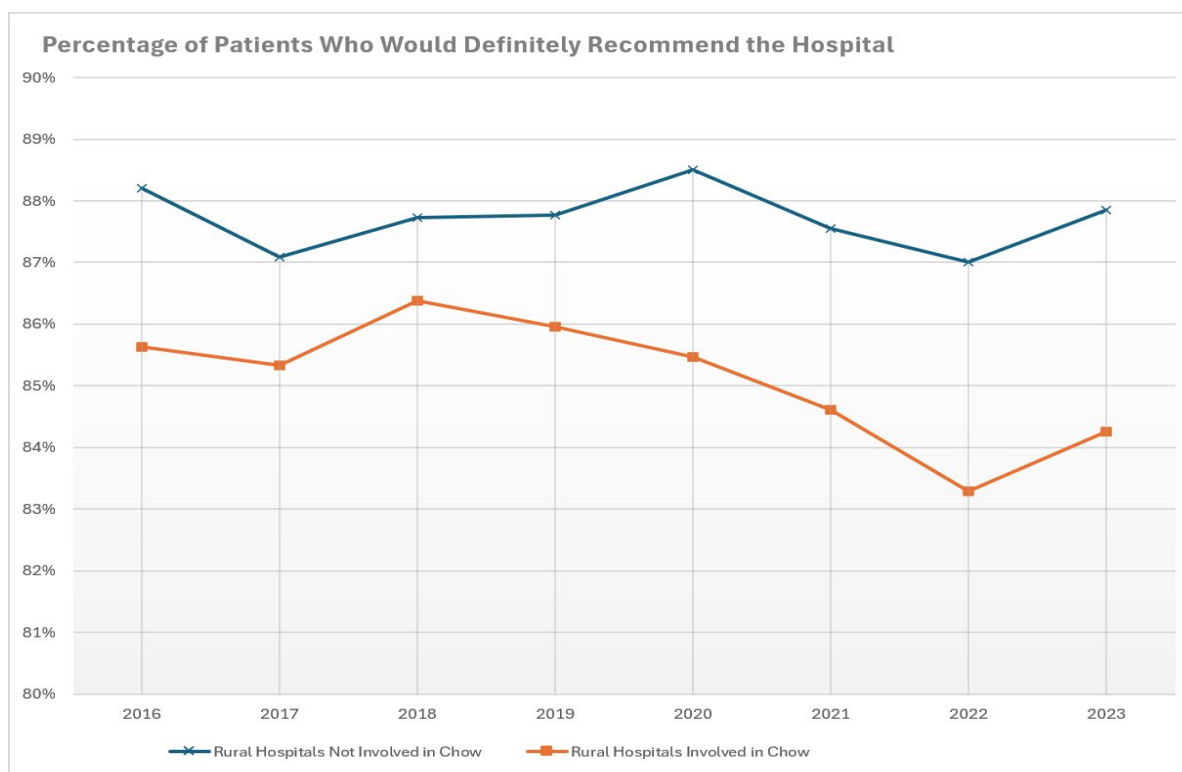


Similar to what we saw earlier, based on these graphs, the three financial measures also did not seem to be different before and after ownership changes.

Patient Experience

The analyses of patient experience (Appendix 2-Table AV) showed that for most of these measures, rural hospitals had consistently higher scores than urban hospitals, although the differences were not big. This is consistent with the findings in a recent study by Fawad et al. (2024), which analyzed patient experiences and rurality in 17 Midwest hospitals. We also noticed that hospitals with ownership changes had consistently lower proportions of patient recommendations, regardless of being rural (Figure 4) or urban. This finding is an important point to note, since patient recommendations might directly affect overall patient volumes in the long term, and thus might lead to differences in financial strength. Even when a hospital is the only one in the region, recent studies showed an increasing trend of patients in rural areas bypassing the nearby hospital(s) and seeking care elsewhere (Friedman and Holmes, 2022).

**Figure 4: Rural Hospitals Involved in CHOW and Not Involved in CHOW
Percentage of Patients Who Would Definitely Recommend the Hospital**



The persistently lower percentage of patient recommendations among rural hospitals involved in ownership changes, compared to those not involved in ownership changes, seemed to support the importance of community outreach and connection, as well making local residents feel welcomed, discussed by KII respondents. To the extent that such connection increases the likelihood of patient recommendations, and thus the volume of future visitors, they may also contribute to the long-term sustainability of rural hospitals.

Hospital Utilization

Overall, patient utilization of health care services in rural hospitals was significantly lower than in urban hospitals (Appendix 2-Table AVI). The lower utilizations were related to the smaller hospital sizes and lower patient volumes in rural areas. However, rural hospitals also showed significantly lower occupancy rates, especially in more recent years (Figure 5A). A recent study showed that rural hospitals had disproportionately high fixed costs of operation (Karim et al., 2026). Therefore, low occupancy rates indicated that even adjusting for their relatively small sizes, rural hospitals are still operating with comparatively lower efficiency and higher average operational cost per patient. Also, there was a large increase in emergency department (ER) visits between 2019 and 2020, and the increasing trend of ER visits persisted. Although this large increase happened in

both rural and urban hospitals, the gap between them also enlarged substantially (Figure 5B). Before 2020, rural hospitals on average had between 15 and 20 percent fewer ER visits than urban hospitals. In 2020 and the years after, the ER visits in rural hospitals were about half of the same visits in urban hospitals. The increase in ER visits coincided with the onset of the COVID pandemic. However, this pattern differs from the national decline in ER utilization documented during the same period, and the reason for this divergence in our data warrants further investigation with more detailed information (e.g. specific medical conditions identified in these ER visits).

Figure 5A: The Difference in Occupancy Rates between Rural and Urban Hospitals in Pennsylvania

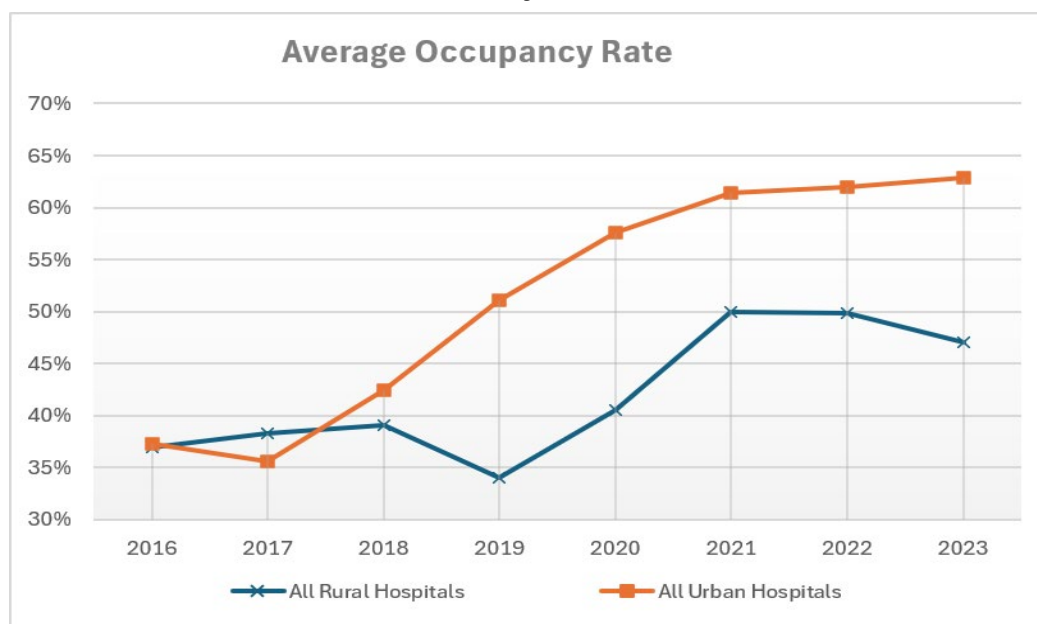
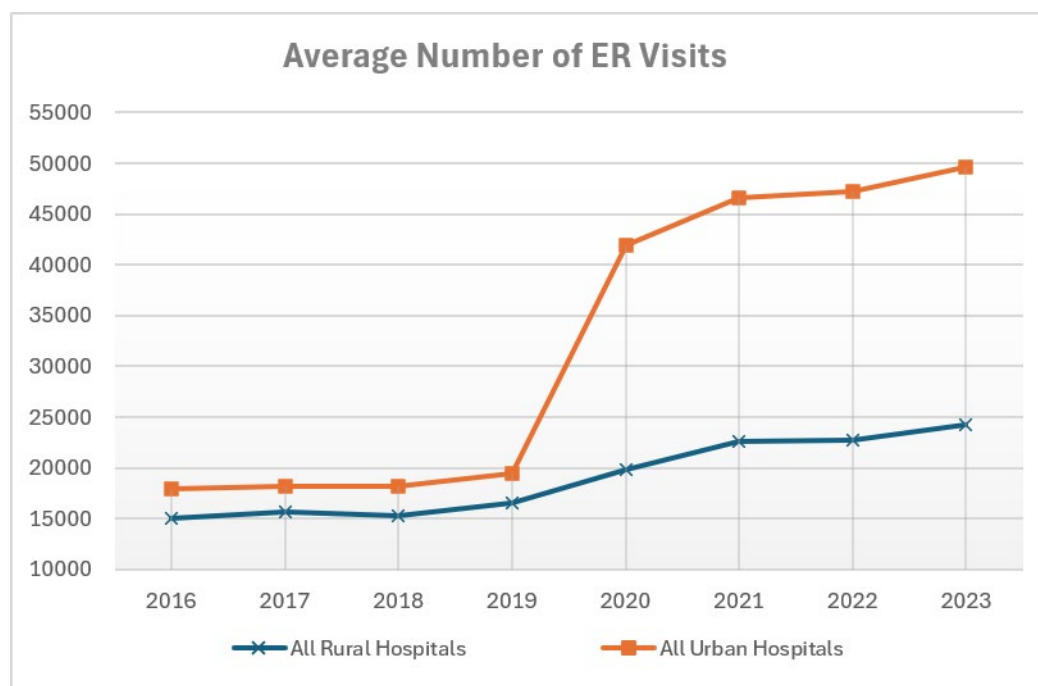


Figure 5B: The Difference in ER Visits between Rural and Urban Hospitals in Pennsylvania



Results of Logistic Regression Analysis and Difference-In-Difference Analysis

Finally, based on the logistic regressions and predictive analysis, we did not find meaningful predictors for mergers and acquisitions. It is worth noting that the odds ratios of year indicators were highly significant and showed a generally increasing trend. This is consistent with the increasing trend of hospital consolidations over time. Similarly, the estimates from the difference-in-difference models showed that none of the quality and cost outcomes were significantly associated with mergers, acquisitions, or changes in affiliations. In examining the potential issue of multi-collinearity, we found that two of the independent variables, the number of admissions and the number of registered nurses were highly correlated with each other and with other covariates. We estimated the logistic model and the DID model without these two variables and the results were similar. The lack of significant findings from these regression analyses might be explained by two considerations. First, although we included in our study sample all general acute-care hospitals in Pennsylvania that reported the outcomes, our overall sample size was still relatively small. In particular, only a fraction of hospitals in our sample experienced consolidations during the study period. Second, consistent with the findings from qualitative data and the descriptive tables, mergers and acquisitions occurred under different contexts and potentially led to different results because of factors not captured in our quantitative data (e.g., the resources and efforts dedicated to system integration after a merger). Thus, the explanatory power of our regression models was limited. The sensitivity analyses with one year lag and the exclusion of the

COVID years also yielded statistically insignificant results. The details of both sets of analyses and the results from the main models are included in the Technical Appendix at the end of this report.

Limitations

The analyses conducted in this project have important limitations. First, our study is observational and retrospective, and therefore the findings cannot necessarily be interpreted as causal. Even with the statistical models used in the analyses, there are likely confounding factors for which we cannot control for. Second, most measures used in the study are self-reported by the hospitals and may have errors due to misreporting. Third, the sample size and the number of consolidations during the study period are relatively small and thus limit our ability to detect (or accurately estimate) the impact of consolidation. Fourth, the different sources of data do not have unified and unique hospital identifiers (nor common spelling of hospital names). Therefore, a significant proportion of the data matching must be done manually, which could generate additional errors or missing data. Fifth, the second part of our study period, from 2020 to 2023, overlapped with the COVID pandemic, and thus may further confound the trends observed in the data. Although we did sensitivity analyses that excluded the COVID period, these sensitivity analyses included only four years of data prior to 2020 and cannot provide insights on more recent trends or impacts. Sixth, the hospital utilization data used in the study did not have certain important details at the patient level that would be helpful in explaining the results. For example, without more detailed information about patients' conditions, it was difficult to pinpoint the reason for the sharp increases of ER visits at the beginning of the COVID pandemic, which seemed to differ from the national trend. Finally, the only cost measures in our data are average hospital charges per admission, before any discounts or contractual adjustments. Hospital charges can be misleading and often do not reflect the actual reimbursements the hospital received, or the actual cost faced by consumers. Therefore, the trends and patterns from hospital charges should be interpreted with these limits in mind.

Discussion

This study examined financial performance, quality, cost, and patient experiences among general acute-care hospitals in Pennsylvania. We compared hospitals in rural areas with those in urban areas and investigated the potential impacts of hospital consolidations on quality outcomes. We also explored possible predictors of hospital ownership changes. Although the logistic regression models and difference-in-difference analyses used in the study did not find significant predictors or effects, the results from both qualitative and quantitative data taken together provided important takeaways and insights for possible future policies.

In some cases, the findings from both quantitative and qualitative analyses quite clearly highlighted the same issues. For example, several key issues found in the qualitative data, the rural health care workforce challenges, the low patient volumes, and the higher Medicare population in the rural areas, were confirmed by the specific measures in the quantitative data: the staffing measures, the service availability measures, and the Medicare share of net patient revenue. In some cases, the qualitative findings, although not directly linked to quantitative data, potentially explained the quantitative results (or the lack of significant results). For example, the logistic regressions and DID analyses did not find statistically significant predictors or impacts of hospital ownership changes. The descriptive comparisons also did not find any clear differences between the pre- and post-consolidation in clinical quality measures or financial measures among rural hospitals with ownership changes during the study period. The nuances in the drivers and processes surrounding hospital consolidations discussed by KII and site visit participants pointed to a complex pattern (or the lack of similar patterns) of ownership changes, with the results depending on many factors that we could not easily measure in the data (e.g., the quality of integration after mergers), which could be part of the reason we could not detect impact or predict in the quantitative data available. In other cases, the importance of certain aspects of rural health care delivery (e.g., assistance with transportation) were discussed in the qualitative findings, but we simply did not have reliable quantitative measures to further investigate. Next, we highlight the key policy considerations by integrating qualitative and quantitative findings.

Policy Considerations

Preserve Access to Essential Rural Hospital Services

The findings demonstrate that rural hospitals continue to face structural challenges that threaten access to essential health care services. Compared to urban hospitals, rural hospitals generally operate with fewer physicians, fewer registered nurses, lower patient volumes, lower occupancy rates, and substantially fewer specialized service lines. The analyses also identified persistent gaps in the availability of critical services, particularly maternity and neonatal care.

These findings suggest that maintaining access to essential services—not necessarily preserving every service at every rural hospital—should remain a central objective of rural health policy. State agencies, health systems, and hospital administrators should continue to identify the services that are most critical to the communities each hospital serves and prioritize resources accordingly. Where maintaining a full range of services is not feasible, policies that strengthen regional care networks and coordinated referral relationships may help preserve access while recognizing the operational realities facing many rural hospitals. One way to do this is to facilitate or allow varying designations at the state level. For example, both the Critical Access and Rural Emergency Hospital designations limit a hospital's infrastructure and its services, but such restrictions are

intended to sustain a basic level of patient access to the most essential hospital care. The UPMC Lock Haven hospital transitioned into an outpatient emergency department in 2023 and has experienced some successes since then in terms of retaining the workforce and providing emergency care to the local population. In some cases, obtaining waivers of certain requirements while maintaining Critical Access designation may be crucial for keeping certain rural hospitals open in challenging times. At the same time, as noted above, past research suggests hospital bypass can further decrease the patient volume and the financial stability of rural hospitals, preventing them from providing the intended level of services. Under these circumstances, it is crucial for state governments and policymakers to consider pre-emptive action that can potentially remedy or ameliorate the consequences.

Strengthen the Rural Health Care Workforce

Across both the quantitative analyses and the qualitative interviews, workforce recruitment and retention emerged as one of the most significant challenges affecting rural hospitals. Respondents consistently identified shortages of physicians, nurses, and other health professionals as barriers to maintaining services and ensuring long-term sustainability.

Expanding the rural health workforce should remain a priority for policymakers. Potential strategies include strengthening partnerships with Pennsylvania's medical and health professional training programs, expanding rural clinical training opportunities, supporting loan repayment and tuition assistance programs tied to rural service, and providing technical assistance to hospitals pursuing Critical Access Hospital designation or other federal programs that improve financial sustainability. While no single strategy will resolve workforce shortages, continued investment in recruitment and retention are likely to have broad benefits across multiple aspects of rural health care delivery.

Support Strategic Health System Partnerships While Preserving Local Decision-Making

The study found that hospital mergers, acquisitions, and health system affiliations occurred under a wide range of circumstances and were often pursued proactively by rural hospitals seeking long-term financial stability rather than as a result of imminent closure. Participants consistently described both benefits and challenges associated with consolidation. Access to financial resources, specialty expertise, and administrative capacity of larger health systems was frequently cited as an advantage. At the same time, respondents also described concerns regarding diminished local decision-making, reduced community engagement, and governance structures that may become less responsive to local needs. The quantitative analyses did not identify consistent predictors of ownership changes or measurable improvements in quality and financial outcomes following consolidation. These findings suggest that ownership changes alone are unlikely to determine hospital success. Instead, the effectiveness of a partnership appears to depend largely on how it is planned, implemented, and governed. Policies

that facilitate voluntary partnerships while preserving meaningful local leadership, community engagement, and accountability may better position rural hospitals to benefit from system-level resources without losing the flexibility needed to respond to local priorities.

Improve Access to Care Beyond Hospital Operations

Participants frequently identified transportation barriers and long travel distances as significant obstacles to accessing health care in rural communities. These challenges not only affect patients' ability to receive timely care but may also contribute to declining utilization, making it more difficult for rural hospitals to sustain essential services. Improving transportation options for both emergency and non-emergency medical care should therefore be viewed as an important component of rural health policy. Coordination between transportation providers, local governments, and health care organizations may improve access to care while strengthening the long-term viability of rural hospitals serving geographically dispersed populations.

Continue Evaluating Quality Measures in Rural Settings

One of the more notable findings of this study was that rural hospitals consistently exhibited higher mortality rates but lower 30-day readmission rates than urban hospitals across the four clinical conditions examined. While these measures are widely used indicators of hospital quality, the observed pattern suggests that traditional performance metrics may not fully capture the unique circumstances under which rural hospitals provide care. These findings do not imply that existing quality measures should be replaced. Rather, they highlight the importance of continued research examining how quality measures should be interpreted within rural health care settings and what additional measures might be included. A better understanding of the relationship between access, patient characteristics, care coordination, and clinical outcomes may help policymakers evaluate rural hospital performance more accurately and design policies that reflect the realities of rural care delivery.

The quality measures selected in this study are widely used in similar studies and government assessment of hospitals. For example, the 30-day readmission rates are used by CMS in determining financial penalties in Medicare reimbursement. However, there are additional factors to consider in interpreting these metrics for rural hospitals. The lower readmission rates paired with high mortality rates could partially reflect the transportation barriers, regular delays in follow-up care, or lack of access to hospital services after discharge. Also, the low patient volume in rural areas could make some standard measures unreportable or unreliable, due to small number of cases in a given reporting year. Factors that are not routinely measured include the distance between the local residents to the nearest hospital, and the availability of ambulances and Emergency Medical Services (EMS) that provide pre-hospital emergency care.

Strengthen Pennsylvania's Rural Health Data Infrastructure

Throughout this project, the research team encountered important limitations in the availability and accessibility of hospital financial and payment data. Although publicly available datasets provide valuable information on hospital utilization, quality, and financial performance, important measures—particularly actual payment information by payer and diagnosis—remain difficult to obtain and standardize across hospitals. Improving Pennsylvania's health data infrastructure would strengthen future research and support more informed policymaking. Continued collaboration among the Pennsylvania Department of Health, the Pennsylvania Health Care Cost Containment Council, hospitals, and researchers could improve the availability, consistency, and usability of statewide hospital data, enabling more comprehensive evaluations of rural hospital performance and the long-term effects of ownership changes.

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Appendix 1: Semi-Structured Questionnaire for Key Informant Interviews (KIIs) and Virtual Site Visits

Rural Hospital Consolidation Key Informant Interview Guide

Thank you for agreeing to talk with me today. We are a team of Penn State researchers, funded by the Center for Rural Pennsylvania, a legislative agency of the Pennsylvania General Assembly. We are conducting a research project with the aim to understand the impact of health care market consolidations (i.e., mergers and acquisitions) on rural health care delivery. As a leader of your organization and in the community, your input and insights will be of great value.

Now, I'd like to start briefly reviewing the stipulations regarding your verbal consent and to answer any questions you may have. This information was included with the calendar invite when this interview was scheduled.

Your participation in this interview is voluntary and you can stop at any time for any reason. Your participation or nonparticipation will not be reported to anyone. You may decline to discuss any topic that we raise. Information in any publications from these interviews will be reported in the aggregate – we will not attribute any statements to specific individuals.

With your permission, we would like to audio record this conversation. The recording will only be shared with a professional transcription firm through a secure web portal. Do I have your permission to record our conversation? [Note: if respondent is not comfortable being recorded, let them know that we will not record and indicate that we will proceed with just note taking]

Do you have any questions before we begin?

A. Respondent and Organizational Background

1. I'd like to start by confirming what I know about you and your organization.
 - i. I have your title/position listed as [xx]. Is that correct?
 - ii. How long have you been at this current position? How long have you been working with the organization?
 - iii. At a high level, can you describe the mission and functions of your organization, as well as your primary roles and responsibilities?

B. Community and Context

1. First, I'd like to ask you about the area (and the market) in which your organization (name) operates.

- i. Thinking about the broader context and the geographic area in which your organization operates, what would you characterize as the most important market and economic characteristics of the area? Are there organizations similar to yours that operate in your area?
- ii. How would you characterize the regional health care market in which your organization operates? For example, what would you consider to be the level of competition among hospitals in this area?
- iii. How would you describe the impact of the COVID-19 pandemic on health care in general in this region?

C. Market Changes and Challenges

- 1. Now I'd like to ask a few questions about important changes in the health care market and the potential consequences.
 - i. To our knowledge, there have been significant consolidations in health care in this region over the past several years (giving examples). In particular, we are aware of the mergers and acquisitions that involved rural hospitals. Are you involved in or familiar with any of these mergers and/or acquisitions?
 - ii. If so, what would you consider to be the most important factors leading to such mergers and/or acquisitions? (Ask about both financial and non-financial factors.)
 - iii. Now, thinking about the consequences of the mergers and/or acquisitions, how do you think that affected the rural hospital(s) in this region? (Ask specifically about the impact on safety, quality, and financial vulnerability.)
 - iv. And how would you describe the impact on the population living in this area? In particular, for people living in this area, has there been any significant impact (positive or negative) on the access to health care services? How about quality of care? (Ask specifically about health care access and possible changes in population level health outcomes.)
 - v. How would you characterize the impact of the COVID-19 pandemic on health care market consolidation (i.e., mergers and acquisitions of hospitals and physician practices in the area)?
 - vi. What do you think are the biggest challenges to the sustainability (both financial and otherwise) of rural hospitals in this region?

D. Perspectives on Government/External Policies and Interventions

1. Now I'd like to ask a few questions related to your perspectives on possible actions and policies that may be taken by the state government (or other external organizations) to help rural hospitals in Pennsylvania.
 - i. Given the population and economic conditions (based on the population change and economic development in that specific region in recent years), do you think hospitals serving rural populations can be sustained in this region?
 - ii. What would you consider to be the most urgent health care needs for the population living in this region?
 - iii. What would you consider to be the most important resource needs for hospitals to continue operating in this region?
 - iv. Moving forward, for rural hospitals, what would you consider to be the most important assistance (financial or otherwise) and/or policy changes that the Pennsylvania state government can provide?

Any final comments and thoughts?

Thanks again for your time and for sharing your perspective!

Appendix 2: Descriptive Tables of the Quantitative Measures

Table AI: Hospital Size and Staffing

AI-A: N (Sample Sizes – Number of Hospitals)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	156	156	154	147	151	147	147	146
All Rural	64	63	62	61	63	59	61	59
Rural with CHOW	26	25	24	23	23	21	21	20
All Urban	92	93	92	86	88	88	86	87
Urban with CHOW	28	29	28	24	24	21	16	13

Note: In all tables in this Appendix, the group “All Rural” hospitals includes the “Rural with CHOW” hospitals. The group “All Urban” hospitals includes the “Urban with CHOW” hospitals. The values in all tables (except for AI-A) are unweighted averages across all hospitals within each specified hospital group.

AI-B: Average Number of Beds per Hospital

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	222	221	223	228	223	236	232	234
All Rural	122	120	122	123	119	123	118	123
Rural with CHOW	128	122	125	128	126	130	130	135
All Urban	292	289	292	302	298	312	312	309
Urban with CHOW	186	184	182	177	168	184	201	205

AI-C: Average Number of Employed Physicians per Hospital

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	46	34	38	47	50	55	68	62
All Rural	19	20	22	32	31	28	24	22
Rural with CHOW	12	8	12	11	11	14	13	15
All Urban	64	44	49	58	63	71	101	88
Urban with CHOW	23	17	32	32	21	17	46	54

AI-D: Average Number of Employed Registered Nurses per Hospital

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	341	353	360	381	374	354	351	371
All Rural	167	165	166	172	161	150	145	152
Rural with CHOW	152	153	156	162	148	134	132	135
All Urban	462	480	491	529	526	491	497	519
Urban with CHOW	241	235	247	238	213	201	236	257

Table All: Types of Services Available**Table All-A: Life Support Availability (Advanced or Basic) [Percentage of Hospitals with the Service]**

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	25.5%	25.5%	27.2%	26.1%	26.4%	28.2%	36.6%	49.6%
All Rural	17.5%	17.7%	19.7%	20.0%	25.8%	29.3%	33.3%	50.0%
Rural with CHOW	15.4%	16.0%	16.7%	17.4%	26.1%	28.6%	23.8%	50.0%
All Urban	31.4%	31.0%	32.6%	30.5%	26.8%	27.4%	39.0%	49.4%
Urban with CHOW	34.6%	37.0%	46.2%	45.5%	42.9%	31.6%	43.8%	38.5%

Note: Basic Life Support provides non-invasive emergency care services, such as CPR and non-invasive airway management. Advanced Life Support offers physician (or paramedic) lead services in more complex medical emergencies, such as intubation, intravenous drug administration, and surgical incisions.

Table All-B: Mobile Intensive or Critical Care Unit Availability (Percentage of Hospitals with the Service)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	8.7%	8.1%	7.5%	10.6%	10.4%	9.9%	13.4%	12.9%
All Rural	7.9%	8.1%	8.2%	10.0%	11.3%	10.3%	10.0%	10.3%
Rural with CHOW	7.7%	8.0%	8.3%	13.0%	17.4%	14.3%	14.3%	15.0%
All Urban	9.3%	8.0%	7.0%	11.0%	9.8%	9.5%	15.9%	14.8%
Urban with CHOW	11.5%	7.4%	7.7%	13.6%	9.5%	5.3%	18.8%	15.4%

Note: A Mobile Intensive Care Unit is a specialized emergency vehicle (ambulance) providing intensive care during patient transport (from home to hospital or between hospitals). A Critical Care Unit (CCU) is a department within a hospital to treat critically ill patients, often during extended period of time.

Table All-C: Neonatal Intensive Care Unit Availability (NICU Level 2 or Above) [Percentage of Hospitals with the Service]

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	37.2%	37.8%	37.0%	38.1%	37.1%	38.8%	38.1%	38.4%
All Rural	20.3%	20.6%	21.0%	21.3%	19.0%	20.3%	18.0%	18.6%
Rural with CHOW	19.2%	20.0%	20.8%	21.7%	21.7%	23.8%	19.0%	20.0%
All Urban	48.9%	49.5%	47.8%	50.0%	50.0%	51.1%	52.3%	51.7%
Urban with CHOW	35.7%	37.9%	32.1%	33.3%	37.5%	42.9%	43.8%	38.5%

Note: NICU has 4 standardized levels: 1-Basic care for healthy newborns; 2-Specialty care for moderately ill newborns; 3-Advanced care for critically ill newborns; and 4-Highest level of care with on-site specialists 24/7)

Table All-D: Clinical Laboratory Availability (Percentage of Hospitals with the Service)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	98.1%	96.8%	97.4%	98.0%	96.7%	97.3%	95.2%	95.2%
All Rural	96.9%	95.2%	95.2%	96.7%	95.2%	96.6%	95.1%	96.6%
Rural with CHOW	100.0%	96.0%	95.8%	100.0%	95.7%	100.0%	100.0%	100.0%
All Urban	98.9%	97.8%	98.9%	98.8%	97.7%	97.7%	95.3%	94.3%
Urban with CHOW	100.0%	100.0%	100.0%	100.0%	95.8%	100.0%	93.8%	92.3%

Table All-E: Clinical Psychology Availability (Percentage of Hospitals with the Service)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	41.0%	41.7%	42.2%	42.9%	35.8%	34.9%	37.7%	34.9%
All Rural	26.6%	28.6%	33.9%	29.5%	23.8%	25.4%	31.7%	27.1%
Rural with CHOW	26.9%	28.0%	37.5%	30.4%	17.4%	19.0%	30.0%	25.0%
All Urban	51.1%	50.5%	47.8%	52.3%	44.3%	41.4%	41.9%	40.2%
Urban with CHOW	28.6%	34.5%	28.6%	20.8%	25.0%	25.0%	31.3%	38.5%

Table All-F: Neurology Availability (Percentage of Hospitals with the Service)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	75.0%	75.6%	77.3%	78.2%	73.5%	75.5%	78.1%	78.8%
All Rural	62.5%	66.7%	67.7%	67.2%	60.3%	62.7%	63.9%	64.4%
Rural with CHOW	69.2%	72.0%	70.8%	69.6%	60.9%	61.9%	71.4%	70.0%
All Urban	83.7%	81.7%	83.7%	86.0%	83.0%	84.1%	88.2%	88.5%
Urban with CHOW	71.4%	69.0%	75.0%	75.0%	75.0%	81.0%	87.5%	84.6%

Table All-G: Podiatry Availability (Percentage of Hospitals with the Service)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	82.7%	81.4%	81.2%	83.7%	79.5%	82.1%	82.2%	83.6%
All Rural	76.6%	79.4%	79.0%	82.0%	69.8%	70.7%	71.7%	69.5%
Rural with CHOW	76.9%	72.0%	75.0%	73.9%	65.2%	70.0%	71.4%	70.0%
All Urban	87.0%	82.8%	82.6%	84.9%	86.4%	89.7%	89.5%	93.1%
Urban with CHOW	82.1%	79.3%	82.1%	79.2%	83.3%	100.0%	93.8%	100.0%

Table All-H: General Surgery Availability (Percentage of Hospitals with the Service)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	98.7%	99.4%	99.4%	98.6%	96.7%	98.0%	96.6%	98.6%
All Rural	98.4%	100.0%	100.0%	98.4%	96.8%	98.3%	96.7%	98.3%
Rural with CHOW	100.0%	100.0%	100.0%	95.7%	95.7%	95.2%	95.2%	100.0%
All Urban	98.9%	98.9%	98.9%	98.8%	96.6%	97.7%	96.5%	98.8%
Urban with CHOW	100.0%	100.0%	100.0%	100.0%	95.8%	100.0%	93.8%	100.0%

Table AIII: Quality and Cost**Table AIII-A: N (Sample Sizes – Number of Hospitals)**

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	156	153	152	148	139	140	134	137
All Rural	64	62	64	63	59	61	57	59
Rural with CHOW	26	24	25	24	22	22	20	20
All Urban	92	91	88	85	80	79	77	78
Urban with CHOW	26	25	22	19	17	14	12	12

Note: Not every hospital in our study sample reported all these measures each year, and therefore the sample size may vary across different measures. (For example, for clinical quality measures, certain hospitals might not have enough patients with that medical condition, such as stroke, in a specific year to be eligible for reporting.)

Table AIII-B: Average Charge (\$) - Heart Failure

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	\$33,096	\$34,287	\$35,492	\$36,605	\$42,091	\$40,621	\$42,295	\$44,352
All Rural	\$17,900	\$19,047	\$20,485	\$22,281	\$26,617	\$25,820	\$27,175	\$28,566
Rural with CHOW	\$17,120	\$18,558	\$18,819	\$20,267	\$24,688	\$25,022	\$25,799	\$27,459
All Urban	\$43,853	\$44,903	\$46,405	\$47,178	\$50,665	\$51,862	\$53,635	\$56,292
Urban with CHOW	\$50,377	\$52,086	\$49,931	\$47,964	\$54,112	\$51,273	\$54,690	\$57,265

Note: Charge per admission is the amount hospital charged based on list price, BEFORE any discounts, which can be significantly higher than the actual amount paid by insurance or patients. These are dollar amounts NOT adjusted for inflation. Each hospital reports a hospital-level average based on ALL admissions due to Heart Failure. We then calculate group-level average based on all hospitals in that group.

Table AIII-C: Heart Failure Mortality rate (within 30 Days of Hospital Admission)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	2.3%	2.4%	2.4%	2.5%	6.8%	2.6%	2.7%	2.8%
All Rural	2.3%	2.4%	2.4%	2.5%	6.8%	2.6%	2.7%	2.8%
Rural with CHOW	2.2%	2.4%	2.6%	2.9%	7.0%	3.1%	2.9%	3.3%
All Urban	1.9%	2.2%	1.9%	2.2%	7.0%	2.3%	2.7%	2.5%
Urban with CHOW	2.0%	2.4%	2.2%	2.4%	7.3%	2.1%	2.4%	2.1%

Table AIII-D: Heart Failure Readmission Rate (within 30 days of Hospital Discharge)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	23.2%	22.9%	22.8%	21.9%	17.2%	20.3%	19.7%	20.6%
All Rural	22.7%	22.6%	22.3%	20.0%	15.9%	19.0%	17.6%	19.3%
Rural with CHOW	22.0%	22.6%	22.0%	20.4%	17.3%	19.2%	17.2%	17.4%
All Urban	23.5%	23.1%	23.2%	23.2%	17.9%	21.3%	21.3%	21.7%
Urban with CHOW	23.0%	24.6%	21.9%	25.1%	21.5%	20.0%	20.6%	22.3%

Table AIII-E: COPD Average Charge (\$)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	\$27,662	\$30,105	\$29,618	\$31,603	\$33,307	\$34,469	\$36,434	\$36,467
All Rural	\$16,214	\$17,832	\$18,737	\$20,089	\$22,163	\$23,726	\$25,481	\$25,860
Rural with CHOW	\$15,920	\$17,505	\$17,051	\$18,581	\$21,366	\$22,845	\$24,588	\$23,772
All Urban	\$35,803	\$38,560	\$37,622	\$40,238	\$41,385	\$42,595	\$44,649	\$44,355
Urban with CHOW	\$42,843	\$46,336	\$44,165	\$44,722	\$46,441	\$45,574	\$48,402	\$45,279

Note: Chronic Obstructive Pulmonary Disease (COPD) refers to a set of serious chronic and progressive lung diseases, possibly leading to hospitalization or even death, if not properly managed. The numbers here reflect all admission to the hospital with COPD as the primary cause.

Charge per admission is the amount hospital charged based on list price, BEFORE any discounts, which can be significantly higher than the actual amount paid by insurance or patients. These are dollar amounts NOT adjusted for inflation. Each hospital reports a hospital-level average based on ALL admissions due to COPD. We then calculate group-level average based on all hospitals in that group.

Table AIII-F: COPD Mortality Rate (within 30 Days of Hospital Admission)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	0.7%	0.6%	0.6%	0.8%	0.8%	1.0%	1.3%	1.0%
All Rural	0.8%	0.7%	0.8%	0.8%	0.7%	1.0%	1.9%	1.4%
Rural with CHOW	0.4%	0.6%	0.6%	0.8%	0.5%	0.6%	2.2%	1.1%
All Urban	0.5%	0.6%	0.5%	0.7%	0.9%	1.1%	0.9%	0.7%
Urban with CHOW	0.8%	0.7%	0.5%	0.6%	0.7%	1.0%	0.7%	0.4%

Table AIII-G: COPD Readmission Rate (within 30 days of Hospital Discharge)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	19.5%	18.8%	18.1%	17.9%	18.6%	19.0%	17.6%	17.5%
All Rural	18.2%	16.7%	16.2%	14.9%	16.4%	16.1%	14.8%	15.2%
Rural with CHOW	18.9%	16.8%	16.1%	15.0%	16.7%	16.3%	17.3%	15.2%
All Urban	20.5%	20.3%	19.5%	20.2%	20.2%	21.2%	19.6%	19.3%
Urban with CHOW	20.9%	20.3%	20.6%	19.6%	19.8%	20.7%	18.3%	20.5%

Table AIII-H: Acute Kidney Failure Average Charge (\$)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	\$29,791	\$30,259	\$30,225	\$30,816	\$32,243	\$34,389	\$36,942	\$37,808
All Rural	\$16,384	\$16,235	\$17,967	\$19,259	\$20,594	\$23,097	\$24,747	\$25,889
Rural with CHOW	\$15,183	\$15,519	\$16,726	\$17,390	\$20,613	\$22,864	\$23,492	\$24,305
All Urban	\$38,527	\$39,298	\$38,443	\$38,838	\$40,543	\$42,929	\$45,767	\$46,785
Urban with CHOW	\$45,211	\$45,986	\$43,824	\$39,825	\$43,769	\$44,862	\$47,538	\$48,108

Note: Charge per admission is the amount hospital charged based on list price, BEFORE any discounts, which can be significantly higher than the actual amount paid by insurance or patients. These are dollar amounts NOT adjusted for inflation. Each hospital reports a hospital-level average based on ALL admissions due to Acute Kidney Failure. We then calculate group-level average based on all hospitals in that group.

Table AIII-I: Acute Kidney Failure Mortality rate (within 30 Days of Hospital Admission)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	2.5%	3.0%	2.2%	2.5%	2.6%	3.0%	3.3%	3.0%
All Rural	3.1%	3.6%	2.2%	2.8%	3.0%	3.6%	4.0%	3.7%
Rural with CHOW	2.7%	3.1%	2.6%	2.6%	3.0%	2.2%	3.7%	2.2%
All Urban	2.1%	2.6%	2.2%	2.3%	2.3%	2.6%	2.7%	2.5%
Urban with CHOW	2.2%	2.6%	2.2%	2.4%	1.7%	3.3%	2.2%	2.9%

Table AIII-J: Acute Kidney Failure Readmission Rate (within 30 Days of Hospital Discharge)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	20.7%	19.0%	18.4%	18.2%	18.1%	16.6%	16.8%	18.6%
All Rural	20.5%	17.6%	17.3%	15.9%	16.7%	14.0%	15.8%	16.8%
Rural with CHOW	21.2%	17.3%	17.4%	14.6%	16.2%	12.2%	15.7%	16.6%
All Urban	20.8%	19.9%	19.2%	19.7%	19.1%	18.6%	17.5%	19.9%
Urban with CHOW	20.7%	19.4%	17.1%	18.5%	18.7%	17.7%	16.7%	19.3%

Table AIII-K: Stroke Average Charge (\$)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	\$37,972	\$39,041	\$40,261	\$42,571	\$44,464	\$48,493	\$50,551	\$53,439
All Rural	\$20,642	\$22,050	\$23,617	\$26,328	\$28,414	\$32,086	\$33,508	\$36,753
Rural with CHOW	\$19,412	\$20,277	\$20,875	\$23,810	\$27,286	\$29,440	\$31,967	\$34,300
All Urban	\$49,001	\$49,907	\$51,159	\$52,799	\$54,752	\$59,358	\$61,606	\$64,262
Urban with CHOW	\$56,184	\$58,101	\$56,766	\$56,611	\$59,581	\$60,339	\$63,636	\$67,779

Table AIII-L: Stroke Mortality Rate (within 30 Days of Hospital Admission)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	2.9%	2.6%	2.5%	2.1%	3.1%	2.7%	3.5%	2.7%
All Rural	3.2%	2.8%	3.5%	1.9%	4.9%	2.9%	3.9%	3.0%
Rural with CHOW	3.0%	3.2%	3.1%	1.9%	2.0%	2.5%	2.8%	2.9%
All Urban	2.6%	2.5%	1.8%	2.2%	2.0%	2.5%	3.2%	2.5%
Urban with CHOW	2.3%	2.6%	1.6%	2.3%	2.0%	3.2%	2.6%	2.3%

Table AIII-M: Stroke Readmission Rate (within 30 Days of Hospital Discharge)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	12.3%	11.4%	10.2%	10.3%	10.2%	9.3%	10.4%	9.8%
All Rural	12.1%	10.8%	9.1%	8.7%	9.5%	8.5%	10.3%	8.0%
Rural with CHOW	12.3%	10.3%	8.2%	8.4%	8.6%	6.2%	10.8%	7.9%
All Urban	12.5%	11.8%	10.9%	11.4%	10.6%	9.8%	10.4%	11.0%
Urban with CHOW	12.7%	11.2%	11.0%	12.6%	9.0%	8.7%	8.4%	9.3%

Table AIV: Financial Performance**Table AIV-A: N (Sample Sizes – Number of Hospitals)**

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	168	169	168	166	164	160	158	156
All Rural	67	68	67	66	67	66	64	64
Rural with CHOW	27	27	26	25	25	24	22	22
All Urban	101	101	101	100	97	94	94	92
Urban with CHOW	27	27	27	26	24	21	20	16

Table AIV-B: Average Net Patient Revenue (in Thousands of Dollars)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	\$249,164	\$258,133	\$269,322	\$290,080	\$294,578	\$305,697	\$344,194	\$357,895
All Rural	\$109,164	\$112,227	\$117,495	\$128,069	\$124,424	\$122,930	\$148,060	\$151,174
Rural with CHOW	\$95,472	\$96,047	\$99,567	\$114,086	\$109,961	\$115,862	\$133,460	\$132,978
All Urban	\$342,035	\$356,368	\$370,038	\$397,537	\$416,118	\$434,022	\$482,133	\$501,701
Urban with CHOW	\$180,168	\$187,230	\$184,785	\$193,922	\$199,471	\$216,155	\$278,054	\$305,579

Note: Net Patient Revenue is a hospital's revenue from patient services after discounts and contractual adjustments

Table AIV-C: Average Operating Revenue (in Thousands of Dollars)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	\$263,523	\$273,121	\$285,091	\$307,686	\$324,218	\$336,717	\$374,003	\$390,956
All Rural	\$113,960	\$117,091	\$122,335	\$133,092	\$133,535	\$131,434	\$157,008	\$159,735
Rural with CHOW	\$99,754	\$100,736	\$103,871	\$118,918	\$118,191	\$124,288	\$141,823	\$140,721
All Urban	\$362,737	\$378,171	\$393,057	\$423,488	\$460,420	\$480,852	\$526,614	\$551,805
Urban with CHOW	\$187,444	\$196,089	\$192,671	\$201,271	\$215,294	\$230,042	\$292,649	\$326,541

Note: Operating revenue is a broad category of revenue from the hospital's core operation, which includes NPR and other revenue sources such as retail pharmacy and parking.

Table AIV-D: Average Operating Income (in Thousands of Dollars)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	\$15,961	\$14,056	\$13,568	\$18,318	\$13,310	\$26,670	\$16,545	\$8,906
All Rural	\$6,576	\$6,594	\$7,054	\$9,494	\$7,801	\$12,825	\$11,259	\$3,972
Rural with CHOW	\$4,247	\$3,702	\$4,175	\$7,583	\$8,236	\$12,520	\$12,426	\$3,839
All Urban	\$22,186	\$19,080	\$17,889	\$24,171	\$17,246	\$36,391	\$20,263	\$12,338
Urban with CHOW	\$3,829	\$146	-\$9,986	-\$2,606	-\$3,008	\$5,314	\$10,513	\$8,781

Note: Operating income is the difference between operating revenue and expenses)

Table AIV-E: Average Operating Expenses (in Thousands of Dollars)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	\$247,562	\$259,065	\$271,523	\$289,368	\$310,988	\$310,048	\$357,457	\$382,050
All Rural	\$107,385	\$110,497	\$115,282	\$123,598	\$125,734	\$118,609	\$145,749	\$155,763
Rural with CHOW	\$95,507	\$97,034	\$99,696	\$111,335	\$109,955	\$111,768	\$129,397	\$136,882
All Urban	\$340,551	\$359,091	\$375,168	\$399,317	\$443,313	\$444,462	\$506,351	\$539,467
Urban with CHOW	\$183,615	\$195,943	\$202,657	\$203,877	\$218,302	\$224,728	\$282,136	\$317,760

Note: Operating expenses are expenses (costs) incurred by the hospital's core operation.

Table AIV-F: Average Operating Margin

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	0.1%	-0.2%	-0.7%	-0.2%	0.0%	3.9%	1.0%	-3.1%
All Rural	1.1%	0.3%	0.3%	2.1%	1.4%	5.6%	6.0%	-0.5%
Rural with CHOW	-1.0%	-2.3%	-2.3%	0.7%	2.1%	3.3%	5.1%	-3.3%
All Urban	-0.5%	-0.6%	-1.3%	-1.6%	-0.9%	2.8%	-2.5%	-4.9%
Urban with CHOW	1.3%	-0.7%	-4.9%	-7.5%	-11.3%	-0.4%	-2.1%	-7.2%

Note: Operating margin refers to the operating income as a percentage of revenue.

Table AIV-G: Medicare Share of Net Patient Revenue

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	39.0%	39.5%	40.4%	41.0%	42.5%	41.0%	40.5%	41.4%
All Rural	42.5%	43.0%	44.5%	44.2%	44.9%	45.0%	44.2%	45.1%
Rural with CHOW	42.8%	43.1%	44.2%	44.8%	45.5%	46.0%	43.9%	45.2%
All Urban	36.7%	37.2%	37.7%	38.9%	40.7%	38.1%	37.9%	38.8%
Urban with CHOW	36.2%	36.5%	38.6%	41.1%	46.6%	40.1%	39.7%	39.9%

Table AIV-H: Medicaid Share of Net Patient Revenue

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	11.9%	12.5%	12.5%	12.5%	13.0%	12.7%	12.9%	13.2%
All Rural	11.2%	11.8%	11.6%	11.2%	12.0%	11.8%	12.3%	11.9%
Rural with CHOW	11.5%	12.6%	13.1%	11.8%	12.5%	12.7%	13.2%	14.5%
All Urban	12.3%	13.0%	13.1%	13.4%	13.8%	13.4%	13.3%	14.1%
Urban with CHOW	14.8%	15.8%	15.8%	16.6%	15.1%	12.8%	11.6%	14.0%

Table AIV-I: Percentage of Uncompensated Care

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	2.3%	2.0%	2.1%	2.1%	2.2%	2.0%	1.8%	1.8%
All Rural	2.6%	2.4%	2.3%	2.3%	2.4%	2.1%	1.8%	1.9%
Rural with CHOW	2.5%	2.5%	2.5%	2.5%	2.9%	2.6%	1.9%	2.0%
All Urban	2.1%	1.8%	2.0%	1.9%	2.0%	2.0%	1.8%	1.7%
Urban with CHOW	1.5%	1.4%	1.7%	2.2%	2.2%	2.4%	2.2%	2.1%

Note: Uncompensated care the proportion of hospital services that are not reimbursed, either due to charity or due to uncollectable fees.

Table AV: Patient Experience**Table AV-A: N (Sample Sizes – Number of Hospitals)**

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	165	165	163	160	157	154	153	151
All Rural	68	66	65	66	65	62	62	61
Rural with CHOW	25	24	23	23	21	19	19	18
All Urban	97	99	98	94	92	92	91	90
Urban with CHOW	18	19	18	15	14	12	10	9

Note: The patient experience measures are based on the “Hospital Consumer Assessment of Healthcare Providers and Systems” (HCAHPS) Survey conducted by CMS, a patient level survey within each participating hospital. Our data contains hospital level scores that are derived from patient level scores.

Table AV-B: Care Transition (Linear Score, 0-100)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	81.72	81.84	81.79	81.93	81.54	80.99	80.49	81.15
All Rural	81.92	81.67	82.14	82.17	81.85	81.24	80.64	81.55
Rural with CHOW	81.42	81.10	82.05	81.71	80.82	79.94	79.35	80.25
All Urban	81.59	81.95	81.56	81.77	81.35	80.82	80.39	80.89
Urban with CHOW	80.33	80.56	80.94	80.50	79.42	79.10	79.10	79.00

Note: The measures in AV-B to AV-H are based on the “Hospital Consumer Assessment of Healthcare Providers and Systems” (HCAHPS) Survey conducted by CMS. The questions in the survey are all based on

Likert scale. The scores are calculated from the average of responses by patients to the survey within a hospital, and then adjusted by patient mix to transform into a 100-point linear score, with higher scores indicating better experience. These table average scores based on reported hospital-level scores in each group.

Table AV-C: Communication About Medicine (Linear Score, 0-100)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	78.68	78.48	78.39	78.15	76.72	75.88	74.89	75.90
All Rural	79.59	79.00	79.05	78.95	77.71	76.64	75.36	76.98
Rural with CHOW	78.50	78.48	78.14	78.29	76.29	75.11	73.65	75.06
All Urban	78.05	78.16	77.97	77.62	76.13	75.37	74.58	75.20
Urban with CHOW	77.78	77.44	78.39	76.93	75.17	73.80	72.60	73.25

Table AV-D: Providing Discharge Information (Linear Score, 0-100)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	88.06	88.20	88.09	87.94	88.07	87.24	86.96	87.31
All Rural	88.27	88.34	88.83	88.67	89.00	88.13	87.92	88.29
Rural with CHOW	87.63	87.95	88.62	88.67	87.71	87.11	86.29	86.75
All Urban	87.91	88.11	87.60	87.44	87.52	86.65	86.33	86.67
Urban with CHOW	87.94	88.39	87.56	85.86	84.92	84.90	85.00	84.63

Table AV-E: Doctor Communication (Linear Score, 0-100)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	91.85	91.60	91.69	91.80	91.53	90.95	90.23	90.65
All Rural	92.48	91.78	92.08	92.16	91.98	91.36	90.58	91.02
Rural with CHOW	91.67	91.33	92.00	91.62	91.06	90.39	89.41	89.75
All Urban	91.42	91.48	91.44	91.56	91.27	90.67	90.00	90.41
Urban with CHOW	90.72	90.28	91.17	90.86	90.67	90.00	88.90	89.63

Table AV-F: Nurse Communication (Linear Score, 0-100)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	92.29	92.09	92.32	92.60	92.22	91.73	91.29	91.82
All Rural	92.76	92.34	92.69	93.07	92.69	92.18	91.83	92.45
Rural with CHOW	92.13	91.95	92.52	92.52	91.88	90.89	91.18	91.25
All Urban	91.97	91.94	92.08	92.28	91.94	91.43	90.94	91.41
Urban with CHOW	90.94	90.44	91.56	91.71	91.33	90.60	90.10	89.88

Table AV-G: Overall Hospital Rating (Linear Score, 0-100)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	88.74	88.40	88.27	88.58	88.56	87.67	87.01	88.06
All Rural	88.52	87.84	88.32	88.52	88.60	87.89	87.17	88.47
Rural with CHOW	87.50	87.00	87.86	87.67	87.18	86.28	85.35	86.63
All Urban	88.88	88.75	88.24	88.63	88.54	87.52	86.90	87.80
Urban with CHOW	87.61	87.17	86.67	87.00	87.00	85.80	85.30	86.13

Table AV-H: Staff Responsiveness (Linear Score, 0-100)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	86.27	86.09	86.50	86.53	85.25	84.22	83.46	84.22
All Rural	87.48	86.83	87.66	87.41	86.31	85.22	84.57	85.96
Rural with CHOW	86.29	86.10	87.43	86.38	84.65	83.33	82.76	84.25
All Urban	85.45	85.63	85.75	85.94	84.63	83.55	82.73	83.09
Urban with CHOW	84.06	84.28	86.00	85.79	83.67	81.80	81.30	81.38

Table AV-I: Will Definitely Recommend the Hospital (Percentage of Patients)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	70.3%	69.9%	69.8%	70.1%	70.4%	68.6%	67.1%	68.9%
All Rural	68.0%	67.0%	67.8%	67.6%	69.1%	66.8%	65.7%	67.4%
Rural with CHOW	64.2%	64.4%	65.8%	64.8%	65.9%	61.9%	60.6%	61.4%
All Urban	71.9%	71.9%	71.1%	71.8%	71.3%	69.8%	68.1%	70.0%
Urban with CHOW	66.5%	66.6%	66.3%	65.6%	64.3%	64.1%	62.0%	62.8%

Table AVI: Utilization**Table AVI-A: Average Number of Admissions**

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	8,180	8,023	7,997	7,969	8,565	9,147	8,691	8,983
All Rural	4,887	4,893	4,864	4,684	4,095	4,430	4,208	4,542
Rural with CHOW	4,768	4,692	4,747	4,429	3,880	4,304	4,162	4,579
All Urban	10,631	10,307	10,272	10,505	11,765	12,309	11,871	11,995
Urban with CHOW	6,309	6,050	5,757	5,354	5,699	6,770	6,645	6,857

Table AVI-B: Average Number of Emergency Room Visits

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	16,299	16,744	16,556	17,784	32,449	36,845	36,914	38,901
All Rural	15,101	15,610	15,230	16,584	19,831	22,656	22,745	24,296
Rural with CHOW	17,591	17,011	16,948	18,146	20,858	23,523	23,984	25,078
All Urban	17,946	18,211	18,184	19,456	41,990	46,642	47,282	49,624
Urban with CHOW	18,892	17,582	17,859	17,187	28,288	32,662	32,267	31,194

Table AVI-C: Average Number of Admissions from Emergency Room

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	6,042	5,856	5,734	6,103	6,117	6,708	6,261	6,528
All Rural	3,381	3,395	3,327	3,221	2,958	3,510	3,140	3,300
Rural with CHOW	3,564	3,364	3,412	3,138	2,794	3,764	3,029	3,526
All Urban	7,935	7,560	7,392	8,171	8,505	8,916	8,545	8,869
Urban with CHOW	5,450	5,291	5,133	5,192	5,165	5,992	5,850	4,874

Table AVI-D: Average Census Patient Days of Care

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	13,375	13,605	12,685	13,016	44,968	50,555	49,432	49,746
All Rural	10,197	10,101	9,681	10,361	19,473	23,080	21,834	21,542
Rural with CHOW	12,035	10,983	10,943	12,199	18,841	23,076	22,216	21,563
All Urban	17,611	18,030	16,419	16,842	63,221	68,976	69,007	68,873
Urban with CHOW	16,368	16,454	15,116	13,157	29,974	33,446	35,009	34,512

Note: Census patient days of care is the sum of daily inpatient census during the reporting period.

Table AVI-E: Average Length of Stay (Days)

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	4.27	4.30	4.23	4.09	4.77	5.07	5.27	5.22
All Rural	4.36	4.34	4.21	4.02	4.62	4.89	4.97	4.46
Rural with CHOW	4.30	4.30	4.02	3.79	4.67	4.99	5.26	4.77
All Urban	4.13	4.25	4.25	4.19	4.88	5.19	5.48	5.75
Urban with CHOW	3.88	4.26	4.29	4.04	4.56	4.76	5.34	4.88

Note: Average Length of Stay is calculated as the total number of inpatient days divided by the total number of patient discharges

Table AVI-F: Average Occupancy Rate

	2016	2017	2018	2019	2020	2021	2022	2023
Overall	37.1%	37.5%	40.2%	40.2%	50.5%	56.8%	57.0%	56.4%
All Rural	37.0%	38.3%	39.1%	34.1%	40.5%	50.0%	49.9%	47.0%
Rural with CHOW	32.3%	34.3%	39.7%	30.8%	41.3%	50.9%	52.7%	47.1%
All Urban	37.3%	35.6%	42.4%	51.1%	57.6%	61.4%	62.0%	62.9%
Urban with CHOW	34.1%	34.3%	36.6%	43.2%	50.9%	55.7%	59.8%	63.0%

Note: Occupancy Rate is defined by CMS as total Patient Days of Care divided by Total Bed Days Available, which is the maximum number of inpatient days that could have occurred if every staffed or licensed bed was continuously filled.

Appendix 3: Rural Hospitals in Pennsylvania – Basic Information in 2023

Table AVII-A: Rural Hospitals in Pennsylvania in 2023 – Size, Utilization, and Financial Performance

County	Hospital Name	Beds	Total Admissions	Total ER Visits	NPR (in \$1000)	Percent Medicare Patients	Percent Medicaid Patients	Operating Margin
Adams	WellSpan Gettysburg	76	4,769	32,405	341,794	26.70%	3.90%	19.10%
Armstrong	ACMH	95	2,745	20,306	119,981	50.90%	9.50%	-5.80%
Bedford	UPMC Bedford	40	1,178	18,157	50,404	43.40%	14.40%	5.80%
Blair	UPMC Altoona	398	15,501	47,770	523,830	45.20%	14.20%	-5.70%
Blair	Conemaugh Nason MC	45	1,788	13,319	50,580	59.50%	6.30%	8.30%
Blair	Penn Highlands Tyrone	25	374	9,956	25,402	54.00%	16.20%	-7.00%
Bradford	Robert Packer	308	14,461	43,889	446,424	45.10%	10.60%	1.40%
Bradford	Troy Community	25	953	7,616	33,952	49.00%	7.60%	14.40%
Butler	Butler Memorial	294	10,248	38,829	272,536	36.90%	5.60%	1.70%
Cambria	Conemaugh Memorial	420	13,428	36,655	346,542	45.70%	15.70%	-10.10%
Cambria	Conemaugh Miners	25	403	10,002	21,037	46.60%	10.00%	9.40%
Carbon	St Luke's Carbon Campus	52	3,396	21,083	86,448	47.00%	6.20%	8.80%
Centre	Mount Nittany	248	10,799	56,362	413,986	34.10%	3.00%	14.00%
Clarion	Clarion	67	1,066	13,226	51,089	41.70%	7.90%	0.90%
Clearfield	Penn Highlands DuBois	330	10,059	43,119	429,276	43.00%	12.50%	-1.10%
Clinton	Bucktail	16	69	1,168	6,240	67.70%	7.70%	-27.90%
Clinton	UPMC Lock Haven	25	682	10,425	25,345	54.20%	15.00%	-13.80%
Columbia	Geisinger Bloomsburg	62	2,786	23,372	71,155	29.00%	11.40%	3.10%
Crawford	Meadville	198	5,815	31,455	237,102	45.70%	7.20%	0.20%
Crawford	Titusville Area	25	656	10,663	53,721	57.00%	17.90%	9.30%
Elk	Penn Highlands Elk	40	1,268	13,463	67,239	42.80%	16.20%	4.20%

County	Hospital Name	Beds	Total Admissions	Total ER Visits	NPR (in \$1000)	Percent Medicare Patients	Percent Medicaid Patients	Operating Margin
Fayette	Penn Highlands Connellsville	60	1,369	9,301	20,647	42.30%	27.70%	-6.80%
Fayette	Uniontown	145	9,684	44,673	148,575	54.50%	14.30%	-4.10%
Franklin	WellSpan Chambersburg	274	13,859	57,659	435,068	35.90%	7.30%	7.10%
Franklin	WellSpan Waynesboro	57	2,810	19,712	84,219	33.30%	6.70%	18.00%
Fulton	Fulton County	21	410	10,658	46,688	23.10%	7.70%	-10.50%
Greene	Washington HS Greene	18	366	12,399	16,291	48.10%	20.40%	-16.90%
Huntingdon	Penn Highlands Huntingdon	71	2,167	12,379	60,391	58.00%	21.90%	-11.20%
Indiana	Indiana Regional	166	5,356	34,195	189,723	56.90%	10.30%	5.00%
Jefferson	Punxsutawney Area	49	1,113	12,093	53,163	47.20%	13.20%	1.30%
Jefferson	Penn Highlands Brookville	35	707	7,912	30,299	52.20%	12.10%	-0.10%
Lawrence	UPMC Jameson	146	5,183	27,650	116,209	55.60%	14.40%	-11.50%
Lycoming	Geisinger Jersey Shore	25	1,450	13,861	43,186	49.20%	15.20%	9.70%
Lycoming	UPMC Muncy	20	569	9,478	53,869	39.30%	8.50%	1.60%
Lycoming	UPMC Williamsport	255	10,730	46,990	460,462	27.80%	30.70%	17.00%
Lycoming	Geisinger MC Muncy	20	1,275	16,404	36,025	59.80%	13.90%	-40.00%
McKean	Bradford Regional	50	855	12,659	39,169	38.40%	25.70%	-18.30%
McKean	UPMC Kane	14	216	7,143	21,640	54.70%	12.30%	-1.90%
Mercer	UPMC Horizon	116	3,425	31,742	157,740	43.70%	11.60%	-1.60%
Mercer	Sharon Regional	163	4,793	22,836	108,202	48.90%	7.30%	-20.10%
Mercer	Grove City	67	821	16,149	53,380	45.20%	4.10%	0.20%
Mifflin	Geisinger Lewistown	133	5,710	32,801	186,103	35.50%	8.50%	7.10%
Monroe	Lehigh Valley Pocono	264	7,226	39,061	285,561	34.80%	10.90%	12.30%
Monroe	St Luke's Monroe	98	7,309	51,011	221,835	38.10%	7.90%	9.20%

County	Hospital Name	Beds	Total Admissions	Total ER Visits	NPR (in \$1000)	Percent Medicare Patients	Percent Medicaid Patients	Operating Margin
Montour	Geisinger Danville	575	29,593	70,078	1,457,206	32.20%	13.10%	3.20%
Potter	UPMC Cole	93	968	10,337	88,768	47.40%	16.60%	-5.00%
Schuylkill	St Luke's Miners	49	2,567	20,744	107,712	38.00%	9.70%	15.30%
Schuylkill	Lehigh Valley Schuylkill	186	5,241	27,430	134,830	42.70%	19.40%	-11.20%
Schuylkill	Geisinger St Luke's	60	4,519	27,150	73,960	42.20%	7.00%	10.50%
Somerset	UPMC Somerset	111	2,328	19,404	82,670	47.60%	16.00%	2.40%
Somerset	Soon-Shiong MC Windber	54	1,007	10,781	46,856	47.40%	5.80%	-14.70%
Somerset	Conemaugh Meyersdale	20	319	3,935	16,922	60.10%	12.80%	-11.70%
Susquehanna	Endless Mountains	25	455	8,485	20,249	55.90%	15.90%	-3.80%
Susquehanna	Barnes-Kasson County	25	401	2,963	18,430	34.00%	25.20%	-1.80%
Tioga	UPMC Wellsboro	25	1,390	12,233	85,831	41.10%	11.70%	-1.60%
Union	Evangelical Community	131	5,201	27,278	223,490	35.30%	3.50%	11.60%
Venango	UPMC Northwest	151	5,600	26,238	137,940	45.00%	11.50%	-11.50%
Warren	Warren General	85	2,317	16,516	82,234	42.90%	10.70%	-1.60%
Washington	Penn Highlands Mon Valley	200	5,092	23,661	113,808	55.10%	13.30%	-13.90%
Washington	Washington	278	8,198	34,981	238,499	47.20%	16.10%	-0.80%
Washington	Canonsburg	104	1,574	19,446	60,287	45.30%	5.20%	-0.10%
Wayne	Wayne Memorial	104	3,043	26,908	103,564	40.20%	11.70%	0.20%

Table AVII-B: Rural Hospitals in Pennsylvania in 2023 – Available Services

County	Hospital Name	Life support	Intensive Care Unit (ICU/CCU)	NICU-2	Lab	Psych.	Neuro.	Podiatry	Gen Surgery
Adams	WellSpan Gettysburg	No	No	No	Yes	No	Yes	Yes	Yes
Armstrong	ACMH	No	No	No	Yes	No	Yes	Yes	Yes
Bedford	UPMC Bedford	No	No	No	Yes	No	No	No	Yes
Blair	UPMC Altoona	Yes	No	Yes	Yes	Yes	Yes	Yes	No
Blair	Conemaugh Nason MC	No	No	No	Yes	No	No	Yes	Yes
Blair	Penn Highlands Tyrone	Yes	No	No	Yes	No	No	No	Yes
Bradford	Robert Packer	Yes	No	Yes	Yes	No	Yes	No	Yes
Bradford	Troy Community	No	No	No	Yes	No	No	No	Yes
Butler	Butler Memorial	No	No	No	Yes	Yes	Yes	Yes	Yes
Cambria	Conemaugh Memorial	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Cambria	Conemaugh Miners	No	No	No	No	No	No	No	Yes
Carbon	St Luke's Carbon Campus	Yes	No	No	Yes	No	Yes	No	Yes
Centre	Mount Nittany	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
Clarion	Clarion	Yes	Yes	No	Yes	No	No	Yes	Yes
Clearfield	Penn Highlands DuBois	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Clinton	Bucktail	Yes	No	No	Yes	Yes	No	No	N/A
Clinton	UPMC Lock Haven	No	No	No	Yes	No	No	Yes	Yes
Columbia	Geisinger Bloomsburg	No	No	No	Yes	No	No	No	Yes
Crawford	Meadville	No	No	No	Yes	Yes	Yes	No	Yes
Crawford	Titusville Area	No	No	No	Yes	No	No	No	Yes
Elk	Penn Highlands Elk	No	No	No	Yes	No	No	Yes	Yes
Fayette	Penn Highlands Connellsville	Yes	No	No	Yes	No	No	Yes	Yes
Fayette	Uniontown	No	No	No	Yes	No	Yes	Yes	Yes

County	Hospital Name	Life support	Intensive Care Unit (ICU/CCU)	NICU-2	Lab	Psych.	Neuro.	Podiatry	Gen Surgery
Franklin	WellSpan Chambersburg	No	No	Yes	Yes	Yes	Yes	No	Yes
Franklin	WellSpan Waynesboro	Yes	No	No	Yes	No	Yes	No	Yes
Fulton	Fulton County	No	No	No	Yes	No	Yes	Yes	Yes
Greene	Washington HS Greene	Yes	No	No	Yes	No	No	No	N/A
Huntingdon	Penn Highlands Huntingdon	Yes	No	No	Yes	No	No	Yes	Yes
Indiana	Indiana Regional	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Jefferson	Punxsutawney Area	No	No	No	Yes	Yes	Yes	Yes	Yes
Jefferson	Penn Highlands Brookville	No	No	No	Yes	No	No	No	Yes
Lawrence	UPMC Jameson	No	No	No	Yes	Yes	Yes	Yes	Yes
Lycoming	Geisinger Jersey Shore	No	No	No	Yes	No	Yes	Yes	Yes
Lycoming	UPMC Muncy	Yes	No	No	Yes	No	Yes	Yes	Yes
Lycoming	UPMC Williamsport	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Lycoming	Geisinger MC Muncy	No	No	No	Yes	No	Yes	Yes	Yes
McKean	Bradford Regional	No	No	No	Yes	Yes	No	Yes	N/A
McKean	UPMC Kane	No	No	No	Yes	No	Yes	Yes	Yes
Mercer	UPMC Horizon	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Mercer	Sharon Regional	Yes	No	No	Yes	Yes	Yes	Yes	Yes
Mercer	Grove City	No	No	No	Yes	No	Yes	Yes	Yes
Mifflin	Geisinger Lewistown	Yes	No	No	Yes	No	Yes	Yes	Yes
Monroe	Lehigh Valley Pocono	No	No	Yes	Yes	No	Yes	Yes	Yes
Monroe	St Luke's Monroe	Yes	No	No	Yes	No	Yes	Yes	Yes
Montour	Geisinger Danville	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
Potter	UPMC Cole	No	No	No	Yes	No	No	Yes	Yes
Schuylkill	St Luke's Miners	Yes	No	No	Yes	No	Yes	Yes	Yes

County	Hospital Name	Life support	Intensive Care Unit (ICU/CCU)	NICU-2	Lab	Psych.	Neuro.	Podiatry	Gen Surgery
Schuylkill	Lehigh Valley Schuylkill	No	No	No	Yes	No	Yes	No	Yes
Schuylkill	Geisinger St Luke's	Yes	No	No	Yes	No	Yes	Yes	Yes
Somerset	UPMC Somerset	No	No	No	Yes	No	Yes	Yes	Yes
Somerset	Soon-Shiong MC Windber	No	No	No	Yes	No	No	No	Yes
Somerset	Conemaugh Meyersdale	Yes	No	No	Yes	No	No	No	Yes
Susquehanna	Endless Mountains	No	No	No	Yes	No	No	Yes	Yes
Susquehanna	Barnes-Kasson County	Yes	No	No	Yes	No	No	Yes	Yes
Tioga	UPMC Wellsboro	Yes	Yes	No	Yes	No	No	Yes	Yes
Union	Evangelical Community	Yes	Yes	No	Yes	No	Yes	No	Yes
Venango	UPMC Northwest	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes
Warren	Warren General	No	No	No	Yes	Yes	No	Yes	Yes
Washington	Penn Highlands Mon Valley	Yes	No	No	Yes	No	Yes	Yes	Yes
Washington	Washington	No	No	Yes	Yes	No	Yes	Yes	Yes
Washington	Canonsburg	Yes	No	No	Yes	No	Yes	Yes	Yes
Wayne	Wayne Memorial	Yes	No	No	Yes	No	Yes	Yes	Yes

Table AVII-C: Rural Hospitals in Pennsylvania – Ownership Changes and Affiliations

County	Hospital Name	Ownership Changes Between 2016 and 2024	Current Affiliation (Based on 2023 and 2024 Information)
Adams	WellSpan Gettysburg	N/A	WellSpan Health
Armstrong	ACMH	Joined PMHCN 2024	Pennsylvania Mountains Health Care
Bedford	UPMC Bedford	N/A	UPMC
Blair	UPMC Altoona	N/A	UPMC
Blair	Conemaugh Nason MC	N/A	Conemaugh/Duke LifePoint
Blair	Penn Highlands Tyrone	Joined Penn Highlands 2020	Penn Highlands
Bradford	Robert Packer	N/A	Guthrie Clinic

County	Hospital Name	Ownership Changes Between 2016 and 2024	Current Affiliation (Based on 2023 and 2024 Information)
Bradford	Troy Community	N/A	Guthrie Clinic
Butler	Butler Memorial	Merger of Butler Health and Excelsa Health in 2023	Independence Health Systems
Cambria	Conemaugh Memorial	N/A	Conemaugh/Duke LifePoint
Cambria	Conemaugh Miners	N/A	Conemaugh/Duke LifePoint
Carbon	St Luke's Carbon Campus	New location opened 2021	St. Luke's University Health Network
Centre	Mount Nittany	N/A	Mount Nittany Health
Clarion	Clarion	Merger of Butler Health and Excelsa Health in 2023	Independence Health Systems
Clearfield	Penn Highlands DuBois	N/A	Penn Highlands
Clinton	Bucktail	N/A	Community Owned
Clinton	UPMC Lock Haven	Acquired by UPMC 2017	UPMC
Columbia	Geisinger Bloomsburg	Geisinger Purchased by Risant Health 2024	Risant Health
Crawford	Meadville	N/A	Meadville Medical Center
Crawford	Titusville Area	N/A	Meadville Medical Center
Elk	Penn Highlands Elk	N/A	Penn Highlands
Fayette	Penn Highlands Connellsville	Joined Penn Highlands 2022	Penn Highlands
Fayette	Uniontown	Joined WVUHS 2020	West Virginia University Health System
Franklin	WellSpan Chambersburg	WellSpan Health and Summit Health merged 2018	WellSpan Health
Franklin	WellSpan Waynesboro	WellSpan Health and Summit Health merged 2018	WellSpan Health
Fulton	Fulton County	N/A	Fulton County Medical Center
Greene	Washington HS Greene	Joined UPMC 2024	UPMC
Huntingdon	Penn Highlands Huntingdon	Joined Penn Highlands 2019	Penn Highlands
Indiana	Indiana Regional	Formed PMHCN in 2020	Pennsylvania Mountains Health Care
Jefferson	Punxsutawney Area	Formed PMHCN in 2020	Pennsylvania Mountains Health Care
Jefferson	Penn Highlands Brookville	N/A	Penn Highlands
Lawrence	UPMC Jameson	Merged with UPMC 2016	UPMC
Lycoming	Geisinger Jersey Shore	Geisinger Purchased by Risant Health 2024	Risant Health
Lycoming	UPMC Muncy	Acquired by UPMC 2017	UPMC
Lycoming	UPMC Williamsport	Merged with UPMC 2016	UPMC
Lycoming	Geisinger MC Muncy	Geisinger Purchased by Risant Health 2024	Risant Health
McKean	Bradford Regional	Affiliation Kaleida Health 2017	Kaleida Health

County	Hospital Name	Ownership Changes Between 2016 and 2024	Current Affiliation (Based on 2023 and 2024 Information)
McKean	UPMC Kane	Joined UPMC 2017	UPMC
Mercer	UPMC Horizon	N/A	UPMC
Mercer	Sharon Regional	Acquired by Tenor 2025	Tenor Health Foundation
Mercer	Grove City	Acquired by AHN 2019; New Name AHN Grove City	Allegheny Health Network
Mifflin	Geisinger Lewistown	Geisinger Purchased by Risant health 2024	Risant Health
Monroe	Lehigh Valley Pocono	Lehigh Valley Health Network Merged with Jefferson 2017	Jefferson Health
Monroe	St Luke's Monroe	New Location Opened 2016	St. Luke's University Health Network
Montour	Geisinger Danville	Geisinger Purchased by Risant Health 2024	Risant Health
Potter	UPMC Cole	Joined UPMC 2018	UPMC
Schuylkill	St Luke's Miners	N/A	St. Luke's University Health Network
Schuylkill	Lehigh Valley Schuylkill	Lehigh Valley Health Network Merged with Jefferson 2017	Jefferson Health
Schuylkill	Geisinger St Luke's	Geisinger Purchased by Risant Health 2024	Risant Health
Somerset	UPMC Somerset	Merged with UPMC 2019	UPMC
Somerset	Soon-Shiong MC Windber	Became Part of the Network Under Soon-Shiong 2016	Independent
Somerset	Conemaugh Meyersdale	N/A	Conemaugh/Duke LifePoint
Susquehanna	Endless Mountains	N/A	Endless Mountains Health System
Susquehanna	Barnes-Kasson County	Acquired by WMHS 2024	Wayne Memorial Health Systems Inc
Tioga	UPMC Wellsboro	Acquired by UPMC 2016	UPMC
Union	Evangelical Community	Acquired by WellSpan 2024	WellSpan Health
Venango	UPMC Northwest	N/A	UPMC
Warren	Warren General	Joint Venture in 2018 with Allegheny Health and LECOM	majority owned by Care Corporation Warren
Washington	Penn Highlands Mon Valley	Merged with Penn Highlands 2021	Penn Highlands
Washington	Washington	Merged with UPMC 2024	UPMC
Washington	Canonsburg	N/A	Allegheny Health Network
Wayne	Wayne Memorial	N/A	Wayne Memorial Health Foundation

Appendix 4: Technical Appendix-Logistic Regression Analysis and Difference-In-Difference Analysis

Logistic Regression Models for Predictive Analyses

To examine potential predictors of consolidations, we employ standard logistic regression models (Muller and MacLehose 2014; Dey et al. 2025), using a binary indicator (yes=1, no=0) for hospital ownership change (mergers, acquisitions, or affiliation changes) as the outcome, and hospital characteristics and financial measures as independent variables (predictors), with year fixed effects. The model is specified below:

$$\ln\left(\frac{P_{it}}{1 - P_{it}}\right) = \beta_0 + \beta_1 X_{it} + \beta_2 F_{it} + \theta_t$$

In the above equation, P_{it} is the probability of hospital “ i ” ownership change (mergers, acquisitions, or affiliation changes) occurring at time “ t ”. Once estimated, the coefficients (the Betas) are used to derive the “odds ratios” shown in the table below. The odds ratios, in this specific context, measures the increase (or decrease) of the odds of ownership change if the independent variables increase by one unit.

X_{it} represents the set of characteristics of hospital “ i ” time “ t ”, including *number of beds, number of admissions, number of emergency room visits, number of employed physicians, number of employed registered nurses, and if the hospital is located in a rural county.*

F_{it} represents the set of financial measures of hospital “ i ” time “ t ”, including *net patient revenue (NPR), operating margin, Medicare share of NPR, and Medicaid share of NPR.*

The model also includes time (year) fixed effects θ_t and a constant β_0 . The standard errors are clustered at the hospital level (Abadie et al. 2023). The model is estimated using maximum likelihood with statistical software Stata.

The main aim for this analysis is to examine if any of the included hospital characteristics or the financial measures are statistically significant predictors of hospital ownership changes. The two sets of coefficients β_1 and β_2 measure the strength and significance of the predictors.

In addition to the baseline model, which is estimated with contemporaneous independent variables from all years, we perform two sensitivity analyses. First, we estimate the same model, but with one year lag. This would allow us to understand if a hospital characteristics and financial performance from previous year predict ownership change in the current year. Second, we exclude the data from 2020 to 2023, the years during the COVID pandemic. The baseline model results are included in Table AVIII-A below.

Table AVIII-A: Odds ratios from the baseline logistic regression model

Variables	Odds Ratio	P-Value
Financial Measures		
Net Patient Revenue	1.000	0.372
Operating Margin	0.343	0.478
Medicare Share of NPR	3.258	0.496
Medicaid Share of NPR	0.829	0.928
Hospital Characteristics		
Number of Beds	1.005	0.325
Number of Admissions	1.000	0.083
Number of ER Visits	1.000	0.084
Number of Employed Physicians	0.995	0.105
Number of Registered Nurses	1.000	0.334
Located in a Rural County	1.053	0.934
Year Indicators (reference-2016)		
2017	5.058	0.024
2018	5.915	0.027
2019	8.007	0.007
2020	9.430	0.003
2021	10.572	0.002
2022	9.332	0.004
2023	9.487	0.004
Constant	0.015	0.000

Model fitness:

Wald chi2: 65.52

Prob > chi2: 0.00

Log pseudolikelihood: - 368.87

Pseudo R2: 0.0735

Robust Standard Errors clustered at the county level

The only statistically significant odds ratios (all greater than one) are from year indicators and showed an increasing trend in general, implying that ownership changes were more likely to happen over time during the study period,

The sensitivity analyses yield similar results, with no statistically significant estimates from the main covariates.

Difference-In-Difference Analyses with Two-way Fixed Effects

To analyze the potential impact of hospital ownership changes on quality and cost outcome, we conduct a set of difference-in-difference (DID) analyses using the ownership change (mergers, acquisitions, or affiliation changes) as the binary treatment indicator (yes=1, no=0). Since we have a longitudinal dataset (unbalanced panel), we use a two-way fixed effects model (Wing et al. 2018; de Chaisemartin and D’Haultfœuille 2023) along with time-varying hospital characteristics as covariates, to estimate the main effects of hospital ownership change. The inclusion of hospital level fixed effects and year fixed effects allows us to control for unobserved time-invariant characteristics (confounding factors) that are steady over time (e.g., organizational culture, managerial strength, or quality improvement practices that may persist over time in certain hospitals) and thus enhance the robustness of the results. The two-way fixed effects panel regression model is considered a generalized version of the standard DID analysis (de Chaisemartin and D’Haultfœuille 2023). The model is specified below:

$$Y_{it} = \beta_0 + \beta_1 D_{it} + \beta_2 X_{it} + h_i + \theta_t + \varepsilon_{it}$$

In the above regression, Y_{it} is the outcome and D_{it} is the main treatment indicator. D_{it} is set to “0” for hospital “ i ” in ALL years before the first ownership change in our data period, and the indicator switches to “1” for ALL years after the ownership change.

X_{it} represents the set of characteristics of hospital “ i ” included in the model that vary over time: *number of beds, number of employed physicians, number of employed registered nurses, number of admissions, and number of emergency room visits*. The rural indicator does not change over time and therefore is not included in the model.

The eight quality outcomes are the mortality rates and 30-day readmission rates of four common conditions in hospital care: Heart Failure, Chronic Obstructive Pulmonary Disease (COPD), Kidney Failure, and Stroke. Eight DID equations are estimated, with each quality outcome as the dependent variable in one of the equations. The set of independent variables on the right-hand side remains the same in all eight.

The model also includes hospital fixed effects h_i , year fixed effects θ_t , a constant β_0 , and a random error term ε_{it} , which represents the unobserved factors specific to each hospital in each year. The standard errors are clustered at the hospital level (Abadie et al. 2023). With this specification, the model uses the hospitals with no ownership changes during our study period (2016–2023) as the control group, and the hospitals with at least one ownership change as the treatment group. The estimated main effects can be considered as the difference between the treatment group and the control group in terms of their changes over time in the outcome. The model is estimated using the panel data module of the statistical software Stata.

In addition to the baseline model, we perform two sensitivity analyses. First, we estimate the same model, but with the ownership change indicator switched to “1” with

one year lag. This would allow us to understand if a hospital ownership change has delayed effects on quality and cost. Second, we exclude the data from 2020 to 2023, the years during the COVID pandemic. Since consolidation happened throughout the study period, including in 2016, we do not test pre-treatment trends as in a standard DID model. The hospital level fixed effects absorb all time-invariant factors within the same hospitals over time, which partly address the pre-consolidation trends. The baseline model results are summarized in the two tables below.

**Table AVIII-B: Results from the Difference-In-Difference Two-way Fixed Effects Model
(30-Day Readmission Rates in Percentage Points as the Outcome)**

	Heart Failure		COPD		Kidney Failure		Stroke	
Variables	Coeff	P-Value	Coeff	P-Value	Coeff	P-Value	Coeff	P-Value
Ownership Change Indicator	0.008	0.995	0.905	0.416	-2.136	0.172	0.073	0.966
<i>Hospital Characteristics</i>								
Number of Beds	0.003	0.772	-0.001	0.835	0.004	0.328	-0.012	0.120
Number of Admissions	0.001	0.037	0.000	0.583	0.000	0.931	0.000	0.052
Number of ER Visits	0.000	0.184	0.000	0.168	0.000	0.358	0.000	0.983
Number of Employed Physicians	0.000	0.845	0.000	0.767	-0.003	0.000	0.002	0.154
Number of Registered Nurses	-0.005	0.176	0.000	0.975	-0.005	0.045	-0.004	0.146
<i>Year Indicators (reference-2016)</i>								
2017	-0.012	0.990	-0.689	0.432	-3.369	0.033	-1.639	0.167
2018	-0.220	0.812	-1.036	0.310	-2.982	0.049	-4.152	0.001
2019	-1.371	0.206	-2.111	0.032	-3.107	0.027	-3.618	0.008
2020	-6.722	0.000	-1.450	0.076	-2.706	0.048	-3.144	0.032
2021	-3.675	0.001	-0.666	0.498	-4.634	0.000	-4.256	0.001
2022	-3.724	0.000	-2.212	0.021	-4.376	0.000	-3.177	0.031
2023	-2.748	0.005	-2.272	0.042	-2.784	0.049	-3.928	0.001
Constant	22.314	0.000	20.176	0.000	20.336	0.000	13.931	0.000

**Table AVIII-C: Results from the Difference-In-Difference Two-way Fixed Effects Model
(Mortality Rates in Percentage Points as the Outcome)**

	Heart Failure		COPD		Kidney Failure		Stroke	
Variables	Coeff	P-Value	Coeff	P-Value	Coeff	P-Value	Coeff	P-Value
Ownership Change Indicator	0.322	0.786	0.015	0.954	-0.470	0.610	-1.492	0.176
Hospital Characteristics								
Number of Beds	-0.005	0.128	-0.003	0.160	0.004	0.324	0.004	0.136
Number of Admissions	0.000	0.527	0.000	0.720	0.000	0.640	0.000	0.285
Number of ER Visits	0.000	0.534	0.000	0.351	0.000	0.052	0.000	0.420
Number of Employed Physicians	0.002	0.336	0.000	0.764	0.000	0.628	-0.001	0.012
Number of Registered Nurses	0.002	0.412	0.000	0.671	0.002	0.247	-0.002	0.112
Year Indicators (reference-2016)								
2017	-0.061	0.896	0.118	0.504	0.086	0.899	0.046	0.956
2018	0.177	0.700	0.047	0.815	-0.797	0.167	-0.007	0.993
2019	0.244	0.641	0.150	0.485	-0.569	0.361	-0.332	0.625
2020	4.561	0.000	0.163	0.533	-0.628	0.283	1.386	0.132
2021	0.427	0.420	0.503	0.112	-0.001	0.999	0.998	0.171
2022	0.369	0.439	0.842	0.037	0.342	0.593	1.632	0.012
2023	0.524	0.313	0.588	0.147	0.109	0.864	1.046	0.116
Constant	2.162	0.017	1.456	0.002	2.915	0.001	2.247	0.004

The sensitivity analyses yield similar results, with no statistically significant estimates for the ownership change indicators.

Appendix 5: List of Measures with Definitions and Notes

This appendix provides a complete list of the quantitative measures used in the study, along with definitions and notes (as applicable).

Table AIX-A: Hospital Quality and Cost Measures

Measures	Definition	Notes (if applicable)
<i>Mortality Rate</i>	percentage of patients dying at the hospital after admission due to one of the four selected conditions	This measures in-hospital mortality. Patients dying after discharge are not counted.
<i>Readmission Rate</i>	percentage of patients readmitted to the hospital within 30 days of discharge	The 30-day readmission rate was established as a standard quality measure that reflects the quality of in-care coordination, discharge planning, and inpatient treatment efficacy. High readmission rates potentially indicate inadequate quality of care in the hospital, post-discharge planning, or care coordination (Nash et al. 2026).
<i>Average Charge</i>	average hospital charge per admission	This is based on the amount a hospital charged for the entire length of stay. It is considered as the “list” price, BEFORE any discounts, and can be significantly higher than the actual amount paid by insurance or patients.

Data Source: Hospital quality and cost measures (2016-2023), from Pennsylvania Health Care Cost Containment Council (PHC4) on four selected clinical conditions: Heart Failure, Chronic Obstructive Pulmonary Disease (COPD), Kidney Failure, and Stroke. This set of measures includes the same three measures for each of the four conditions: mortality rate, readmission rate, and average charge.

Table AIX-B: Hospital Utilization Measures

Measures	Definition	Notes (if applicable)
<i>Number of Admissions</i>	total number of admissions across all medical conditions in a given year at the hospital	
<i>Number of Emergency Room (ER) Visits</i>	total number of ER visits across all medical conditions in a given year at the hospital	
<i>Number of Admissions from ER</i>	total number of patients who visited ER and then admitted to the hospital in a given year	
<i>Patient Days of Care</i>	sum of daily inpatient census during the one-year reporting period	Daily inpatient census is the total number of patients receiving inpatient care at the hospital on a given day.
<i>Average Length of Stay</i>	total number of inpatient days divided by the total number of patient discharges during a given period	
<i>Occupancy Rate</i>	total patient days of care divided by total bed days available	This is the definition adopted by CMS. Total bed days available is the maximum number of inpatient days that could have occurred if every staffed or licensed bed was continuously filled.

Data Source: Hospital Utilization Measures (2016–2023), from the Pennsylvania Department of Health (DOH) Hospital Annual Reports.

Table AIX-C: Hospital Characteristics Measures (Size, Staffing, and Services)

Measures	Definition	Notes (if applicable)
<i>Number of Beds</i>	total number of licensed beds	
<i>Number of Employed Physicians</i>	as the name of the measure suggests	
<i>Number of Employed Registered Nurses</i>	as the name of the measure suggests	
<i>Life Support Availability</i>	whether the hospital provides life support services (basic or advanced)	Basic life support provides non-invasive emergency care services, such as CPR and non-invasive airway management. Advanced life support offers physician (or paramedic)-led services in more complex medical emergencies, such as intubation, intravenous drug administration, and surgical incisions.
<i>Mobile Intensive Care and/or Critical Care Availability</i>	whether the hospital has Mobile Intensive Care Unit and/or Critical Care Unit services.	A Mobile Intensive Care Unit (ICU) is a specialized emergency vehicle (ambulance) providing intensive care during patient transport (from home to hospital or between hospitals). A Critical Care Unit (CCU) is a department within a hospital to treat critically ill patients who need immediate, continuous life-sustaining care, often during extended periods of time.
<i>Neonatal Intensive Care Service Availability</i>	whether the hospital has a Neonatal Intensive Care	NICU has four standardized levels: 1-basic care for

Measures	Definition	Notes (if applicable)
	Unit (NICU) at level 2 or above	healthy newborns; 2-specialty care for moderately ill newborns; 3-advanced care for critically ill newborns; and 4-the highest level with on-site specialists 24/7.
<i>Clinical Laboratory Availability</i>	whether the hospital provides clinical laboratory services	
<i>Clinical Psychology Availability</i>	whether the hospital provides clinical psychology services	
<i>Neurology Availability</i>	whether the hospital provides neurology services	
<i>Podiatry Availability</i>	whether the hospital provides podiatry services	
<i>General Surgery Availability</i>	whether the hospital provides general surgery services	

Data Source: Hospital Characteristics (Size, Staffing, and Service Availability) Measures (2016-2023), from the Pennsylvania Department of Health (DOH) Hospital Annual Reports.

Table AIX-D: Hospital Financial Measures

Measures	Definition	Notes (if applicable)
<i>Net Patient Revenue (NPR)</i>	revenue from patient services after discounts and contractual adjustments	
<i>Operating Revenue</i>	revenue from the hospital's core operations	Total operating revenue includes all revenues allocated by the hospital to meet operating expenses, such as revenue from patient services, investment income, contributions, and revenue from other operations (e.g., cafeteria, parking, rent, research and educational activities).
<i>Operating Expenses</i>	expenses incurred by the hospital's core operations	
<i>Operating Income</i>	difference between operating revenue and expenses	
<i>Operating Margin</i>	operating income as a percentage of revenue	
<i>Medicare Share of NPR</i>	percentage of NPR from Medicare patients	
<i>Medicaid Share of NPR</i>	percentage of NPR from Medicaid patients	
<i>Percentage of Uncompensated Care</i>	the proportion of hospital services that are not reimbursed, either due to charity or due to uncollectable fees	

Data Source: Hospital financial measures (2016–2023), from Pennsylvania Health Care Cost Containment Council (PHC4).

Table AIX-E: Patient Experience Measures

Measures	Definition	Notes (if applicable)
<i>Nurse Communication</i>	the quality/effectiveness of communication from nurses experienced by patients	
<i>Doctor Communication</i>	the quality/effectiveness of communication from doctors experienced by patients	
<i>Communication about Medicines</i>	the quality/effectiveness of communication about medicines experienced by patients	
<i>Providing Discharge Information</i>	the extent to which the hospital provides patients sufficient information upon discharge	
<i>Staff Responsiveness</i>	how responsive the hospital staff are responsive to patients	
<i>Care Transition</i>	the quality/effectiveness of care transition experienced by patients	
<i>Hospital Rating</i>	the overall quality of hospital services experienced by patients	
<i>Willingness to Recommend the Hospital</i>	the percentage of patients being willing to “definitely recommend” the hospital	

Data Source: Patient experience measures (2016-2023), from the Centers for Medicare & Medicaid Services (CMS) Care Compare. These eight patient experience measures are based on the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) Survey conducted by CMS. Surveyed patients were asked to rate certain aspects (listed in the table below) of their experiences during a recent inpatient hospital stay. The questions in the survey use Likert scales (e.g., Always, Usually, Sometimes, Never). Seven of the eight measures are based on the average response by patients to the survey within a hospital, and then adjusted by patient mix to transform into a 100-point linear score, with higher scores indicating better experience. The willingness to recommend the hospital measures the percentage of patients who responded being willing to “definitely recommend” the hospital.

Hospital Change of Ownership Information and Definition

Hospital Changes of Ownership (CHOW) Records (2016-2023), from the Pennsylvania Department of Health, includes the following information:

- a) names and locations of the hospitals and/or health system involved in the transaction**
- b) date of the transaction**
- c) the specific types of transaction: merger, acquisition, or change of affiliation**

A **merger** typically unites two hospitals or health systems of relatively similar sizes, to create a new, combined entity. An **acquisition**, on the other hand, often involves a large hospital (or health system) purchasing and absorbing a relatively small hospital (or health system). In mergers, the two (or more) merging organizations often share ownership and governance of the newly formed entity. In acquisitions, the acquiring organization (the buyer) often holds the decision-making power and (majority) ownership.

Change of affiliation is a kind of new partnership where a hospital seeks collaboration with or assistance from with a large health system, without giving up independent ownership and managerial control. Legally speaking, change of affiliation does not change ownership. However, such changes are often analyzed in conjunction with mergers and acquisitions, because affiliation changes often lead to resource pooling, and create more advantageous purchasing contracts, and develop better referral networks.

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