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Access, Quality, And Financial Performance Of Rural Hospitals Following Health System Affiliation

Claire E. O'Hanlon[1,2], **Ashley M. Kranz**[3], **Maria DeYoreo**[1], **Ammarah Mahmud**[3], **Cheryl L. Damberg**[1], **Justin W. Timbie**[3]

[1.]RAND Corporation, Santa Monica, CA.

[2.]VA HSR&D Center for the Study of Healthcare Innovation, Implementation, & Policy, Los Angeles, CA.

[3.]RAND Corporation, Arlington, VA.

Abstract

More than a hundred rural hospitals have closed since 2010. Some rural hospitals have affiliated with health systems to improve their financial performance and potentially avoid closure, but the effects of affiliation on rural hospitals and their patients are unclear. To examine the relationship between affiliation and performance, we compared rural hospitals that affiliated with a health system in the period 2008–17 and a propensity score weighted set of nonaffiliating rural hospitals on twelve measures of structure, utilization, financial performance, and quality. Following health system affiliation, rural hospitals experienced a significant reduction in on-site diagnostic imaging technologies, the availability of obstetric and primary care services, and outpatient nonemergency visits, as well as a significant increase in operating margins (by 1.6–3.6 percentage points from a baseline of −1.6 percent). Changes in patient experience scores, readmissions, and emergency department visits were similar for affiliating and nonaffiliating hospitals. While joining health systems may improve rural hospitals' financial performance, affiliation may reduce access to services for patients in rural areas.

Access to high-quality health care services remains a challenge in rural areas of the United States,[1] with more than a hundred rural hospitals having closed since 2010.[2] Hospital closures are often due to poor financial performance,[3] and while operating margins of urban hospitals have increased in recent years, operating margins of rural hospitals have steadily decreased.[4] Hospital closures are likely to exacerbate disparities that already exist for rural residents in access to health care,[5] as well as in life expectancy and mortality.[6] Urban-rural life expectancy gaps increased by a factor of five from 1969 to 2009,[7] and mortality in the poorest nonmetropolitan areas is 22 percent higher than in similarly poor metropolitan areas.[8] Furthermore, community hospitals are economic anchors; closures of sole community hospitals in rural areas are associated with reduced income and increased unemployment.[9] While Congress sought to provide financial protection to rural hospitals via the critical

access hospital designation in 1997, maintaining access to care in rural areas remains a concern.

In addition to access concerns in rural areas, disparities in the quality of care between rural and urban areas have been documented in previous studies.[10] Rural patients report longer wait times for specialist appointments, and rural specialists are less likely to be board certified than urban specialists are.[11] Rural Medicare beneficiaries have greater risk of emergency department visits and less follow-up care after discharge, compared with urban beneficiaries.[12] Reducing these disparities may be challenging because of difficulties conducting quality improvement activities in rural hospitals, due in part to the presence of fewer registered nurses,[13] a small set of colleagues with whom to learn and collaborate, fewer resources to facilitate participation in quality improvement data collection systems and national or regional programs, and lower procedure volumes.[14] Monitoring the quality of care in rural hospitals is also challenging due to the lack of regularly reported quality data, as over half of rural hospitals are critical access hospitals—which are not subject to the same quality reporting requirements as other hospitals.[15]

These factors, combined with declines in rural populations,[16] have led some rural hospitals to affiliate with large health systems, potentially as an alternative to closure. Mergers and acquisitions among rural hospitals have increased, from 10–30 per year in the 2000s to approximately 30–70 in the 2010s.[17] For rural hospitals, affiliation can lead to an infusion of capital, since systems can usually obtain capital at lower cost or from different sources than independent hospitals can. Independent hospitals that join systems have been found to increase their capital expenditures by $16,000 per bed annually.[18] These expenditures could include quality-improving investments (such as upgrading electronic health records and replacing old equipment) or access-improving investments (such as adding new service lines). However, some of these expenditures reflect the costs of affiliation, such as new signage and branding and the integration of information technology. In addition to capital, other benefits of affiliation might include cost reductions due to economies of scale and clinical standardization,[19] as well as access to specialists.[17]

For health systems, acquiring rural hospitals may provide numerous benefits, including increasing patient referrals from community hospitals to the system's associated tertiary or quaternary care centers.[20] Systems may also acquire rural hospitals to better position themselves for success under alternative payment models, in which size may help achieve economies of scale or protect against financial losses.[17] Additionally, systems with a large geographic footprint and patient pool have additional leverage when negotiating prices with insurers.[21]

The effects of health system affiliation on rural hospital performance are largely unknown, due to the dearth of research on health system affiliation among rural hospitals specifically. Prior research has found that system-affiliated hospitals are more profitable[22] and perform better on inpatient quality indicators[23] than nonaffiliated hospitals do, but these studies did not explore differences between urban and rural hospitals.

Rural hospitals may be particularly likely to see improved performance following affiliation because these hospitals—particularly those that are critical access hospitals—generally have lower overall performance than nonrural hospitals do.[24,25] Despite these potential benefits, health system affiliation may negatively affect rural patients. Previous work that examined urban and rural hospitals together has shown that hospital consolidation is associated with higher prices and that the effects of affiliation on health care quality are mixed.[26] Affiliation may also negatively affect access, as health systems sometimes close rural facilities after acquiring them.[27] Even if closure or conversion from acute to subacute care facilities (such as skilled nursing or outpatient facilities) is averted, health systems may eliminate service lines within their rural hospitals to improve these hospitals' financial performance. Moreover, hospitals that convert are more likely to be members of hospital systems.[28]

To assess the relationship between the health system affiliation and performance of rural hospitals, we compared changes in performance in the period 2008–17 for a nationwide sample of rural hospitals that became affiliated with health systems to changes among those that remained unaffiliated. We used twelve measures of structure, utilization, financial performance, and quality. We hypothesized that health systems would seek to consolidate services within their tertiary care facilities, leading to a reduction in the provision of certain services provided at rural hospitals. Concurrently, we expected to find an increase in the availability of selected services on-site, such as primary care—which might lead to referrals elsewhere in the health system. We hypothesized that affiliating hospitals' financial performance would improve through increased revenues,[29] greater leverage over payers, increased administrative capacity to obtain payment, and the elimination of unprofitable service lines. Finally, we hypothesized that compared to nonaffiliating hospitals, affiliating hospitals would experience larger improvements in the quality of care due to the quality improvement personnel, technology, and resources available through their health system.

Study Data And Methods

Data

We used the American Hospital Association (AHA) Annual Surveys for 2008–17 to identify rural hospitals that reported annually to AHA, operated continuously throughout 2008–17, and either were never affiliated with a health system during the study period ("nonaffiliating hospitals") or first reported affiliation in 2009–16 ("affiliating hospitals"). Rurality was defined using the definition of the Federal Office of Rural Health Policy in the Department of Health and Human Services, which includes short-term general acute nonfederal facilities located outside metropolitan core-based statistical areas, short-term general acute nonfederal facilities within metropolitan areas that have Rural-Urban Commuting Area Codes of 4 or greater, and all critical access hospitals.[30] We excluded from our analysis rural hospitals that were always affiliated with a health system in the study period or that switched from affiliated to nonaffiliated in 2009–17.

Hospital characteristics, structural measures, and utilization measures for 2008–17 were also obtained from the AHA Annual Surveys. Financial measures for the same period were obtained from the Healthcare Cost Report Information System of the Centers for Medicare and Medicaid Services (CMS). Hospital-level quality measures were obtained from CMS's

Hospital Compare website and were available for only a portion of our study period (2011–17).

Measures

Exhibit 1 presents a summary of performance measure domains, measures, hypotheses, and data sources. The four structural measures were a hospital technology composite measure and three indicators of services offered on-site: obstetrics, a rural health clinic, and a primary care department. The technology composite measure was a count of up to eleven on-site advanced diagnostic imaging technologies tracked by the AHA Annual Survey, such as magnetic resonance imaging and computed tomography. The three utilization measures were admissions, emergency department visits, and nonemergency outpatient visits. The three financial measures were operating margin, asset-to-liability ratio (a measure of long-term debt) and uncompensated or unreimbursed care as a percentage of operating costs. The two quality measures were a composite measure of patient experience and the thirty-day hospitalwide all-cause unplanned readmission rate. The composite measure of patient experience was a weighted sum of nine normalized measures from the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS) survey, including measures related to staff communication and responsiveness, the cleanliness and noise level of the hospital, and other measures of overall experience. The weights were equivalent to those used in HCAHPS star ratings.[31] Additional information on the technology and patient experience composite measures is available in online appendix A.[32]

Propensity Score Weighted Comparison Group

We weighted the comparison group of nonaffiliating rural hospitals to have comparable baseline characteristics to affiliating rural hospitals. For affiliating hospitals, the "baseline" year was the calendar year before the hospital first became affiliated. We randomly assigned nonaffiliating hospitals to cohorts in proportion to the number of hospitals that affiliated in each year of the study period, and the "baseline" year for each cohort of nonaffiliating hospitals was selected to match the baseline year to which each comparison cohort was randomly assigned. We derived propensity score weights from generalized boosted models using the TWANG package in R.[33] The propensity score models adjusted for baseline characteristics, including nineteen hospital characteristics, twelve baseline performance measures, baseline year, and an indicator for whether the hospital was in a state that expanded eligibility for Medicaid under the Affordable Care Act. Additional details on our propensity score weighting methodology are provided in appendix B.[32] We truncated all outcomes at the 0.5 and 99.5 percentiles within each year to ensure that outliers did not unduly influence the results.

Regression Models

We used linear regression models to estimate annual differences in trends for affiliating hospitals relative to nonaffiliating hospitals (the difference-in-differences methodology). We estimated separate linear regression models for each of the twelve performance measures of interest (full regression specifications and results are provided in appendix C).[32] We used standard survey analysis procedures to account for propensity score weights and clustered standard errors to account for multiple observations per hospital.

Each model provided estimates of the incremental changes in outcomes for affiliating rural hospitals relative to nonaffiliating ones in each of the six years after a hospital first reported affiliation. Each difference-in-differences estimate was based on at least a third of the affiliating hospitals in our sample and at least three cohorts of affiliating hospitals. For example, the six-year estimates included hospitals that were newly affiliated in 2009, 2010, and 2011. We also controlled for year, health system affiliation during the study period, a time-varying indicator for hospitals in states that expanded Medicaid under the Affordable Care Act, and any covariates that remained unbalanced after propensity score weighting (see appendix C).[32] Because we randomly assigned comparison hospitals to affiliating hospital cohorts by affiliation year, we repeated our analysis three times, using three different random allocation procedures. The reported results reflect an average of the three sets of regression results, with point estimates calculated by averaging estimated regression coefficients and variances calculated as the average of the estimated variances plus the variance between estimates—which was negligible. The difference-in-differences assumption of parallel trends was confirmed (appendix D).[32]

Limitations

Our study had several limitations. First, information about health system affiliation in the AHA data is drawn from numerous sources, including other AHA databases and self-report by hospital leaders. The accuracy of this information is difficult to determine because *affiliation* may have different meanings in different hospitals and health systems. Health system affiliation might entail an overhaul of existing policies, norms, and practices of the affiliating hospital to align them with those of the larger health system, or it might include only a limited amount of clinical integration. Incorrectly assigning hospitals to affiliating or nonaffiliating groups would have attenuated our estimated association between health system affiliation and performance.

Second, while our propensity score weighting method produced a balanced comparison group of nonaffiliating rural hospitals, there might have been unobserved time-varying differences between affiliating and nonaffiliating rural hospitals that could have biased our results.

Third, our estimates were based only on hospitals that affiliated and remained open for the duration of the study period. Our analysis did not include hospitals that closed following acquisition by a health system.

Finally, our results are generalizable only to the subset of hospitals that responded to the AHA survey in each year of the period 2008–17.

Study Results

Descriptive Characteristics

We identified 994 rural hospitals that were never affiliated with a health system in the study period ("nonaffiliating") and 306 rural hospitals that switched from nonaffiliated to affiliated in the period 2009–17 ("affiliating"). We analyzed data on affiliating hospitals for an average of 5.2 years following affiliation.

Before weighting to be comparable to the sample of affiliating hospitals, nonaffiliating hospitals differed from affiliating hospitals with respect to ownership, region, and urbanization (exhibit 2). They also had fewer total facility employees, were less likely to be accredited by the Joint Commission, and were located in less socioeconomically disadvantaged neighborhoods. After applying propensity score weights, we observed few differences between affiliating hospitals and the weighted group of nonaffiliating hospitals, and the only differences we considered meaningful were the percentage of hospitals located in the western US and government ownership.

We observed small differences in baseline performance between affiliating and unweighted nonaffiliating hospitals (appendix exhibit C1),[32] which were no longer significant after weighting (exhibit 3).

Association Of Health System Affiliation With Rural Hospital Performance

Structural Measures: Affiliating rural hospitals reduced their number of on-site imaging modalities during the first three years following affiliation (shown as a change in the "technology composite" measure). These reductions of approximately 0.3 imaging modalities per hospital are the equivalent of a third of the affiliating hospitals eliminating one modality, relative to nonaffiliating rural hospitals. We observed a significant reduction in the availability of obstetric services in affiliating rural hospitals (7–14 percent annually), relative to nonaffiliating hospitals, in five of the six years following affiliation, as well as a reduction in the presence of primary care departments (7–19 percent annually) in five of the six years. We observed no significant differences in the availability of on-site rural health clinics for affiliating hospitals, relative to nonaffiliating hospitals.

Utilization Measures: Affiliating and nonaffiliating rural hospitals did not differ significantly with respect to changes in admissions and emergency department visits. However, affiliating hospitals had 10,000–21,000 fewer outpatient nonemergency visits per year relative to nonaffiliating hospitals following affiliation—a relatively large proportion of the 60,000 visits observed at baseline.

Financial Measures: Operating margins increased significantly following rural hospital affiliations with a health system—by 1.6–3.6 percentage points in years 2–5, from a baseline of −1.6 percent. Changes in hospitals' asset-to-liability ratio did not differ significantly between affiliating and nonaffiliating hospitals. Uncompensated or unreimbursed care as a percentage of operating costs increased significantly for affiliating hospitals relative to nonaffiliating hospitals following affiliation. However, this appears to have been driven by a reduction in operating costs, as trends in overall uncompensated or unreimbursed care dollars did not differ between the two groups (data not shown).

Quality Measures: No consistent significant difference in trends between affiliating and nonaffiliating hospitals were observed for patient experience or 30-day all-cause unplanned readmission rates.

Discussion

Overall, we found that health system affiliation was associated with improved financial performance of rural hospitals, but that it might also reduce local access to certain services and was not associated with improved health care quality for the two measures we examined. Specifically, we observed that health system affiliation of rural hospitals was associated with reduced on-site access to imaging, obstetric services, and primary care departments; a reduction in outpatient nonemergency visits; and increased operating margins and uncompensated or unreimbursed care as a percentage of operating costs. We observed no association between health system affiliation and patient experience scores or readmission rates.

Protection from financial losses may motivate rural hospitals to affiliate with health systems. Indeed, we found that affiliating rural hospitals, which had negative mean operating margins at baseline, significantly increased their mean operating margins relative to those of nonaffiliating rural hospitals over a period of several years. However, the observed increase in operating margins was not accompanied by increased utilization or a reduction in uncompensated or unreimbursed care, which suggests that the increased operating margins may be due to a combination of reduced provision of unprofitable services, increased prices, and improved efficiency. While a prior study found a negative association between affiliation and operating margin,[34] that study had a slightly earlier period (2005–12), used a different method of identifying health system affiliation, and defined rural hospitals using the Office of Management and Budget's less precise, county-based definition of rurality. Additional research is needed to understand the relative contributions of mechanisms such as increased prices and improved efficiency to increases in operating margin after health system affiliation, as well as the characteristics of hospitals or health systems that may predict smaller or larger changes in operating margins after affiliation.

Affiliation with a health system was accompanied by a reduction in both obstetric and primary care service lines, which runs counter to reports by some stakeholders that local services are not reduced and may even be expanded after hospital acquisitions.[19] While we expected that health systems would drop less profitable services such as obstetrics,[35] the reduction in primary care departments ran counter to our hypothesis that health systems would try to increase referrals to their other parts from the hospital's primary care services. Furthermore, we found no evidence that rural hospitals were reducing inpatient services overall and shifting more services to outpatient settings. The reductions in obstetric and primary care service lines and outpatient visits suggest that rural patients in these areas may be losing access to important services, although we cannot rule out the possibility that patients can access these services in other settings. We also do not know if affiliating hospitals are working with primary care facilities in their communities to maintain access in other ways. Although we did not find a change in emergency department visits following affiliation, which suggests that the loss of these service lines is not translating into more emergency care, it may take more time to observe the negative impacts of lack of access to primary care services. A recent study found that rural hospital closures in California increased inpatient mortality significantly,[6] but the extent to which changes in access to

individual service lines affect patients' health status remains unclear and is a priority for future research.

We found reduced access to on-site imaging technologies following health system affiliation. This might have occurred because health systems dropped duplicative services or equipment that was costly to maintain[36] or that could be accessed at tertiary facilities—where specialists could provide both imaging and other services as needed. While this reduction might indicate reduced access to imaging services for patients in rural hospitals, it is possible that it might not—if there were another convenient place for patients to access imaging services. However, since patients in rural areas already have limited choices for receiving health care services compared to patients in urban areas,[1] this reduction in on-site technologies remains concerning. Future studies should assess whether patients are either obtaining imaging services within the system or elsewhere or forgoing these services, following reductions in on-site imaging technologies.

Neither quality measure we examined—patient experience and thirty-day all-cause readmissions—changed differentially for affiliating and nonaffiliating hospitals. Hospital executives routinely emphasize the advantages of affiliation for sharing knowledge and obtaining resources that will improve quality of care,[19] but we did not observe improvements for the two measures we examined. The affiliating rural hospitals in our sample underperformed relative to other rural hospitals with respect to patient experience, with scores 0.10 standard deviations below the rural hospital average before affiliation. Similarly, affiliating rural hospitals' mean baseline readmission rate slightly exceeded the 2017 national average (15.5 percent in rural affiliating hospitals versus 15.2 percent for all hospitals nationwide)[37]. Another study of both rural and nonrural hospitals found short-term negative associations with measures of patient experience in the first two years after a merger,[38] though this study restricted affiliating hospitals to those involved in mergers and acquisitions and used a one-to-one propensity matching method. Previous research on mergers and acquisitions among California hospitals found that ninety-day readmissions for heart failure actually increased after hospital acquisition by a health system.[39]

Understanding the consequences of provider consolidation is a matter of growing concern to policy makers, regulators, and patients, but research in this area is hampered by several methodological challenges. Available measures of system affiliation do not capture nuances of integration and interaction between health systems and their affiliated hospitals. The AHA's system affiliation indicator is a broad measure that likely captures heterogeneous arrangements between hospitals and health systems—from highly financially and clinically integrated systems, to term-limited joint ventures or ownership arrangements in name only. Understanding hospitals' and health systems' motivations for affiliating and how these motivations relate to the structure of affiliations would provide context that would be useful in interpreting these findings. Developing methods to differentiate types of hospital affiliations would allow the estimation of effects of different types of affiliation arrangements.

While some communities may benefit when their local hospital affiliates with a health system, affiliation also presents challenges for local communities—especially loss of local

control of the hospital.[34] Elimination of service lines may have similar effects to rural hospital closures, such as damage to the local economy.[9,40] A comprehensive assessment of the benefits and harms of consolidation for patients, hospitals, and their communities would take all of these factors into account. Despite these challenges and the fact that many previous studies have shown that hospital affiliation and consolidation rarely benefit patients and may limit access to services, affiliations and consolidations continue apace. As acquisitions of small hospitals frequently do not trigger monetary thresholds for regulatory oversight, and regulatory bodies are often unsuccessful when they challenge potential consolidations, regulators and policy makers are often at a loss for what they can do to prevent hospital consolidation or mitigate its potential negative consequences.

Although health system affiliation may help prevent closure of rural hospitals or their conversion to subacute care facilities if operating margin is a critical determinant,[41] this may come at the cost of loss of access to certain services. Given the potentially negative consequences of health system affiliation, policy makers should support mechanisms that help rural hospitals remain financially viable without health system affiliation. This could be achieved through innovative payment models such as global budgets, which are used in Maryland and being tested in Pennsylvania; expanding or creating designations such as critical access hospital status that are accompanied by preferred payment status under government insurance programs; or possibly even new forms of public-private partnerships between rural hospitals and the communities they serve. However, in places where health system affiliation has already occurred, policy makers should consider ways to alleviate its negative consequences. Our findings raise concerns that health system affiliation might lead to reduction in access to care in rural areas. Health systems should invest in systems and processes such as telehealth that reduce the travel burden on patients, offer convenient hours and transportation to accommodate patients from remote areas, and promote care coordination and medical record interoperability with remaining community providers. As the trend toward health system affiliation shows no sign of slowing, there is a pressing need to understand its causes and ameliorate any negative consequences.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Exhibit 1:

Performance measures; hypothesized changes for affiliating rural hospitals, compared to nonaffiliating ones; and data sources

Performance measure	Hypothesized change	Data source
Structure		
Technology composite[a]	Decrease	AHA Annual Survey
Obstetric care services	Decrease	AHA Annual Survey
Rural health clinic	Increase	AHA Annual Survey
Primary care department	Increase	AHA Annual Survey
Utilization		
Admissions	Decrease	AHA Annual Survey
Emergency department visits	Decrease	AHA Annual Survey
Outpatient visits (nonemergency)	Increase	AHA Annual Survey
Financial		
Operating margin	Increase	HCRIS
Asset-to-liability ratio	Increase	HCRIS
Uncompensated or unreimbursed care as a percentage of operating costs	Decrease	HCRIS
Quality		
Patient experience composite[b]	Increase	Hospital Compare
30-day hospitalwide all-cause unplanned readmissions	Decrease	Hospital Compare

SOURCE Authors' analysis. NOTES AHA is the American Hospital Association. HCRIS is the Healthcare Cost Report Information System.

[a]A count of up to eleven types of advanced diagnostic imaging technologies available on-site.

[b]A weighted sum of nine normalized measures of patient experience.

Exhibit 2:

Baseline characteristics of affiliating and nonaffiliating rural hospitals

		Nonaffiliating rural hospitals (*n* = 994)		Standardized mean difference	
Characteristic	**Affiliating rural hospitals (*n* = 306)**	**Unweighted**	**Weighted**	**Unweighted**	**Weighted**
Ownership (%)					
For profit	7.8	2.8	4.3	0.19	0.13
Nonprofit	61.8	42.3	54.4	0.40	0.15
Government (nonfederal)	30.4	54.9	41.3	−0.53	−0.24
Mean hospital referral region HHI	0.139	0.124	0.131	0.16	0.08
Mean inpatient days	14,520	12,902	15,232	0.09	−0.04
Mean physician or dentist FTEs	9.5	7.4	9.7	0.12	−0.01
Mean facility personnel FTEs	398	318	404	0.22	−0.02
Joint Commission accreditation (%)	47.7	28.8	39.9	0.38	0.16
AMA medical school affiliation (%)	10.5	8.8	10.7	0.06	−0.01
Trauma center level (%)					
Regional	2.6	0.9	1.5	0.11	0.07
Community	3.9	2.6	3.5	0.07	0.02
Rural	17.0	18.5	19.1	−0.04	−0.06
Other	8.2	9.8	7.3	−0.06	0.03
Mean neighborhood SES index[a]	−0.378	−0.228	−0.329	−0.24	−0.08
Census region (%)					
Northeast	12.4	7.9	13.9	0.14	−0.05
South	38.6	29.1	34.7	0.20	0.08
Midwest	43.4	41.8	41.2	0.03	0.04
West	5.6	21.2	10.2	−0.68	−0.20
Degree of urbanization (%)					
Metropolitan	3.3	3.8	5.3	−0.03	−0.12
Midsize	42.1	29.0	38.8	0.27	0.07
Small town	36.3	40.5	36.9	−0.09	−0.01

		Nonaffiliating rural hospitals (*n* = 994)		Standardized mean difference	
Characteristic	**Affiliating rural hospitals (*n* = 306)**	**Unweighted**	**Weighted**	**Unweighted**	**Weighted**
Rural[b]	18.3	26.7	19.0	−0.22	−0.02

SOURCE Authors' analysis of data from the American Hospital Association Annual Survey (2008–17), Healthcare Cost Report Information System (2008–17), Hospital Compare (2011–17), and American Community Survey (ACS) (2008–17). NOTES HHI is Herfindahl-Hirschman Index. FTE is full-time equivalent. AMA is the American Medical Association.

[a]We used data from the ACS to construct an index (presented in units of standard deviations) describing the socioeconomic status (SES) of hospital neighborhoods. This index was constructed at the ZIP code level using six survey items (high school graduation rate, male unemployment rate, median annual household income, percentage of households with incomes below the federal poverty level, percentage of households headed by a woman, and percentage of households receiving public assistance) and the methods in Bird CE, Seeman T, Escarce JJ, Basurto-Dávila R, Finch BK, Dubowitz T, et al. Neighborhood socioeconomic status and biological "wear and tear" in a nationally representative sample of US adults. J Epidemiol Community Health. 2010;64(10):860–5.

[b]Rural hospitals are defined as critical access hospitals or hospitals located in areas with Rural-Urban Commuting Area Codes of 4 or more, which might include hospitals in otherwise metropolitan counties.

Exhibit 3:

Change over time in performance measures of affiliating and nonaffiliating rural hospitals

Performance measure	Baseline mean		Incremental change for affiliating hospitals, by number of years after affiliation					
	Affiliating hospitals	Weighted nonaffiliating hospitals	1	2	3	4	5	6
Structure								
Technology composite	4.22	4.09	−0.30***	−0.32**	−0.32**	−0.22	−0.28	−0.42
Obstetric care services (%)	51.0	49.2	−6.5**	−6.5*	−8.0**	−10.0**	−12.9**	−13.6**
Rural health clinic (%)	26.1	26.6	−2.5	2.1	2.3	1.6	0.8	3.6
Primary care department (%)	36.9	33.1	−7.4**	−9.6**	−10.9**	−9.6*	−16.8***	−19.2***
Utilization								
Admissions	2,208	2,076	−195*	−76	−195	−150	−202	−408
Emergency department visits	13,720	12,424	−197	−2	−186	316	−274	−524
Outpatient visits (nonemergency)	60,020	56,829	−10,280***	−14,133***	−17,455***	−16,955***	−20,555***	−21,200***
Financial								
Operating margin (%)	−1.6	−1.8	0.44	1.61**	2.17***	3.38****	3.56***	2.75*
Asset-to-liability ratio	2.2	2.4	0.0	−0.1	−0.2	−0.2	−0.1	−0.1
Uncompensated or unreimbursed care as percentage of operating costs (%)	7.5	7.3	1.05****	0.94**	1.06**	1.36***	1.92***	1.95***
Quality								
Patient experience composite	−0.10	−0.09	−0.078	−0.121	−0.172*	−0.156	−0.083	−0.022
30-day hospitalwide all-cause unplanned readmissions (%)	15.5	15.4	1.9	2.4	4.6	13.2**	1.8	−4.1

SOURCE Authors' analysis of data from the American Hospital Association Annual Survey (2008–17), Healthcare Cost Report Information System (2008–17), and Hospital Compare (2011–17). NOTES The technology composite measure and the patient experience composite measure are explained in the notes to exhibit 1. Significance refers to p-values less than 0.05.

* $p < 0.01$

** $p < 0.05$

*** $p < 0.01$

**** $p < 0.001$