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# Medicaid Expansion Alone Not Associated With Improved Finances, Staffing, Or Quality At Critical Access Hospitals

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**ABSTRACT** Critical access hospitals are important providers of care for rural and other underserved communities, but they face staffing and quality challenges while operating with low margins. Medicaid expansion has been found to improve hospital finances broadly and therefore may have permitted sustained investments in staffing and quality improvement at these vulnerable hospitals. In this difference-in-differences analysis, we found that critical access hospitals in Medicaid expansion states did not have statistically significant postexpansion increases in operating margins relative to hospitals in nonexpansion states. Nor did we see evidence of statistically significant differential improvement at critical access hospitals in expansion versus nonexpansion states on either staffing measures (physicians and registered nurses per 1,000 patient days) or quality measures (percentage-point changes in readmissions and mortality within thirty days of admission for pneumonia or heart failure). These findings suggest that critical access hospitals may need to take additional measures to bolster finances to provide continued support for the delivery of high-quality care to rural and other underserved communities.

Critical access hospitals provide vital health care for rural and other underserved communities. Approximately one-third of US hospitals are critical access hospitals, defined as those with fewer than twenty-five beds, located more than thirty-five miles from another hospital, or historically deemed to be a “necessary provider” by states.<sup>1</sup> Because critical access hospitals provide access to care in otherwise underserved communities, they have significant financial protections such as receiving cost-based reimbursement at 101 percent of reasonable costs from Medicare rather than the fixed payments of the inpatient prospective payment system,<sup>2</sup> as well as exemption from hospital value-based purchasing programs.<sup>3</sup> Despite these additional supports, critical access hospi-

tals still face resource and quality challenges while operating with very low margins.<sup>4</sup>

The poor financial health of critical access hospitals is considered to be one of the main drivers behind their mixed performance on quality measures. Critical access hospitals demonstrate better performance than other hospitals on measures of patient experience and have fewer complications after common surgical procedures.<sup>5,6</sup> However, they have poorer performance on process-of-care measures and higher risk-adjusted thirty-day mortality rates from acute myocardial infarction, heart failure, and pneumonia.<sup>7,8</sup> The financial performance of critical access hospitals also makes it difficult to address health care workforce shortages and understaffing, which could also be driving quality differences.<sup>9–11</sup> Some have argued that improvements

in the finances of critical access hospitals would allow for a more sustained investment in staffing and quality improvement infrastructure, which could lead to better patient outcomes.<sup>9</sup> However, whether increased financing would translate to improvements in staffing ratios or quality remains unknown.

Medicaid expansion under the Affordable Care Act (ACA) is one important mechanism by which hospitals improved their financial health, and thus potentially their staffing and quality of care. Medicaid expansion has been associated with improved overall margins among hospitals in expansion states compared with those in non-expansion states, particularly in states with “larger” Medicaid expansions (that is, those with lower eligibility thresholds at the outset).<sup>10–12</sup> Prior work focusing exclusively on rural critical access hospitals has shown improved trends in finances among those in expansion states<sup>13</sup> and a decreased likelihood of closure among rural critical access hospitals and other rural hospitals after Medicaid expansion.<sup>14</sup> However, to our knowledge, no prior work has examined the impact of Medicaid expansion on finances at all critical access hospitals nationally (that is, including the 15 percent of those hospitals located outside of exclusively rural areas, such as large rural towns or cities),<sup>7</sup> or on critical access hospital staffing levels or quality. Because critical access hospitals are defined and paid differently while serving rural and other underserved communities with growing rates of illness and poverty,<sup>15–17</sup> it is important to understand the impact of Medicaid expansion on this particularly vulnerable group of hospitals.

In this study we examined the following two questions: What are the characteristics of critical access hospitals in states that expanded Medicaid compared with those in states that did not? And what is the relationship between Medicaid expansion and changes in critical access hospital finances, staffing ratios, and quality? Understanding whether expansion is associated with improvements in these outcomes has important implications for states that have not yet expanded Medicaid, particularly in the wake of widespread COVID-19-related economic downturns.

## Study Data And Methods

**HOSPITALS** We identified critical access hospitals using 2011–18 data from the Healthcare Provider Cost Reporting Information System from the Centers for Medicare and Medicaid Services (CMS). We used the RAND Corporation’s Hospital Data tool,<sup>18</sup> which is intended to make those data more accessible and useful to researchers. We excluded critical access hospitals if data were

unavailable for the full eight years of the study period. Connecticut, Delaware, Maryland, New Jersey, and Rhode Island have no critical access hospitals and were thus excluded from the analyses. See online appendix exhibit A for details on sample creation.<sup>19</sup>

Hospitals may be missing in the Healthcare Provider Cost Reporting Information System if they changed ownership or closed. There have been differentially more hospital closures in nonexpansion states than in expansion states, and lower-quality hospitals may be more likely to close.<sup>14,20</sup> As this may bias observed changes in hospital quality toward the null, we examined characteristics of critical access hospitals with and without missing data and confirmed that baseline performance on quality was not associated with the likelihood that a critical access hospital was missing from the data during the study period (appendix exhibit B).<sup>19</sup>

**EXPOSURE** The primary exposure was an indicator variable representing whether a state expanded Medicaid, collected from publicly available data reported by the Henry J. Kaiser Family Foundation.<sup>21</sup> Hospitals located in states that did not expand Medicaid during the study period were coded as 0. Hospitals located in states that expanded Medicaid were coded as 0 in the years before the date of expansion and 1 in the years after expansion if the state adopted expansion on January 1 of a calendar year. For hospitals in states that expanded Medicaid in the middle of a calendar year, following prior work,<sup>10</sup> we assigned a scalar equivalent to the fraction of the year that Medicaid expansion was in effect. For example, if a state expanded Medicaid in August 2015, the value of the indicator variable for hospitals in that state would equal 0 in the years before 2015, 1 in the years after 2015, and 0.42 in 2015 to reflect five of twelve months (that is, 42 percent of that year) of exposure. See appendix exhibit C for additional details.<sup>19</sup>

**OUTCOMES** To determine whether critical access hospitals demonstrated financial improvements after Medicaid expansion, we used two measures from the Healthcare Provider Cost Reporting Information System: percentage uncompensated care (total unreimbursed and uncompensated care cost divided by operating expenses) and operating margins (profitability based on net income from the core operations of patient care). Because of the skewed nature of cost data, both measures were winsorized at the first and ninety-ninth percentiles, as has been done in prior work.<sup>10,11</sup> We also calculated the share of Medicaid inpatient days, using data from the American Hospital Association (AHA) Annual Survey,<sup>22</sup> defined as the fraction of Medicaid inpatient facility days divided by total

inpatient facility days.

We obtained additional annual hospital-level information on eight measures of staffing from the AHA Annual Survey. The AHA survey staffing module asks responding hospitals to “report full-time (35 hours or more [per week]) and part-time (less than 35 hours [per week]) personnel who were on the hospital/facility payroll at the end of your reporting period. ...Exclude private-duty nurses, volunteers, and all personnel whose salary is financed entirely by outside research grants. Exclude physicians and dentists who are paid on a fee basis.”<sup>22</sup>

As a result of declines in physician supply and decreased access to care in rural and other underserved communities,<sup>23,24</sup> we examined the following four physician measures: total number of employed physicians; number of full-time-equivalent (FTE) physicians and dentists, combined; number of primary care physicians; and number of specialist physicians. Given that nurse staffing may be more easily scaled up by hospitals, as well as the known relationship between nurse staffing and quality,<sup>25–27</sup> we examined two measures of nurse staffing: numbers of registered nurses (RNs), both full and part time, and numbers of licensed practical or vocational nurses (LPNs), both full and part time. All staffing measures were divided by 1,000 adjusted patient days to account for differences in hospital size and occupancy. We chose this measure because it accounts for volume inclusive of outpatient services, which are increasingly being provided by rural hospitals.<sup>28</sup>

We used publicly available data from Hospital Compare<sup>29</sup> to measure hospital quality. Critical access hospitals have been excluded from mandatory public reporting of quality measures because of their low case volume, but in recent years a growing number have begun reporting their performance.<sup>30</sup> We focused on quality measures for patient experience and patient outcomes that were most frequently reported by critical access hospitals during the study period and have been thought to be more relevant to the experience and care provided by these hospitals.<sup>31,32</sup>

For patient experience, we examined performance corresponding to the highest level on the Hospital Consumer Assessment of Healthcare Providers and Systems (HCAHPS), defined across eight domains: cleanliness of hospital environment (responded “always” clean), quietness of hospital environment (responded “always” quiet), nurse communication (responded “always” communicated well), doctor communication (responded “always” communicated well), responsiveness of hospital staff (responded “always” responsive), communication

## Strategies beyond Medicaid expansion will be essential to supporting health care delivery for rural and underserved communities.

about medications (responded “always” communicated well), discharge information (responded they received information), and overall hospital rating (ranked their hospital a 9 or 10 on a 1–10 scale).

For patient outcomes, we examined risk-standardized hospital-level thirty-day readmission and mortality rates after hospital admissions for heart failure and pneumonia.

**COVARIATES** Hospital characteristics were obtained from the Healthcare Provider Cost Reporting Information System, including the number of hospital beds, ownership status (non-profit, for-profit, government), geographic region (Northeast, Midwest, South, West), and teaching status (major or minor versus non-teaching). We also collected county-level rural-urban commuting area codes (urban, large rural city or town, small and isolated small rural town) from the Department of Agriculture, per capita income from the Bureau of Economic Analysis, and unemployment rates from the Bureau of Labor Statistics.

**ANALYSIS** First we compared characteristics between critical access hospitals in expansion versus nonexpansion states. We then used difference-in-differences linear regression to model the three sets of outcomes described above: financial measures, hospital staffing ratios, and quality measures. To test the validity of using a difference-in-differences approach, we created unadjusted plots of the trends in performance across all outcomes, stratified by state Medicaid expansion status, to visually inspect for parallel trends before Medicaid expansion. We then tested for parallel trends using a regression model in which the primary explanatory variable was an interaction term between a state’s Medicaid expansion status (1 if ever expanded during the study period, 0 if never expanded during the study period) and the number of years that

# Understanding how best to improve care for patients in underserved communities should remain an ongoing policy priority.

had passed since the beginning of the study period (2011) for a given observation. We found no significant evidence to reject the hypothesis of parallel pre trends across any measured outcomes, although we note that all coefficients for pre trends for quality measures were negative (appendix exhibits D–H).<sup>19</sup>

Analyses were conducted at the hospital-year level. The primary explanatory variable was an indicator variable for a state's time-varying Medicaid expansion status as outlined above in the description of the "exposure," which, in combination with year and hospital fixed effects, provides a difference-in-differences estimate. These fixed effects also accounted for increased reporting rates among critical access hospitals on quality measures over time, as well as other time-invariant secular trends in states and hospitals. Time-varying model covariates included number of hospital beds, county-level per capita income, and county-level unemployment rates. Hospitals were weighted by baseline levels of volume (number of adjusted patient days in 2011), and robust standard errors were clustered at the state to reflect the level of the policy exposure. Because critical access hospitals differed in terms of which outcomes they reported, we present the number of observations included in each regression to reflect different underlying samples of hospitals included in each analysis. Hospitals were not required to report in every year to be included in a regression for a given quality measure. To account for multiple comparisons within each set of outcomes (finances, staffing, quality), we adjusted the threshold for statistical significance for the number of outcomes examined within each domain by dividing our threshold of 0.05 by the number of outcomes:  $p < 0.017$  for evaluations of finances (3 outcomes),  $p < 0.008$  for staffing (6 outcomes), and  $p < 0.004$  for quality (12 outcomes).

We then performed several sensitivity analyses. First, as has been done in prior work,<sup>10,33</sup> we repeated the primary analyses after excluding six states and Washington, D.C., which all had higher levels of Medicaid eligibility before the ACA (see appendix exhibit I for details).<sup>19</sup> Second, we repeated all regressions without weights to evaluate for the potential for improvements in relatively smaller critical access hospitals compared with larger ones. Finally, we repeated all regressions using an unbalanced panel of critical access hospitals, which included hospitals with missing Healthcare Provider Cost Reporting Information System data in some years and were inclusive of hospitals that may have changed ownership or closed during the study period.

All analyses were performed using Stata 15. This study was exempt from Institutional Review Board approval because of the Common Rule and the use of publicly available data.

**LIMITATIONS** This study had limitations. First, our use of administrative, hospital-level data limited our ability to capture specific aspects of patient care or complexity, such as patient case-mix. We were unable to account for whether changes in case-mix may have occurred differentially in expansion versus nonexpansion states, but, reassuringly, prior work has shown that case-mix among hospitalized adults did not appreciably change after Medicaid expansion.<sup>34</sup> Second, staffing data in the AHA are imperfect, and we were unable to confirm the extent to which physicians or nurses who provide services at critical access hospitals are employees of the hospital. However, AHA data are the most comprehensive, longitudinal, and nationally representative source of hospital staffing information available. Third, we examined just three domains of hospital quality and were unable to assess other ways in which critical access hospitals may be meaningfully investing resources that improve patient care. Nonetheless, we chose to focus on quality measures that are patient centered, most commonly reported by critical access hospitals, and potentially more relevant to this group of hospitals.<sup>31,32</sup> Finally, among the many factors that could affect the outcomes we studied, we examined just one: Medicaid expansion. It is possible that there are other unobserved factors that affected these outcomes. Although our difference-in-differences approach attempted to minimize this bias, it remains possible that our results are biased from omitted variables.

## Study Results

**HOSPITAL CHARACTERISTICS** The sample included 1,158 critical access hospitals, of which 648

## EXHIBIT 1

Sample characteristics of critical access hospitals in Medicaid nonexpansion and expansion states, 2011–18

Sample characteristics	In nonexpansion states <sup>a</sup>	In expansion states <sup>b</sup>
No. of beds (mean)	22.2	22.1
Profit status (%)		
Nonprofit	43.9	60.8
For-profit	8.3	2.4
Government	47.9	36.8
Region (%)		
Northeast	0.0	8.5
Midwest	50.6	46.8
South	40.2	12.3
West	9.2	32.4
Major or minor teaching (%)	0.5	1.2
Rural-urban classification (%)		
Urban	6.8	7.2
Large rural city or town	5.9	11.8
Small and isolated small rural town	87.3	81.1
Proportion Medicaid inpatient days (% mean)	31.9	31.8
County per capita income (\$, mean)	40,469	41,397
County unemployment rate (% mean)	5.3	5.9

**SOURCE** Authors' analysis of data from the Healthcare Cost Reporting Information System, American Hospital Association (AHA) Annual Survey, Department of Agriculture, Bureau of Economic Analysis, and Bureau of Labor Statistics, 2011–18. **NOTES** Proportion Medicaid inpatient days reflects the fraction of Medicaid inpatient facility days divided by total inpatient facility days as reported in the AHA Annual Survey. Means are weighted by the number of adjusted patient days. Percentages reflect denominators of the total number of hospital-year observations. <sup>a</sup>501 hospitals, 4,081 hospital-year observations. <sup>b</sup>648 hospitals, 5,185 hospital-year observations.

were in Medicaid expansion states and 510 in nonexpansion states (exhibit 1; for standard deviations, see appendix exhibit J).<sup>19</sup> Hospital-year observations from critical access hospitals in expansion states were less often government owned (36.8 percent versus 47.9 percent), more often located in the West (32.4 percent versus 9.2 percent), and less often located in large rural cities or towns (11.8 percent versus 5.9 percent) compared with those in nonexpansion states. Hospital-year observations from critical access hospitals in expansion and nonexpansion states had similar proportions of Medicaid inpatient days (31.8 percent versus 31.9 percent, respectively) and were located in areas with higher average rates of unemployment (5.9 percent versus 5.3 percent, respectively).

#### DIFFERENTIAL CHANGES IN FINANCIAL HEALTH

Critical access hospitals in expansion states had nonsignificant postexpansion increases in the share of Medicaid inpatient days (differential change, 3.1 percentage points;  $p = 0.08$ ) (appendix exhibit K)<sup>19</sup> and nonsignificant postexpansion reductions in uncompensated care after Medicaid expansion relative to critical access hospitals in nonexpansion states (differential change,  $-0.7$  percentage points;  $p = 0.05$ ) at a

threshold adjusted for multiple comparisons. Critical access hospitals in expansion states also demonstrated nonsignificant postexpansion increases in operating margins (differential change, 1.3 percentage points;  $p = 0.05$ ) compared with hospitals in nonexpansion states.

#### DIFFERENTIAL CHANGES IN STAFFING RATIOS

Critical access hospitals in expansion states had no significant differential changes in the total number of employed physicians compared with nonexpansion states (0.11 per 1,000 patient days;  $p = 0.35$ ) (exhibit 2; for standard deviations, see appendix exhibit L).<sup>19</sup> There were also nonsignificant postexpansion differential changes in nurse staffing levels (for RNs,  $-0.48$  per 1,000 patient days,  $p = 0.40$ ; for LPNs,  $-0.26$  per 1,000 patient days,  $p = 0.29$ ). Coefficients for both nurse staffing measures were negative in direction.

#### DIFFERENTIAL CHANGES IN QUALITY

Critical access hospitals in expansion states had similar HCAHPS performance as those in nonexpansion states both before expansion (percentage of patients giving an overall hospital rating of 9 or 10 on a 1–10 scale: 72.9 percent in expansion states versus 73.6 percent in nonexpansion states) and after expansion (75.7 percent in expansion states versus 76.8 percent in nonexpansion states in 2018), with a nonsignificant differential change between the two groups at a threshold adjusted for multiple comparisons (differential change,  $-1.10$  percentage points;  $p = 0.03$ ) (exhibit 3; for standard deviations, see appendix exhibit M).<sup>19</sup> There were no significant differential changes in any of the other components of patient experience (exhibit 3).

Similarly, there were no significant differential changes across readmission or mortality rates between critical access hospitals in expansion states compared with those in nonexpansion states (exhibit 4; for standard deviations, see appendix exhibit N).<sup>19</sup> Before Medicaid expansion, critical access hospitals in expansion and nonexpansion states demonstrated similar performance on readmissions from heart failure (thirty-day readmission rates of 23.0 percent in expansion states, 23.2 percent in nonexpansion states) and pneumonia (17.4 percent in both expansion and nonexpansion states). Readmission rates declined overall for both groups, but with no significant differential changes between critical access hospitals in expansion versus nonexpansion states (differential change on heart failure readmission rates, 0.18 percentage points [ $p = 0.13$ ]; on pneumonia readmission rates,  $-0.11$  percentage points [ $p = 0.16$ ]). Similar patterns were evident for mortality.

**SENSITIVITY ANALYSES** Unweighted models (appendix exhibit O)<sup>19</sup> and analyses excluding

**EXHIBIT 2**
**Differential changes in hospital staffing ratios for critical access hospitals in Medicaid nonexpansion and expansion states, 2011–18**

Staffing measures and study periods	In nonexpansion states, mean	In expansion states, mean	Differential change (percentage points)	Number of observations
Total employed MDs per 1,000 patient days				6,017
Pre-Medicaid expansion	0.23	0.36	— <sup>a</sup>	
Post-Medicaid expansion	0.34	0.50	0.11	
FTE MDs and dentists per 1,000 patient days				9,179
Pre-Medicaid expansion	0.13	0.21	— <sup>a</sup>	
Post-Medicaid expansion	0.15	0.22	0.01	
Primary care MDs per 1,000 patient days				6,016
Pre-Medicaid expansion	0.10	0.16	— <sup>a</sup>	
Post-Medicaid expansion	0.13	0.17	0.01	
Specialists per 1,000 patient days				6,017
Pre-Medicaid expansion	0.06	0.08	— <sup>a</sup>	
Post-Medicaid expansion	0.09	0.16	0.06	
RNs per 1,000 patient days				9,176
Pre-Medicaid expansion	1.34	1.59	— <sup>a</sup>	
Post-Medicaid expansion	1.44	1.59	−0.48	
LPNs per 1,000 patient days				9,176
Pre-Medicaid expansion	0.33	0.30	— <sup>a</sup>	
Post-Medicaid expansion	0.31	0.26	−0.26	

**SOURCE** Authors' analysis of data from the Healthcare Cost Reporting Information System, American Hospital Association Annual Survey, Department of Agriculture, Bureau of Economic Analysis, and Bureau of Labor Statistics, 2011–18. **NOTES** None of the findings for differential change met statistical significance at a threshold adjusted for multiple comparisons ( $p < 0.008$ ). The pre- and postexpansion periods include hospital-year observations from years before and after Medicaid expansion, respectively, and reflect state-specific differences in the timing of Medicaid expansion. Observations included in the summary of means reflect differences in state-specific timing of Medicaid expansion among expansion states. Means are weighted by the number of adjusted patient days. Differential change represents the adjusted difference in a given staffing measure between critical access hospitals in expansion versus nonexpansion states since the time of expansion. Primary care includes general practitioners, general internal medicine, family practice, and general pediatrics providers. Registered nurse (RN) and licensed practical or vocational nurse (LPN) staffing measures reflect the sum of total full-time RNs or LPNs + 0.5(number of part-time RNs or LPNs), respectively. FTE is full-time equivalent. <sup>a</sup>Not applicable.

states with high baseline Medicaid eligibility thresholds before Medicaid expansion under the ACA (appendix exhibit P)<sup>19</sup> revealed consistent findings: namely, that critical access hospitals in expansion states had no significant differential improvements in operating margins and no significant differential changes in staffing or quality. When we repeated analyses using an unbalanced panel of critical access hospitals, we again found similar results (appendix exhibit Q).<sup>19</sup>

## Discussion

Medicaid expansion, which has been shown to improve the financial health of hospitals, might have been particularly important for critical access hospitals because of the financial challenges they face. However, in this national study we found no evidence that critical access hospitals in Medicaid expansion states nationwide experienced statistically significant differential improvements in operating margins, staffing levels, or quality compared with those in nonexpansion states. Our findings were consistent across different domains of hospital quality and were robust to several sensitivity analyses.

The lack of significant differential improvement in operating margins is a key finding of this work and may be due to several potential mechanisms. First, the financial benefits of Medicaid expansion for critical access hospitals may have been too small to detect. Although prior work has found that hospital conversion to critical access hospital status has been associated with better finances, those improvements in margins were large, in the range of 2.0–6.5 percent.<sup>35</sup> The financial improvements associated with Medicaid expansion are smaller in comparison. Second, Medicaid reimbursement rates might not be high enough to affect margins when substituted for uncompensated care. Third, other sources of financial support for uncompensated care (for example, county or state subsidies, such as disproportionate share hospital payments) may have been reduced when Medicaid expanded, offsetting the increased revenue from Medicaid.<sup>36</sup> Fourth, critical access hospitals also face myriad other financial challenges, such as high fixed costs in the context of growing demands for medical technology and growing market pressure in the wake of market consolidation, which are largely independent of policies designed to improve insurance coverage.<sup>37,38</sup>

## EXHIBIT 3

## Differential changes in patient experience measures for critical access hospitals in Medicaid nonexpansion and expansion states, 2011–18

Patient experience measures and study periods	In nonexpansion states, mean	In expansion states, mean	Differential change (percentage points)	No. of observations
Cleanliness				5,838
Pre-Medicaid expansion	79.5%	78.6%	— <sup>a</sup>	
Post-Medicaid expansion	80.4	79.5	−0.71	
Quietness				5,840
Pre-Medicaid expansion	65.7	62.9	— <sup>a</sup>	
Post-Medicaid expansion	67.9	64.9	−0.45	
Nurse communication				5,840
Pre-Medicaid expansion	81.8	81.4	— <sup>a</sup>	
Post-Medicaid expansion	83.2	83.1	−0.22	
Doctor communication				5,838
Pre-Medicaid expansion	86.1	84.1	— <sup>a</sup>	
Post-Medicaid expansion	86.1	84.5	0.35	
Responsiveness of staff				5,839
Pre-Medicaid expansion	74.0	74.1	— <sup>a</sup>	
Post-Medicaid expansion	75.8	75.6	−0.96	
Communication about medications				5,803
Pre-Medicaid expansion	67.8	67.2	— <sup>a</sup>	
Post-Medicaid expansion	68.9	68.4	−0.26	
Discharge information				5,839
Pre-Medicaid expansion	86.7	86.3	— <sup>a</sup>	
Post-Medicaid expansion	88.0	88.3	0.22	
Overall hospital rating				5,840
Pre-Medicaid expansion	73.6	72.9	— <sup>a</sup>	
Post-Medicaid expansion	76.8	75.7	−1.10	

**SOURCE** Authors' analysis of data from the Healthcare Cost Reporting Information System, Hospital Compare, American Hospital Association Annual Survey, Department of Agriculture, Bureau of Economic Analysis, and Bureau of Labor Statistics, 2011–18. **NOTES** None of the findings for differential change met statistical significance at a threshold adjusted for multiple comparisons ( $p < 0.004$ ). The pre- and postexpansion periods include hospital-year observations from years before and after Medicaid expansion, respectively, and reflect state-specific differences in the timing of Medicaid expansion. Observations included in the summary of means reflect differences in state-specific timing of Medicaid expansion among expansion states. Means are weighted by the number of adjusted patient days. Differential change represents the adjusted percentage-point difference in a given quality measure between critical access hospitals in expansion versus nonexpansion states since the time of expansion. <sup>a</sup>Not applicable.

With more time, it is possible that Medicaid expansion may be associated with better overall finances at critical access hospitals, particularly if more rural states decide to expand Medicaid under new incentives introduced by the federal government.<sup>39</sup> Although prior work has shown that rural hospital payer mixes and finances improved after Medicaid expansion,<sup>13</sup> our findings may have differed because of our use of difference-in-differences analyses and our inclusion of the full national sample of critical access hospitals. Furthermore, because critical access hospitals are supported by distinct payment mechanisms and represent a financially and geographically heterogeneous group of hospitals,<sup>40</sup> it is plausible that they might respond differently to Medicaid expansion than other groups of hospitals.

Given our findings of no change in hospital finances, it may be unsurprising that we did not observe significant improvements in staffing or

quality. With regard to staffing, critical access hospitals operate under fewer staffing requirements compared with other acute care hospitals, given their geography and resource limitations at baseline—for example, critical access hospitals are not required to have on-site physicians at all times.<sup>41</sup> These staffing differences exist in the context of national nurse staffing shortages, increasingly limited access to care in rural and underserved communities, and growing concern for rural hospital closures.<sup>42–44</sup> All of these factors serve to threaten the viability of health care delivery systems that provide care for rural and other underserved communities. Nurse staffing shortages may be particularly formidable, given multiple barriers to recruitment related to education, transportation, and remuneration.<sup>45</sup> Given these challenges, it may be that any financial benefits of Medicaid expansion were not sufficient to motivate broad changes in staffing. Furthermore, many of these challenges have been

**EXHIBIT 4**
**Differential changes in patient outcome measures for critical access hospitals in Medicaid nonexpansion and expansion states, 2011–18**

Outcome measures and study periods	In nonexpansion states, mean	In expansion states, mean	Differential change (percentage points)	Number of observations
Heart failure readmissions				5,098
Pre-Medicaid expansion	23.2%	23.0%	— <sup>a</sup>	
Post-Medicaid expansion	21.6	21.7	0.18	
Pneumonia readmissions				7,281
Pre-Medicaid expansion	17.4	17.4	— <sup>a</sup>	
Post-Medicaid expansion	16.6	16.5	–0.11	
Heart failure mortality				4,710
Pre-Medicaid expansion	12.2	12.2	— <sup>a</sup>	
Post-Medicaid expansion	12.5	12.4	0.05	
Pneumonia mortality				7,257
Pre-Medicaid expansion	12.4	12.6	— <sup>a</sup>	
Post-Medicaid expansion	15.4	15.4	–0.13	

**SOURCE** Authors' analysis of data from the Healthcare Cost Reporting Information System, Hospital Compare, American Hospital Association Annual Survey, Department of Agriculture, Bureau of Economic Analysis, and Bureau of Labor Statistics, 2011–18.

**NOTES** None of the findings for differential change met statistical significance at a threshold adjusted for multiple comparisons ( $p < 0.004$ ). The pre- and postexpansion periods include hospital-year observations from years before and after Medicaid expansion, respectively, and reflect state-specific differences in the timing of Medicaid expansion. Observations included in the summary of means reflect differences in state-specific timing of Medicaid expansion among expansion states. Means are weighted by the number of adjusted patient days. Differential change represents the adjusted percentage point difference in a given quality measure between critical access hospitals in expansion states versus nonexpansion states since the time of expansion. <sup>a</sup>Not applicable.

exacerbated by the financial strain introduced by the COVID-19 pandemic,<sup>46</sup> suggesting that critical access hospitals may need additional support beyond Medicaid expansion to be able to meaningfully invest in personnel in ways that preserve access to care and provide employment for people who live in rural and other underserved communities.

Relatedly, we also did not find that Medicaid expansion was associated with improvements in quality. Improving readmission and mortality rates is difficult for hospitals broadly, and as a result, we might not expect quality to have appreciably changed as a result of Medicaid expansion, given the combination of relatively small financial improvements in the context of multiple financial stressors facing critical access hospitals. In addition to having fewer resources, these hospitals also deliver care in communities where the availability and quality of outpatient and postacute care may be limited in ways that make it difficult to improve patient outcomes. Patients in rural and underserved communities also face growing burdens of social determinants of health,<sup>17,47,48</sup> and investing in their improvement likely requires more resources than those accrued by critical access hospitals after Medicaid expansion. Unfortunately, data limitations restricted our ability to measure how hospitals may be meaningfully investing in surrounding communities to address social determinants and

upstream drivers of adverse patient outcomes.

Taken together, these findings support the argument that although Medicaid expansion may have had benefits for some hospitals, it is not a panacea for all of the challenges facing hospitals serving rural and underserved communities. Early findings after the inception of the critical access hospital program showed that conversion of hospitals from non-critical access hospital status to critical access hospital status was associated with improvements in patient safety and lower risk for closure, partially attributed to Medicare's cost-plus-based approach to reimbursement.<sup>49</sup> Hospitals in rural and other underserved areas are also increasingly adopting new tactics to improve quality, such as scaling up telemedicine or deploying community health worker models.<sup>50,51</sup> However, it cannot be assumed that Medicaid expansion will suffice in isolation. Given the multiple challenges related to limited access and growing comorbidity burden, additional strategies beyond Medicaid expansion will be essential to supporting health care delivery for rural and underserved communities.

## Conclusion

Critical access hospitals remain an important source of care for rural and underserved communities in the US. Our findings suggest that Med-

icaid expansion was not associated with statistically significant differential changes in finances, staffing, or quality between critical access hospitals in expansion states and those in non-

expansion states. Understanding how best to improve care for patients in rural and underserved communities should remain an ongoing policy priority. ■

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