By Richard C. Lindrooth, Marcelo C. Perraillon, Rose Y. Hardy, and Gregory J. Tung

Understanding The Relationship Between Medicaid Expansions And Hospital Closures

ABSTRACT Decisions by states about whether to expand Medicaid under the Affordable Care Act (ACA) have implications for hospitals' financial health. We hypothesized that Medicaid expansion of eligibility for childless adults prevents hospital closures because increased Medicaid coverage for previously uninsured people reduces uncompensated care expenditures and strengthens hospitals' financial position. We tested this hypothesis using data for the period 2008–16 on hospital closures and financial performance. We found that the ACA's Medicaid expansion was associated with improved hospital financial performance and substantially lower likelihoods of closure, especially in rural markets and counties with large numbers of uninsured adults before Medicaid expansion. Future congressional efforts to reform Medicaid policy should consider the strong relationship between Medicaid coverage levels and the financial viability of hospitals. Our results imply that reverting to pre-ACA eligibility levels would lead to particularly large increases in rural hospital closures. Such closures could lead to reduced access to care and a loss of highly skilled jobs, which could have detrimental impacts on local economies.

Richard C. Lindrooth (richard
.lindrooth@ucdenver.edu) is a
professor in the Department
of Health Systems,
Management, and Policy,
Anschutz Medical Campus,
Colorado School of Public
Health, University of Colorado,
in Aurora.

Marcelo C. Perraillon is an
assistant professor in the
Department of Health
Systems, Management, and
Policy, Anschutz Medical
Campus, Colorado School of
Public Health, University of
Colorado.

Rose Y. Hardy is a graduate
student in the Department of
Health Systems, Management,
and Policy, Anschutz Medical
Campus, Colorado School of
Public Health, University of
Colorado.

Gregory J. Tung is an
assistant professor in the
Department of Health
Systems, Management, and
Policy, Anschutz Medical
Campus, Colorado School of
Public Health, University of
Colorado.

Ongoing debates about the future of health care in the US and the Affordable Care Act (ACA) have focused on the impact of various elements of the ACA and proposed alternatives on people's access to affordable health insurance coverage. Less attention has been paid to the implications of coverage changes on hospitals' financial performance and sustainability.

Access to care is a fundamental element of the US health care system, and policy makers have long recognized the relationship between hospitals' financial sustainability and patients' access to hospital care. Policies that promote improved health insurance coverage, such as expansions of eligibility for Medicaid, lead to increased hospital revenue at the point of care because hospitals are reimbursed for care that would otherwise be uncompensated.

Medicaid is the primary source of health insurance coverage for low-income Americans, and its role and structure figure prominently in the larger health care debate. Recent research has shown that the increase in the proportion of insured people in states that expanded Medicaid was about double the increase in nonexpansion states.[1] The increase in coverage was particularly large among childless adults, the eligibility category targeted by the ACA expansion.[2] Overall, increased coverage occurred with either little or no "crowd-out" of private coverage.[1,2] Unsurprisingly, increased health insurance coverage has led to reduced expenditures on uninsured patients by hospitals in expansion states.[2–6]

Evidence exists on the positive impact of Medicaid expansions on financial performance, but an important unanswered policy question is the

effect of Medicaid expansion decisions on hospital closures.[7] This policy question has renewed importance as Congress continues to consider policies that could fundamentally change the federal government's role in funding Medicaid and reduce the ability of states to cover low-income residents. Recent research has identified an increase in the rate of rural hospital closures in the period after the ACA but did not specifically model the impact of Medicaid expansion decisions.[8] To our knowledge, the relationship between hospital closures and states' Medicaid expansion decisions has not been analyzed with multiple years of postexpansion data. We sought to fill this gap.

In this study we hypothesized that hospitals in states that expanded Medicaid were less likely to close than hospitals in states that did not expand Medicaid. The primary mechanism underlying this hypothesis is that increased Medicaid coverage for previously uninsured people reduces spending on uncompensated care and strengthens hospitals' financial position in expansion states. We tested this hypothesis by estimating the association between the ACA's Medicaid expansion and hospital financial performance and closure.

Study Data And Methods

The analysis was limited to nonfederal, short-term, general and critical access hospitals in operation for at least one year in the period 2007–15. *Critical access hospital* is a designation given to rural hospitals by the Centers for Medicare and Medicare Services (CMS) that allows them to receive more generous cost-based reimbursement from Medicare, with the goal of promoting access to inpatient care in rural areas.

Hospitals in states that expanded childless adults' eligibility for Medicaid after 2014 were excluded from the analysis, to eliminate potential bias from Medicaid expansions related to concerns about hospital finances.[9] Our primary specifications exclude a 2013–14 "washout" period that reflects the time period when enrollment related to the expansion was increasing but had not yet reached its full impact on uninsurance rates.[10] In addition, hospital data are reported by fiscal year, which often is different from calendar year. State-level Medicaid and Children's Health Insurance Program (CHIP) income eligibility limits were collected for four income-based eligibility categories: adults with dependent children, childless adults, children (including those eligible for CHIP), and pregnant women.

HOSPITAL DATA We used the CMS Provider of Services file to identify potential hospital closures in the period 2008–16, based on Medicare provider IDs that were no longer operating because of either closure or merger/acquisition. From this set of hospitals, we verified actual hospital closures, defined as hospitals' ceasing to deliver short-term general hospital services, from multiple sources.[11]

Hospital financial outcomes were computed using CMS's Healthcare Provider Cost Reporting Information System reports. *Total margin* is defined as total income divided by revenue; *operating margin* is net patient income divided by net patient revenue; and *Medicaid and uncompensated care margin* is defined using net income related to treatment of Medicaid and uninsured patients divided by the net revenue from treating these patients. Information about the latter became available for all hospitals beginning in 2011. This margin was included because it directly measures the financial benefit to hospitals when patients switch from no insurance to Medicaid. Net revenue included payments received from state and local governments' indigent care programs and Medicaid but did not include disproportionate-share hospital (DSH) payments, because reliable data were not available at the hospital level. Revenues and expenses related to CHIP were not included in the calculation because these were unrelated to the ACA Medicaid expansion. The financial variables were trimmed at the first and ninety-ninth percentiles of the original distribution to prevent unrealistically large outliers from biasing our results.

Data on hospital ownership, teaching status, bed size (numbers of beds), critical access hospital status, rural location, and numbers of profitable and unprofitable services were drawn from the Healthcare Provider Cost Reporting Information System and the Provider of Services files. Profitable services included open heart surgery, cardiac catheterizations, chemotherapy, neurosurgery, and obstetrics. Unprofitable services included alcohol and drug services, burn care units, and psychiatric services (inpatient, outpatient, child and adolescent, and emergency).[12] Following previous literature, we defined a hospital as *rural* if it was in an area with a Rural-Urban Commuting Area code greater than 4 or if it was designated as a critical access hospital.[8] Fiscal years that overlapped two calendar years were assigned to the calendar year that represented the majority of days within the fiscal year.

We calculated a Herfindahl-Hirschman Index to measure the competitiveness of local markets, defined using 2007 hospital referral regions.[13] County-level per capita income and rates of uninsurance and unemployment were obtained from the Census Bureau.

STATISTICAL METHODS We computed the mean

We hypothesized that hospitals in states that expanded Medicaid were less likely to close than hospitals in states that did not.

level and pre- and postexpansion change over time of all outcomes and covariates in expansion and nonexpansion states. We tested the significance of changes over time and the difference between the changes in expansion and non-expansion states.

The association of ACA Medicaid expansions and the outcomes was estimated using a difference-in-differences specification. The specification included a dichotomous variable that equaled 1 if the hospital was in a state that expanded Medicaid in 2014 and 0 otherwise. A post variable that equaled 1 during the postexpansion period was interacted with the expansion state variable to measure the change in the outcome in expansion states relative to change in non-expansion states. In other words, we estimated the difference between pre- and postexpansion changes in the outcomes experienced by hospital in expansion and nonexpansion states.

Outcomes were modeled as a function of hospital and market characteristics and the state Medicaid federal poverty level eligibility limits for children, parents, and pregnant women. We controlled for changes in eligibility for these categories, to isolate the impact of the ACA's expansion of eligibility for childless adults. We modeled the probability of closure as a function of previous-year covariates to take into account the timing of the closure decision, which is generally made before the actual closure. In addition, the data were incomplete in the year of the closure, because the hospital was not in operation the entire year. The hospital closure model was estimated using logistic regression. The analyses of financial outcomes included hospital and year fixed effects, and the analysis of closures included year fixed effects. We performed sensitivity analyses of the closure models by estimating specifications that included the washout period (2013–14), included states that

expanded Medicaid in 2015 or 2016, excluded states that expanded Medicaid before 2014,[14] or included state random effects. We also estimated linear probability models that included either state fixed effects or random effects.

We also estimated a specification with actual Medicaid poverty-related eligibility levels for childless adults in place of the interaction between the "Post" period and "Expansion State" status (denoted as Post*Expansion State hereafter). This specification directly measured the association of childless adult eligibility levels with the probability of hospital closure.

We tested whether the association between Medicaid expansion and the outcomes varied depending on local uninsurance rates for adults measured in the period before expansion. This specification tested our hypothesis that hospitals in expansion states would experience substitution of uninsured patients for Medicaid patients. If this substitution was driving our results, the association of the expansion and each outcome would become stronger as the preexpansion rate of uninsurance increased. This was tested by adding pre-2014 local adult uninsurance rates to the specification and interacting it with the Expansion State, Post, and Post*Expansion State variables. We reported the percentage change in the probability of closure calculated with the marginal effect of the Post*Expansion State variable evaluated at local uninsurance rates ranging from 0 percent to 30 percent. All standard errors were clustered by state. To avoid the known problems of interaction terms in logistic models, we report the percentage change in the probability of closure that was calculated as the marginal effect divided by the closure probability.[15]

The difference-in-differences results had a causal interpretation if a number of assumptions were satisfied.[16] Most importantly, the decision to expand Medicaid must be exogenous (that is, not confounded). This would hold true if states decided to expand Medicaid without considering hospitals' financial performance or viability. Hospitals in all states must be subject to "common shocks"—which implies that we needed to control for all relevant time-varying differences between hospital markets in expansion and non-expansion states. For example, we included median income and unemployment rates to control for differences in the local economy, and Medicaid eligibility levels for childless adults, children, and pregnant women to control for changes in poverty-related eligibility levels experienced in expansion and nonexpansion states during the study period. Finally, hospitals in nonexpansion states should be representative of hospitals in expansion states, to provide an estimate of what

would have occurred if Medicaid had not been expanded.

We performed tests of preexpansion parallel trends in expansion and nonexpansion states to test the validity of our assumptions. In the closure specification we also tested whether the adjusted mean probability of the closure in the pre-expansion period was the same in expansion and nonexpansion states because we estimated a nonlinear model. Finally, we tested whether the change in the covariates from the pre- to the post-expansion period was the same in expansion and nonexpansion states.

All analyses were conducted using Stata, version 14.2. This study was deemed exempt from review by an Inter-Institutional Review Board.

LIMITATIONS Our study had several limitations. First, we could not observe the timing of the information that was used by hospital executives to inform closure decisions.

Second, hospital fiscal years often do not correspond to calendar years. Thus, data representing fiscal years 2013 and 2014 might reflect a mix of data for the two calendar years. To minimize this potential bias, we excluded data during a washout period.

Third, the decision to expand Medicaid was not random. Although we controlled for potential confounders in our models, and the testable assumptions required for causal inference were satisfied, we cannot definitively assert causality.

Study Results

States that did not expand Medicaid experienced a large increase (0.429 closures per 100 hospitals) from 2008–12 to 2015–16 in the unadjusted rate of closures (exhibit 1). In contrast, the closure rate decreased by 0.33 per 100 hospitals in expansion states. Total margins improved by 0.011, or about 33 percent, in expansion states; although the increase was more than the 0.005 increase in nonexpansion states, the difference-in-differences was not significant. However, the difference between the unadjusted change in the Medicaid and uncompensated care margins was quantitatively larger in expansion states than nonexpansion states and statistically significant.

EXHIBIT 1

Summary statistics for states, by Medicaid expansion status and period

	Did not expand Medicaid (n = 14,549)			Expanded Medicaid (n = 15,548)			Difference-in-differences[a]
	2008–12	2015–16	Change	2008–12	2015–16	Change	
Closures per 100 hospitals	0.39	0.81	0.43**	0.51	0.18	−0.33**	−0.76***
FINANCIAL INDICATORS							
Total margin	0.03	0.04	0.005	0.03	0.04	0.011***	0.006
Operating margin	−0.03	−0.04	−0.017***	−0.03	−0.03	−0.004	0.013
Medicaid and uncompensated care margin[b]	−0.80	−0.92	−0.12***	−0.77	−0.67	0.106***	0.226***
MEDICAID ELIGIBILITY THRESHOLD[c]							
Adults with dependent children	59	44	−14.2**	114	141	26.6**	40.8***
Childless adults	0	6	6.1	3	139	136.0***	130.0***
Children[d]	215	234	19.2**	245	284	38.6***	19.4
Pregnant women	185	202	17.1***	217	241	23.5***	6.4
HOSPITAL CHARACTERISTICS[e]							
Rural	0.57	0.56	−0.01	0.44	0.45	0.00	0.013***
Teaching	0.16	0.17	0.01	0.31	0.31	0.01	0.002
For profit	0.21	0.21	0.01	0.09	0.09	−0.00	−0.006
Public	0.30	0.26	−0.04***	0.19	0.17	−0.03***	0.010
Critical access	0.28	0.28	0.00	0.26	0.27	0.01**	0.006
200 or more beds	0.26	0.26	0.00	0.35	0.34	−0.01	−0.010
100–199 beds	0.22	0.19	−0.03***	0.23	0.22	−0.01	0.015
No. of unprofitable services	0.82	1.03	0.21***	1.22	1.42	0.21***	0.006
No. of profitable services	1.34	1.75	0.41***	1.63	2.07	0.44***	0.027
LOCAL-MARKET CHARACTERISTICS							
Median income ($10,000s)	4.38	4.83	0.45***	5.10	5.57	0.47***	0.018
Unemployment rate	7.30	5.49	−1.80***	7.99	6.06	−1.94***	−0.144
Herfindahl-Hirschman Index	0.16	0.17	0.02	0.16	0.17	0.01**	−0.002

SOURCE Authors' analysis of data from the Centers for Medicare and Medicaid Services, the Henry J. Kaiser Family Foundation, and the Census Bureau. **NOTES** Standard errors were calculated with state clustering. Total, operating, and Medicaid and uncompensated care margins are defined in the text. [a]Change over time in states that expanded eligibility for Medicare versus change in states that did not. [b]Data were first available for 2011. [c]Percent of federal poverty level. [d]Includes those eligible for the Children's Health Insurance Program. [e]Proportion of hospitals. **p < 0.05 ***p < 0.01

The childless adults category saw the largest increase in eligibility thresholds in expansion states because childless adults were the focus of the ACA's Medicaid expansion. After expansion, their eligibility threshold averaged 139 percent of poverty in those states, an increase of 136 percentage points. The changes in the other categories were higher in expansion than nonexpansion states. Among these changes, the difference between changes in thresholds for adults with dependent children was significant, reflecting a 40.8-percentage-point increase in poverty-related eligibility in expansion states vis-a-vis nonexpansion states. The changes over time in hospital characteristics, such as teaching status and the numbers of profitable and unprofitable services, were similar regardless of expansion status. However, nonexpansion states tended to have more rural hospitals, fewer teaching hospitals, and more for-profit and public hospitals than expansion states did. The increase in market-area median income and the decrease in unemployment rates were similar in expansion and nonexpansion states. The differences-in-differences in the hospital characteristics were not significant, with the exception of the rural indicator—which reflected higher rates of rural hospital closures in nonexpansion states.

The annual unadjusted hospital closure rate, measured as the number of closures per 100 hospitals, declined in both expansion and non-expansion states as the United States emerged from the 2008–09 Great Recession (exhibit 2). Between 2010 and 2012, closure rates were nearly identical in the two groups of states. They began to diverge after 2012. This may be related to the June 2012 Supreme Court decision that made the Medicaid expansion optional for states. Beginning in July 2012, over the twelve to eighteen months following the Supreme Court decision, states announced whether or not they would participate in the 2014 expansion.

The large increase in closures in nonexpansion states in 2013 occurred at a time when DSH payments were expected to be phased out. From 2012 to 2013 the closure rate increased from about 0.45 to just over 0.90 closures per 100 hospitals in nonexpansion states, whereas the rate remained at about 0.45 in expansion states. After 2014, the closure rate in expansion states declined but remained relatively high in nonexpansion states.

Exhibit 3 displays odds ratios from the logit analysis of the probability of hospital closure. The association of the ACA Medicaid expansion and the probability of closure in the difference-in-differences specification was measured using the odds ratio of the Post*Expansion State interaction. In the full sample, hospitals in expansion states were over six times (OR: 0.155), or about

Unadjusted hospital closure rates by state Medicaid expansion status, 2008–16
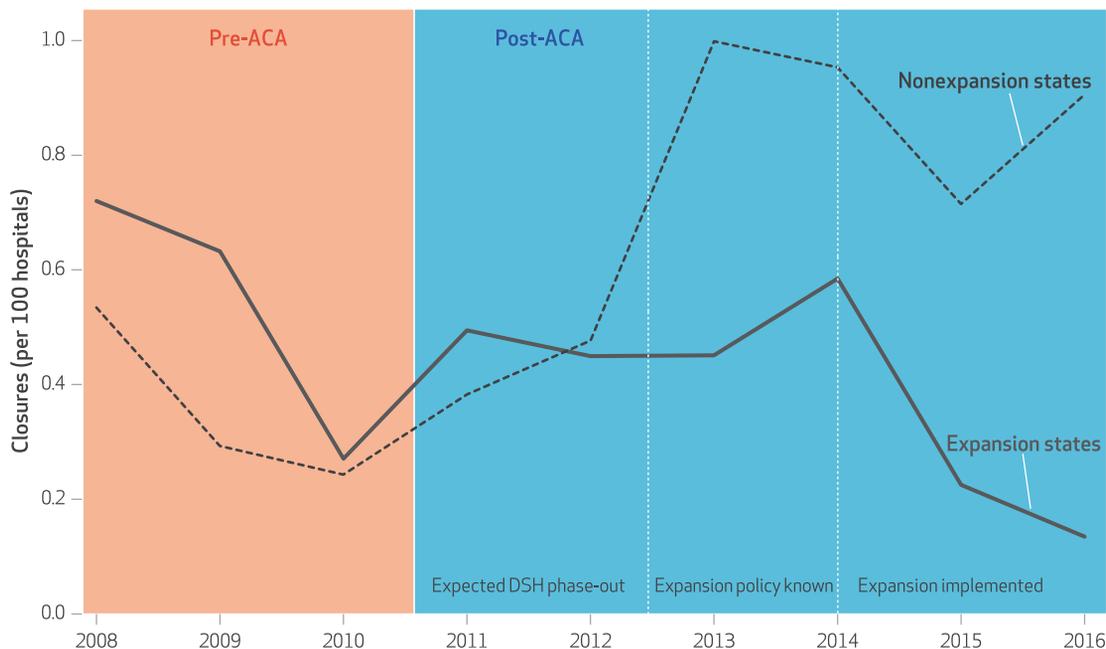
SOURCE Authors' analysis of data from the Centers for Medicare and Medicaid Services. **NOTE** Closures were independently validated from multiple sources.

EXHIBIT 3

Odds ratios of hospital closure, states that expanded Medicaid versus those that did not

	Difference-in-differences specification			Medicaid eligibility threshold specifications		
	All	Rural	Urban	All	Rural	Urban
Post*Expansion State	0.155***	0.184***	0.181**	—	—	—
Expansion State	1.672	1.373	2.149	1.479	1.257	1.939
Medicaid eligibility threshold						
Adults with dependent children	1.192	1.380	0.936	1.149	1.349	0.883
Childless adults	—	—	—	0.395***	0.346**	0.727
Children[a]	1.327	0.805	1.621	1.356	0.823	1.627
Pregnant women	0.714	1.153	0.588	0.734	1.209	0.589
Hospital characteristics						
Rural	0.574	—	—	0.576	—	—
Teaching	0.816	1.657	0.647	0.816	1.664	0.646
For profit	2.051***	1.943**	2.284***	2.022***	1.925**	2.269***
Public	0.587	0.425**	1.028	0.577	0.415**	1.023
Critical access	0.356***	0.299***	—	0.356***	0.304***	—
200 or more beds	0.272***	0.537	0.196***	0.271***	0.537	0.195***
100–199 beds	0.478***	0.494	0.455***	0.473***	0.487	0.449***
Number of unprofitable services	1.102	0.845	1.243**	1.106	0.844	1.248**
Number of profitable services	0.607***	0.331***	0.732***	0.609***	0.334***	0.731***
Local-market characteristics						
Median income	0.859	0.999	0.812**	0.985	1.001	0.979**
Unemployment rate	1.109***	1.160***	1.015	1.107***	1.161***	1.014
Herfindahl-Hirschman Index	0.292	0.137	0.397	0.292	0.136	0.391
Constant	0.023***	0.006***	0.050***	0.023***	0.006***	0.056***
Preexpansion tests: parallel trends?	Yes ($p = 0.404$)	Yes ($p = 0.310$)	Yes ($p = 0.982$)	—	—	—
Adj. means equal?	Yes ($p = 0.838$)	Yes ($p = 0.473$)	Yes ($p = 0.571$)	—	—	—
Number of observations	30,097	15,102	14,995	30,097	15,102	14,995
Number of hospitals	4,562	2,254	2,308	4,562	2,254	2,308

SOURCE Authors' analysis of data from the Centers for Medicare and Medicaid Services, the Henry J. Kaiser Family Foundation, and the Census Bureau. **NOTES** Standard errors were calculated with state clustering. The odds ratios are approximately equivalent to relative risk ratios because closures are a low-probability event. See exhibit 4 for estimates of the percentage changes in probability of closure. Total, operating, and Medicaid and uncompensated care margins are defined in the text. [a]Includes those eligible for the Children's Health Insurance Program. **p < 0.05 ***p < 0.01

84 percent, less likely to close than hospitals in nonexpansion states. This reduction in closure probability remained significant in the rural and urban subsamples.

The results of the Medicaid eligibility threshold specifications were consistent with those of the difference-in-differences specification in the full sample and the rural subsample. An increase in childless adults' Medicaid eligibility threshold of 100 percent of poverty made a hospital about 2.5 times (OR: 0.395) less likely to close than a hospital in a non-expansion state, with other factors held constant. However, in the urban hospital subsample, increasing childless adults' Medicaid income eligibility did not have a significant effect. The coefficients for the other eligibility categories were not significant. All specifications satisfied the parallel trends assumption. The p values of the tests for preexpansion parallel trends are reported at the bottom of exhibit 3.

The odd ratios on the other covariates in the Medicaid eligibility threshold specifications were quite similar to those in the difference-in-differences specifications. For instance, for-profit hospitals were associated with a higher likelihood of closure than the reference category of nonprofit hospitals were, and an increase in the number of profitable services was associated with a significantly lower likelihood of closure in all specifications. Local-market characteristics also influenced the probability of closures. Higher local unemployment rates were associated with a higher probability of hospital closure in both the full sample and the rural hospital subsample in both specifications, whereas increased median income was associated with a reduced probability of urban hospital closure. The coefficient estimates and the results of the sensitivity analyses are in the online appendix.[17]

Our results support the hypothesis that the expansion differentially affected hospitals in areas with high preexpansion uninsurance rates, with a greater effect in counties with higher preexpansion rates of uninsurance (exhibit 4). The estimates in each column reflect a different pre-

Association of state Medicaid expansion with hospital closures and financial margins, by county uninsurance rate

	Base case[b]	County residents ages 19–64 with no health insurance before expansion[a]						
		0%	5%	10%	15%	20%	25%	30%
ALL HOSPITALS								
Change in closure probability	−84.3%***	−79.3%***	−80.1%***	−80.9%***	−81.6%***	−82.2%***	−82.8%***	−83.3***
Change in margin								
Total	0.004	0.015	0.011	0.007	0.003	−0.000	−0.004	−0.008
Operating	0.015**	−0.018	−0.011	−0.003	0.005	0.012	0.020	0.028
Medicaid and uncompensated care	0.221***	0.055	0.101	0.146**	0.191***	0.237***	0.282***	0.327***
RURAL HOSPITALS								
Change in closure probability	−81.0%***	23.4%	−17.9%	−47.5%	−66.6%***	−78.6%***	−86.1%***	−90.7%***
Change in margin								
Total	0.013**	0.021	0.018	0.016	0.014**	0.011	0.009	0.007
Operating	0.030***	−0.040	−0.021	−0.003	0.016	0.034***	0.053***	0.071***
Medicaid and uninsured	0.177***	−0.127	−0.033	0.061	0.155***	0.248***	0.342***	0.436***
URBAN HOSPITALS								
Change in closure probability	−81.7%***	−63.0%	−71.9%**	−78.6%***	−83.7%***	−87.5%***	−90.5%***	−92.7%***
Change in margin								
Total	−0.008	−0.003	−0.005	−0.008	−0.010	−0.013	−0.015	−0.017
Operating	−0.008	−0.018	−0.017	−0.015	−0.014	−0.012	−0.011	−0.010
Medicaid and uncompensated care	0.276***	0.197	0.210	0.223**	0.236**	0.248**	0.261**	0.274**

SOURCE Authors' analysis of data from the Centers for Medicare and Medicaid Services, the Henry J. Kaiser Family Foundation, and the Census Bureau. **NOTES** Standard errors were calculated with state clustering. Total, operating, and Medicaid and uncompensated care margins are defined in the text. [a]Specification includes pre-2013 county uninsurance rates fully interacted. The percent change and marginal effects were recalculated at each level of uninsurance. [b]Percent change in probability of closures is based on the same specification as exhibit 3. **p < 0.05 ***p < 0.01

expansion uninsurance rate that increases moving from left to right. Column 1 reports the percentage decrease in the probability of closure associated with the Medicaid expansion using the primary specification with no interactions previously reported in exhibit 3. The full results of these specifications are available in the appendix.[17] Moving right from column 2, the percentage decrease in the probability of closure associated with the Medicaid expansion increased in magnitude and significance as county-level uninsurance rates increased in all three samples. The "dose response" was particularly strong for rural hospitals. The increase in the relationship between adult uninsurance rates and the association between the expansion and Medicaid and uninsured margins was particularly striking. While there was no difference between expansion and nonexpansion states in areas with uninsurance rates of less than 10 percent, the estimates became significant and quantitatively larger as the uninsurance rate increased above 10 percent.

Discussion

Our analysis of hospital closures in the period 2008–16 reveals that the ACA's expansion of eligibility for Medicaid for childless adults was associated with significant reductions in the probability of hospital closures. The results reported in exhibits 3 and 4 were stronger for rural hospitals, which also experienced significantly improved total, operating, and Medicaid and uncompensated care margins related to the ACA's Medicaid expansion. We posit that the primary mechanism that underlies the relationship between hospital closures and Medicaid expansions is the substitution of utilization by patients with Medicaid coverage for utilization by uninsured patients. The financial benefit from this shift in utilization improved hospitals' financial margins and enabled them to remain in business. We also found that the financial benefits of the ACA's Medicaid expansion, and corresponding decreased risk of closure, were greater for hospitals in areas with higher uninsurance rates. This result, as reported in exhibit 4, was more pronounced for hospitals in rural areas. The finding that the relationship was stronger at hospitals in areas with higher uninsurance rates strongly supports the link between hospitals' financial viability and increased rates of health insurance coverage as a consequence of the ACA's Medicaid expansion.

Our results echo other findings from the liter-

ature. For example, hospitals in expansion states were found to have significantly better financial performance in 2014 than hospitals in non-expansions states.[7] For-profit hospitals are significantly more likely to close than nonprofit ones,[18–20] reflecting their mission to maximize profits by closing instead of subsidizing unprofitable hospitals so that they can reallocate capital from unprofitable markets to more profitable markets or industries. Higher unemployment rates increase the probability of closure among rural hospitals.[21] Critical access hospitals are less likely to close than other rural hospitals, as a result of relatively generous reimbursement under Medicare's critical access hospital program.[8] Rural hospitals have previously been shown to be at greater risk of closure compared to urban hospitals.[22]

The characteristics of rural markets (for example, their low volume of patients and few private payers) as well as segments of urban markets served by safety-net hospitals (for example, their large numbers of medically indigent and Medicaid patients) may make it difficult for even an efficient hospital to survive.[23,24] In such markets, the social benefit of access to an individual hospital potentially outweighs any efficiency gains related to its closure.[25,26]

Governments at all levels have enacted policies that subsidize local hospitals. For example, counties and municipalities commonly subsidize, and in some cases bail out, safety-net hospitals that play a critical role in providing access to local patients.[26] At the federal level, concerns about rural hospital closures in the late 1980s and early 1990s led Congress to preferentially reimburse hospitals that qualified for critical access hospital status in the Balanced Budget Act of 1997. Medicare and Medicaid DSH payments were implemented in 1981 to offset the cost that hospitals incurred from treating large numbers of uninsured and Medicaid patients. All of these mechanisms support hospitals through direct transfers or preferential payments to eligible hospitals.

As other research has also shown, policies that increase insurance coverage by subsidizing premiums—through an ACA Marketplace or a Medicaid expansion—will also improve the financial health of hospitals that treat newly insured patients.[7] This mechanism directly links the financial benefit of health insurance coverage to the hospital that provides the care. Reimbursement at the point of care is a substitute for government subsidies that flow directly to hospitals. This substitution was recognized in the original version of the ACA, which directed that DSH allotments be phased out because health insurance coverage rates were projected to in-

In rural areas with fewer hospitals, hospital closures are likely to have more serious consequences.

crease. The targeted reduction in DSH allotments was delayed in subsequent legislation, in part because not all states chose to expand Medicaid.[27]

If future policies are adopted that both eliminate the Medicaid expansion and lower health insurance coverage rates, our findings suggest that hospitals' financial positions would suffer, leading to increased hospital closures. If policy makers repeal the ACA's Medicaid expansion, many rural hospitals in expansion states will need additional subsidies to remain in operation. Policy alternatives include increased DSH payments, expansion of the critical access hospital program, and other mechanisms.

Although our results do not measure the effects of variation in DSH payments, hospital closures that occurred in 2013 and 2014 were made at the time when DSH payments were expected to be phased out—which might explain the uptick in closures in both expansion and nonexpansion states. The Bipartisan Budget Act of 2013 and subsequent legislation has delayed the phasing out of DSH payments. Under the Medicare Access and CHIP Reauthorization Act of 2015, the phase-out began at the start of federal fiscal year 2018.[27] It will need to be addressed in the context of policies that either change or repeal ACA's Medicaid expansion.

When making decisions related to hospital subsidies and other forms of financial support, policy makers should also consider whether a hospital closure is harmful to patients. The effects of closure on access and patient welfare depend upon local hospital market structure and the degree to which local residents rely on the hospital for inpatient care. Research has shown that urban hospitals that close are often more inefficient or of poorer quality than their competitors. Closure may reflect the existence of more desirable alternatives that are valued more by local residents. In such cases, hospital closures are a sign that hospitals have been performing poorly.[20,28,29] Closure can actually improve patient welfare, because patients who

would otherwise have gone to the closed hospital will be treated instead at better-managed hospitals.[26,28] However, virtually all closures will increase the travel time required for some patients to access hospital services.[30] This could lead to worse outcomes for patients with conditions for which the need for care is time sensitive.[31,32] In addition, hospitals are often major employers of local residents. The closure of a hospital results in the loss of well-paid, highly skilled jobs. Absent alternative employers, hospital closures will hasten the migration of well-paid skilled labor to larger cities.[33]

Given the idiosyncratic circumstances related to hospital closures, whether to subsidize a hospital to keep it open is an empirical question that incorporates the trade-offs between access, quality, and efficiency.[26,34,35] Nonetheless, in rural areas with fewer hospitals, hospital closures are likely to have more serious consequences than in urban areas.

Conclusion

Our results shed light on some implications of current policy proposals being considered by the 115th Congress. A policy that eliminates the Medicaid expansion without a corresponding adjustment in DSH payments or other subsidies will likely result in an increase in hospital closures, especially in rural areas. If patients do not have access to other hospitals, as is the case in many rural markets, access to health care will suffer, regardless of whether a person has health insurance. ∎

NOTES

1 Courtemanche C, Marton J, Ukert B, Yelowitz A, Zapata D. Early impacts of the Affordable Care Act on health insurance coverage in Medicaid expansion and non-expansion states. J Policy Anal Manage. 2017;36(1):178–210.

2 Kaestner R, Garrett B, Chen J, Gangopadhyaya A, Fleming C. Effects of ACA Medicaid expansions on health insurance coverage and labor supply. J Policy Anal Manage. 2017;36(3):608–42.

3 DeLeire T, Joynt K, McDonald R. Impact of insurance expansion on hospital uncompensated care costs in 2014 [Internet]. Washington (DC): Department of Health and Human Services, Office of the Assistant Secretary for Planning and Evaluation; 2014 Sep 24 [cited 2017 Nov 29]. (Issue Brief). Available from: https://aspe.hhs.gov/system/files/pdf/77061/ib_Uncompensated Care.pdf

4 Colorado Hospital Association. Impact of Medicaid expansion on hospital volumes. Greenwood Village (CO): CHA; 2014 Jun.

5 Cunningham P, Garfield R, Rudowitz R. How are hospitals faring under the Affordable Care Act? Early experiences from Ascension Health [Internet]. Washington (DC): Kaiser Commission on Medicaid and the Uninsured; 2015 Apr 30 [cited 2017 Nov 29]. Available from: https://www.kff.org/health-reform/issue-brief/how-are-hospitals-faring-under-the-affordable-care-act-early-experiences-from-ascension-health/

6 Camilleri S. The ACA Medicaid expansion, disproportionate share hospitals, and uncompensated care. Health Serv Res. 2017 May 8. [Epub ahead of print].

7 Blavin F. Association between the 2014 Medicaid expansion and US hospital finances. JAMA. 2016;316(14):1475–83.

8 Kaufman BG, Thomas SR, Randolph RK, Perry JR, Thompson KW, Holmes GM, et al. The rising rate of rural hospital closures. J Rural Health. 2016;32(1):35–43.

9 Alaska, Indiana, and Pennsylvania expanded Medicaid in 2015. Montana and Louisiana did so in 2016. Michigan and New Hampshire did so on April 1 and August 15, 2014, respectively. These states were included in the analysis because they still had time to ramp up enrollment in 2014, which was during our washout period.

10 Henry J. Kaiser Family Foundation. Total monthly Medicaid and CHIP enrollment [Internet]. Menlo Park (CA): KFF; 2017 Sep [cited 2017 Nov 29]. Available from: https://www.kff.org/health-reform/state-indicator/total-monthly-medicaid-and-chip-enrollment/

11 Several online sources were particularly helpful for identifying closures: Becker's Hospital Review and the North Carolina Rural Health Research Program at the University of North Carolina's Cecil G. Sheps Center for Health Services Research were helpful sources of information from 2010 to present. Information on closures before 2010 was available from lists compiled by state hospital associations and newspaper articles that covered hospital mergers, acquisitions, and closures. We were able to identify the status of all hospitals on our original list. However, in a few cases, it was unclear whether a hospital on the Provider of Services list had merged with another institution or closed. We used Google Maps to look up the location of such hospitals and confirmed that there was not a general hospital in operation.

12 Horwitz JR. Making profits and providing care: comparing nonprofit, for-profit, and government hospitals. Health Aff (Millwood). 2005;24(3):790–801.

13 Dartmouth Institute for Health Policy and Clinical Practice. Dartmouth atlas of health care [Internet]. Lebanon (NH): The Institute; c 2017 [cited 2017 Nov 28]. Available from: http://www.dartmouthatlas.org/data/region/

14 States with major expansions of eligibility for childless adults before 2014 include Arizona, Connecticut, Delaware, the District of Columbia, and Vermont in 2011 and Minnesota in 2012.

15 Ai C, Norton EC. Interaction terms in logit and probit models. Econ Lett. 2003;80(1):123–9.

16 Dimick JB, Ryan AM. Methods for evaluating changes in health care policy: the difference-in-differences approach. JAMA. 2014;312(22):2401–2.

17 To access the appendix, click on the Details tab of the article online.

18 Ciliberto F, Lindrooth RC. Exit from the hospital industry. Econ Inq. 2007;45(1):71–81.

19 Deily ME, McKay NL, Dorner FH. Exit and inefficiency: the effects of ownership type. J Hum Resour. 2000;35(4):734–47.

20 Joynt KE, Chatterjee P, Orav EJ, Jha AK. Hospital closures had no measurable impact on local hospitalization rates or mortality rates, 2003–11. Health Aff (Millwood). 2015; 34(5):765–72.

21 Thomas SR, Holmes GM, Pink GH. To what extent do community characteristics explain differences in closure among financially distressed rural hospitals? J Health Care Poor Underserved. 2016;27(4A):194–203.

22 Kaufman BG, Reiter KL, Pink GH, Holmes GM. Medicaid expansion affects rural and urban hospitals differently. Health Aff (Millwood). 2016;35(9):1665–72.

23 Holmes GM, Kaufman BG, Pink GH. Predicting financial distress and closure in rural hospitals. J Rural Health. 2017;33(3):239–49.

24 Bazzoli GJ, Kang R, Hasnain-Wynia R, Lindrooth RC. An update on safety-net hospitals: coping with the late 1990s and early 2000s. Health Aff (Millwood). 2005;24(4): 1047–56.

25 McNamara PE. Welfare effects of rural hospital closures: a nested logit analysis of the demand for rural hospital services. Am J Agric Econ. 1999;81(3):686–91.

26 Capps C, Dranove D, Lindrooth RC. Hospital closure and economic efficiency. J Health Econ. 2010;29(1): 87–109.

27 Medicaid and CHIP Payment and Access Commission. Report to Congress on Medicaid Disproportionate Share Hospital payments [Internet]. Washington DC: MACPAC; 2016 Feb [cited 2017 Nov 29]. Available from: https://www.macpac.gov/wp-content/uploads/2016/01/Report-to-Congress-on-Medicaid-DSH.pdf

28 Harrison TD. Consolidations and closures: an empirical analysis of exits from the hospital industry. Health Econ. 2007;16(5):457–74.

29 Lindrooth RC, Lo Sasso AT, Bazzoli GJ. The effect of urban hospital closure on markets. J Health Econ. 2003;22(5):691–712.

30 Bazzoli GJ, Lee W, Hsieh HM, Mobley LR. The effects of safety net hospital closures and conversions on patient travel distance to hospital services. Health Serv Res. 2012; 47(1 Pt 1):129–50.

31 Buchmueller TC, Jacobson M, Wold C. How far to the hospital? The effect of hospital closures on access to care. J Health Econ. 2006;25(4):740–61.

32 Hsia RY, Kanzaria HK, Srebotnjak T, Maselli J, McCulloch C, Auerbach AD. Is emergency department closure resulting in increased distance to the nearest emergency department associated with increased inpatient mortality? Ann Emerg Med. 2012;60(6):707–715.e4.

33 Holmes GM, Slifkin RT, Randolph RK, Poley S. The effect of rural hospital closures on community economic health. Health Serv Res. 2006;41(2):467–85.

34 Wishner J, Solleveld P, Rudowitz R, Paradise J, Antonisse L. A look at rural hospital closures and implications for access to care: three case studies [Internet]. Washington (DC): Kaiser Commission on Medicaid and the Uninsured; 2016 Jul 7 [cited 2017 Nov 29]. Available from: http://www.kff.org/report-section/a-look-at-rural-hospital-closures-and-implications-for-access-to-care-three-case-studies-issue-brief/

35 Hodgson A, Roback P, Hartman A, Kelly E, Li Y. The financial impact of hospital closures on surrounding hospitals. J Hosp Adm. 2015;4(3): 25–34.