Rural Hospitals' Profitability: Which Special Programs Matter?

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ABSTRACT

Objective. To assess Medicare special programs' effectiveness in preserving the financial viability of rural hospitals.

Data sources. This study utilizes national data for non-federal, short-term, general, and critical access hospitals in operation for at least 360 days during the period 2012–2019, obtained from the Centers for Medicare & Medicaid Services Healthcare Cost Report Information System (HCRIS) and the American Hospital Association (AHA) Annual Survey Database.

Study Design. This longitudinal study consists of 2,214 rural hospitals during the period 2012-2019 and relies on an unbalanced panel design to examine the relationship between Medicare special programs and the financial performance of rural hospitals.

Data Collection/Extraction methods: The analysis was performed using fixed-effects regression analysis. Robust standard errors are clustered at the hospital level to correct for possible heteroskedasticity and autocorrelation.

Principal Findings: The base average operating margin (OM) of rural hospitals was significantly lower level (-7.40% vs. -1.35%) than metropolitan hospitals in the beginning of the study and fell by 2.49% over the years. In comparison, the OM of metropolitan hospitals fell by 1.35% during the eight-year study period. Our analysis indicates that the special Medicare programs targeted for rural hospitals did not significantly help the financial position of rural hospitals.

Conclusions: Policy makers need to explore and identify more effective policies to improve the financial viability of rural hospitals.

Keywords: rural hospitals, financial condition, Medicaid expansion states, Critical Access Hospitals, Sole Community Hospitals, Rural Referral Centers

INTRODUCTION

Given the significance of rural hospitals to the communities they serve, the federal government has developed programs over the years to protect their financial well-being, a precursor of closure.[1] The survival of rural hospitals has an impact on access to healthcare services for approximately 57 million individuals in the United States.[2] [3] Rural populations tend to be poorer, older, on Medicare or Medicaid, and have poorer overall health.[4] Rural residents, including Medicare beneficiaries, experience disparities that are worsened by poor access and hospital closures.[5] Mortality rates are worse for low-income Medicare beneficiaries in rural areas than their non-rural counterparts.[6] Moreover, the current pandemic has exacerbated the challenges faced by rural hospitals. As Henning-Smith[7] explains, populations in rural settings tend to be older and have more underlying health conditions, and, therefore, they are more vulnerable to the risks of COVID-19. Hale and associates[8] argue that the "well-documented historical barriers in accessing preventive and treatment-related health care services, which contribute to higher overall mortality and decreased life expectancy in rural communities, remains a salient issue during the ongoing pandemic." Rural hospitals suffer from workforce shortages and thus have limited capacity to absorb a surge in demand, which places rural communities in a particularly vulnerable position during the pandemic. Finally, rural hospitals are essential to the economies of the communities they serve since they are major employers, bring in funds from outside the community, and stimulate the growth of local businesses.[9]

Rural hospitals operate in a challenging environment that significantly reduces their profits and, thus, their ability to serve their communities. The poor financial performance of rural hospitals has accelerated their closure rate.[10] One hundred and eighty-one rural hospitals have closed since 2005 and the number of closures exceeded 10 every year since 2013 with 18 closures in 2019 and

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[1] J. Cosgrove, "Rural hospital closures: Number and characteristics of affected hospitals and contributing factors," *GAO Reports* (2018).

[2] Jane Wishner, Patricia Solleveld, Robin Rudowitz, Julia Paradise and Larisa Antonisse, "A look at rural hospital closures and implications for access to care: three case studies," *Kaiser Family Foundation [Internet]* (2016).

[3] Health Resources and Services Administration, "Defining the Rural Population," (2021). https://www.hrsa.gov/rural-health/about-us/definition/index.html.

[4] Brystana G. Kaufman, Sharita R. Thomas, Randy K. Randolph, Julie R. Perry, Kristie W. Thompson, George M. Holmes and George H. Pink, "The rising rate of rural hospital closures," *The Journal of Rural Health* 32, no. 1 (2016).

[5] Emefah Loccoh, Karen E Joynt Maddox, Jiaman Xu, Changyu Shen, José F Figueroa, Dhruv S Kazi, Robert W Yeh and Rishi K Wadhera, "Rural-Urban Disparities In All-Cause Mortality Among Low-Income Medicare Beneficiaries, 2004–17: Study examines all-cause mortality rates for rural and urban low-income Medicare beneficiaries dually enrolled in Medicaid," *Health Affairs* 40, no. 2 (2021).

[6] Loccoh et al., "Rural-Urban Disparities In All-Cause Mortality Among Low-Income Medicare Beneficiaries, 2004–17: Study examines all-cause mortality rates for rural and urban low-income Medicare beneficiaries dually enrolled in Medicaid."

[7] Carrie Henning-Smith, "The unique impact of COVID-19 on older adults in rural areas," *Journal of Aging & Social Policy* 32, no. 4-5 (2020).

[8] N. Hale, M. Meit, S. Petttjohns, M. Wahlquist and M. Loos, "The Implications of Long COVID on Rural Communities. ," *Journal of Rural Health* (2022).

[9] Gerald A Doeksen, Thomas G Johnson, and Chuck Willoughby, *Measuring the economic importance of the health sector on a local economy: A brief literature review and procedures to measure local impacts* (Southern Rural Development Center Starkville, MS, 1997).

[10] Kaufman et al., "The rising rate of rural hospital closures."

19 in 2020.[11] To protect the health of rural communities, the federal government developed special Medicare programs to reduce the financial burdens of rural hospitals. These special programs include Critical Access Hospital (CAH), Sole Community Hospital (SCH), Rural Referral Center (RRC), and Medicare-Dependent Hospital (MDH) designations. The eligibility criteria differ between these programs but are mainly based on hospital size and distance from other hospitals.[12]

CMS grants CAH designation to hospitals with twenty-five or fewer beds, have an emergency department, are at least thirty-five miles away from the nearest hospital, and have an average length of stay of fewer than four days.[13] CAHs designated by their state as a Necessary Provider prior to January 1, 2006, are exempt from distance requirements.[14] CAHs are reimbursed by Medicare on the basis of reasonable costs.[15] The SCH designation was developed by Congress in 1983 to support rural hospitals, which are small in size and are often the only provider of inpatient care for rural residents in isolated locations.[16] SCHs are different from other rural hospitals.[17] They are almost exclusively not-for-profit, small in size, have lower staffing levels, and more likely than other rural hospitals to have an intensive care unit. [18] Hospitals qualify as RRCs and receive federal support if they are "high-volume hospitals that treat complicated cases and function as regional or national referral centers."[19] To be classified as an MDH "a hospital must be located in a rural area, have 100 or fewer beds, not be classified as a SCH, and have had at least 60 percent of its inpatient days or discharges attributable to Medicare beneficiaries." [20]

CAHs are the only rural general hospitals that are exempted from Medicare's Inpatient Prospective Payment System (IPPS) and are reimbursed by Medicare for 101% of allowable Medicare cost.[21] The federal government assists other rural hospitals with payment adjustments and alternative payment models. IPPS payments for other rural hospitals are adjusted or are based

[11] "Rural Hospital Closures," 2021, accessed 9/24/2021, 2021, https://www.shepscenter.unc.edu/programs-projects/rural-health/rural-hospital-closures/.

[12] George M. Holmes, George H. Pink, and Sarah A. Friedman, "The financial performance of rural hospitals and implications for elimination of the critical access hospital program," *The Journal of Rural Health* 29, no. 2 (2013).

[13] Centers for Medicare and Medicaid, Critical Access Hospitals, (2019).

[14] Medicare Payment Advisory Commission, *Payment Basics: Critical Access Hospitals Payment System.* (Washington, DC: Medicare Payment Advisory Commission (MedPAC), 2008).

[15] Ge Bai, Farah Yehia, Wei Chen and Gerard F Anderson, "Varying Trends In The Financial Viability Of US Rural Hospitals, 2011–17: Study examines the financial viability of 1,004 US rural hospitals that had consistent rural status in 2011–17," *Health Affairs* 39, no. 6 (2020).

[16] Frances M Wu, Stephen M. Shortell, Thomas G. Rundall, and Joan R. Bloom., "The role of health information technology in advancing care management and coordination in accountable care organizations," *Health care management review* 42, no. 4 (2017).

[17] Wu et al., "The role of health information technology in advancing care management and coordination in accountable care organizations."

[18] Dean E Farley, *Sole Community Hospitals: Are They Different?*, vol. 5 (US Department of Health and Human Services, Public Health Service, Office of the Assistant Secretary for Health, National Center for Health Services Research and Health Care Technology Assessment, 1985).

[19] Medicare Payment Advisory Commission, *Report to the Congress: Medicare in Rural America* (Medicare Payment Advisory Commission, 2001)., p. 58

[20] Medicare Payment Advisory Commission, *Report to the Congress: Medicare in Rural America.*, p.97

[21] George M. Holmes, *A comparison of rural hospitals with special Medicare payment provisions to urban and rural hospitals paid under prospective payment* (NC Rural Health Research & Policy Analysis Center, 2010).

on cost per discharge to determine a hospital's specific payment rate.[22] SCHs and MDHs, due to their low volume, also benefit from a volume decline adjustment when their volume drops by more than 5%.[23] Reimbursement for RRCs is the same as the IPPS reimbursement rate for urban hospitals, which is higher than the rural hospital IPPS rate. Finally, SCHs, MDHs, and RRCs benefit from higher disproportionate share payments. The Medicare Modernization Act (MMA) of 2003 increased the disproportionate share adjustment for RRCs and SCHs with a limit of 12% for SCHs.[24]

Details about the benefits and eligibility requirements for hospitals participating in the Medicare special rural hospital programs are provided in Table 1. Among smaller hospitals, whose financial position suffers the most under PPS because of lack of scale, it appears that MDH and SCH facilities receive the least generous benefits.

Table 1 Description of Medicare Programs Targeted for Rural Hospitals

Name of Program	Eligibility Requirements and Benefits
Critical Access Hospital (CAH)	**Eligibility Requirements** • located 35 miles or more from a similar hospital • Prior to 2006 35-mile limit was waived if certified by its state as being a necessary provider of health care services to residents • provides 24-hour emergency care services • has no more than 25 beds • has an average length of stay no more than 96 hours **Benefits** • exempt from IPPS and are paid by Medicare at the rate of 101 percent of approved costs
Medicare Dependent Hospital (MDH)	**Eligibility Requirements** • have at least 60 percent of its inpatient days or admissions covered by Medicare • no more than 100 beds • not be classified as a SCH **Benefits** • receives the higher of IPPS rate or a blend of current IPPS rates (25 percent) and their historical costs (75 percent) • if the number of cases treated declines by more than 5 percent the hospital can receive Medicare payments to fully compensate it for fixed costs

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[22] Holmes, *A comparison of rural hospitals with special Medicare payment provisions to urban and rural hospitals paid under prospective payment*.

[23] Holmes, Pink, and Friedman, "The financial performance of rural hospitals and implications for elimination of the critical access hospital program."

[24] Holmes, *A comparison of rural hospitals with special Medicare payment provisions to urban and rural hospitals paid under prospective payment*.

Table 1 Description of Medicare Programs Targeted for Rural Hospitals (continued)

Name of Program	Eligibility Requirements and Benefits
Rural Referral Center (RRC)	**Eligibility Requirements** • at least 275 beds • at least 50 percent of its Medicare patients referred from other hospitals by physicians not on the hospital staff • at least 60 percent of the hospital's Medicare patients live more than 25 miles from the hospital • at least 5,000 discharges per year • a case-mix index value greater than or equal to the median for all urban hospitals in the same region **Benefits** • receive Medicare payments that are based on the higher urban IPPS rate • higher DSH adjustments • relaxed criteria for geographic reclassification which, in turn, allows them to receive higher wage adjustments for their IPPS calculations
Sole Community Hospital (SCH)	**Eligibility Requirements:** • located at least 35 miles from a "like"[1] hospital or have a travel time from a like hospital of at least 45 minutes; rural hospitals can also qualify for this program if they are at least 25 miles from a similar hospital and have less than 50 beds and no more than 25% of hospitalized inpatient Medicare patients in the hospital's service area are admitted to other like hospitals within a 35-mile radius of the hospital or, if larger, within its service area **Benefits** • receives the higher of IPPS rate or a blend of current IPPS rates (25 percent) and their historical costs (75 percent) • receive a higher disproportionate share (DSH) adjustment • receive payments to fully compensate for fixed costs if the hospital suffers a decline of more than 5 percent in the total number of cases treated

Sources: CMS 2019, MedPac 2001, https://www.cms.gov/Medicare/Provider-Enrollment-and-Certification/CertificationandComplianc/CAHs, http://www.medpac.gov/docs/default-source/payment-basics/medpac_payment_basics_17_cah_final09a311adfa9c665e80adff00009edf9c.pdf

Note [1] CMS (2019) defines "like" hospital as one that furnishes short-term, acute care but is not designated as CAH.

While the federal government has relied on these programs to support rural hospitals for decades now, little is known about their impact on rural hospitals' operating and total margins in the post-Medicaid expansion era. In this study, we examine the profitability of rural hospitals from 2012 to 2019. We perform a longitudinal analysis to determine the relationship between special federal programs and the financial performance of rural hospitals. This is the first longitudinal study to use multivariate methods to separately analyze the four Medicare special programs for rural hospitals. We use an unbalanced panel design which allowed us to include almost twice as

many rural hospitals in the study file as the most recent study of rural hospital financial status.[25] This gives us a "truer" depiction of the financial status of rural hospitals as we found that hospitals that reported less than 7 years of data in our 8-year panel were less profitable than those that reported data for 7 or 8 years. For example, the operating margin for rural hospitals that reported data for 7 or more years was –8.11%, while the operating margin for rural hospitals that reported data for less than 7 years was -17.54% A similar difference was found for the total margin. Bai and colleagues[26] acknowledged that their balanced panel design could result in overstating hospital profits.

1. METHODS

1.1. Data and Sample

The analysis includes non-federal, short-term, general, and critical access hospitals in operation for at least 360 days during the period 2012–19. The analytical file included 2,214 rural hospitals and 2,002 metropolitan hospitals. Some hospitals opened during the study period and others closed; therefore, an unbalanced panel was used with 16,861 observations from rural hospitals and 14,509 from metropolitan hospitals. The vast majority of hospitals reported data for 7 (7.4%) or 8 years (85.9%).

We had two options for choosing a reference group for the payment variables, metropolitan hospitals or rural PPS hospitals. The latter allows a comparison of hospitals with more similar operating and market environments. However, rural PPS hospitals are a poor benchmark for gauging payment mechanisms as hundreds of hospitals failed because of the inadequacies of the Medicare PPS and many opted to leave PPS to obtain more sustainable cost-based payment rates as CAHs.[27] Since either option has its shortcoming, we chose to use both and estimate regression equations for a full sample of hospitals and for a sample restricted to rural hospitals. Therefore, the reference group for the binary variables representing the Medicare special programs will be metropolitan hospitals in the former and RuralPPS in the latter.

The primary sources of data are the Centers for Medicare & Medicaid Services Healthcare Cost Report Information System (HCRIS) and the American Hospital Association (AHA) Annual Survey Database. HCRIS contains annual Medicare Cost Reports and provides information for constructing key financial measures and hospital eligibility for the Medicare special payment programs. HCRIS has known limitations with item nonresponse and data quality.[28] [29] Further, financial data can vary substantially because of accounting events (e.g., write-offs). We dealt with

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[25] Bai et al., "Varying Trends In The Financial Viability Of US Rural Hospitals, 2011–17: Study examines the financial viability of 1,004 US rural hospitals that had consistent rural status in 2011–17."

[26] Bai et al., "Varying Trends In The Financial Viability Of US Rural Hospitals, 2011–17: Study examines the financial viability of 1,004 US rural hospitals that had consistent rural status in 2011–17."

[27] Michael D. Rosko and Ryan L. Mutter, "Inefficiency differences between critical access hospitals and prospectively paid rural hospitals," *J Health Polit Policy Law* 35, no. 1 (Feb 2010), https://doi.org/10.1215/03616878-2009-042.

[28] Gloria J. Bazzoli, Naleef Fareed, and Teresa M. Waters, "Hospital financial performance in the recent recession and implications for institutions that remain financially weak," *Health Aff (Millwood)* 33, no. 5 (May 2014), https://doi.org/10.1377/hlthaff.2013.0988, https://www.ncbi.nlm.nih.gov/pubmed/24799569.

[29] Fredric Blavin and Christal Ramos, "Medicaid Expansion: Effects On Hospital Finances And Implications For Hospitals Facing COVID-19 Challenges," *Health Aff (Millwood)* 40, no. 1 (Jan 2021), https://doi.org/10.1377/hlthaff.2020.00502, https://www.ncbi.nlm.nih.gov/pubmed/33400570.

outliers by winsorizing at the first and ninety-ninth percentiles. We excluded about 2.5 percent of the observations with missing data or with data reported for a period of less than 360 days. The excluded hospitals were about the same bed size as the hospitals in the final analytical file but were more likely to be in a Medicaid expansion state or a multi-hospital system, have a teaching program but less likely to be a for-profit or government owned hospital.

The AHA data provide information on hospitals' organizational characteristics and utilization. While this study focuses on rural hospitals, we include metropolitan hospitals to serve as a reference group. We also include a category, termed RuralPPS, comprised of rural hospitals that do not participate in any of the special Medicare programs that are the focus of this study.

To avoid confounding results, we do not include metropolitan hospitals (i.e., 2,318 observations from 425 hospitals) that participated in any of the four Medicare special programs that were designed for rural hospitals. Rural areas were defined by the criteria (i.e., located in non-metropolitan counties or in census tracts in metropolitan areas with a Rural-Urban Commuting Area (RUCA) code of 4.0 or greater) established by the Federal Office of Rural Health Policy.[30]

1.2. Statistical Methods

We used Stata, Version 15 to estimate fixed-effect regressions to examine the relationship between federal special programs and hospital profitability. The fixed-effects technique cannot detect the effects of variables that do not change much over time within hospitals. Thus, the insignificant coefficients estimated for these variables should be interpreted carefully. Robust standard errors are clustered at the hospital level to correct for possible heteroskedasticity and autocorrelation.

We employed two variables to reflect hospital profitability – 1) total margin is defined as total income divided by revenue, and 2) operating margin is net patient income divided by net patient revenue. The latter measures profitability from operations and is a more sensitive measure of the impact of payment policies. Total margin includes non-operating sources of income such as investments, philanthropy and government appropriations and is a better measure of the solvency of hospitals.[31] The reader should note that in 2017 investment income was by far the largest source of non-operating income for not-for-profit hospitals accounting for 43 percent of non-operating income.[32] The profit margin variables were winsorized at the first and ninety-ninth percentiles of the original distribution to prevent unrealistically large or small outliers from biasing our results.

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[30] https://www.hrsa.gov/rural-health/about-us/definition/index.html

[31] Michael D. Rosko, Mona Al-Amin, and Manouchehr Tavakoli., "Efficiency and profitability in US not-for-profit hospitals," *Int J Health Econ Manag* 20, no. 4 (Dec 2020), https://doi.org/10.1007/s10754-020-09284-0, https://www.ncbi.nlm.nih.gov/pubmed/32816192.

[32] Ge Bai, Farah Yehia, Wei Chen, and Gerard F. Anderson., "Investment Income of US Nonprofit Hospitals in 2017," *J Gen Intern Med* 35, no. 9 (Sep 2020), https://doi.org/10.1007/s11606-020-05929-5.

1.3. Profit Model

To develop a theoretical model for the regression analysis of financial margins, we consulted 12 recent (i.e., 2007 or later) articles that examined hospital profitability. [33] [34] [35] [36] [37] [38] [39] [40] [41] [42] [43] [44] While there was considerable inconsistency in the variables used in these studies, most of the studies used independent variables that can be grouped as follows: government policy, hospital characteristics, patient characteristics, and environmental characteristics.

Government Policy To represent government policy, we included binary variables for the four special Medicare programs that are the focus of this study and for hospitals located in a state that expanded its Medicaid program following the passage of the Affordable Care Act. We also included a variable for hospitals that were classified as both Rural Referral Centers (RRC) and Sole Community Hospitals (SCH). This variable was mutually exclusive from hospitals that participated in only one special program. More cases were classified as RCC and SCH (n = 699) than just RCC (n = 674). We also included a variable for as a residual category, labeled Other Multi-Medicare (n = 133), for hospitals in other multiple combinations of Medicare special programs. Because of the small size of this category, we do not discuss its results. We hypothesize that participation in these programs will improve hospital financial performance as measured by operating margin and total margin.

Hospital Characteristics Hospital size and membership in multi-hospital systems are likely to affect hospitals profits in similar ways. On the cost-side, they are likely to convey the benefits

[33] Ge Bai and Gerard F Anderson, "A More Detailed Understanding Of Factors Associated With Hospital Profitability," *Health Aff (Millwood)* 35, no. 5 (May 1 2016), https://doi.org/10.1377/hlthaff.2015.1193, https://www.ncbi.nlm.nih.gov/pubmed/27140996.

[34] Bai et al., "Varying Trends In The Financial Viability Of US Rural Hospitals, 2011–17: Study examines the financial viability of 1,004 US rural hospitals that had consistent rural status in 2011–17."

[35] Bazzoli, Fareed, and Waters, "Hospital financial performance in the recent recession and implications for institutions that remain financially weak."

[36] Fredric Blavin, "Association Between the 2014 Medicaid Expansion and US Hospital Finances," *JAMA* 316, no. 14 (Oct 11 2016), https://doi.org/10.1001/jama.2016.14765, https://www.ncbi.nlm.nih.gov/pubmed/27727384.

[37] Blavin and Ramos, "Medicaid Expansion: Effects On Hospital Finances And Implications For Hospitals Facing COVID-19 Challenges."

[38] Brystana G. Kaufman, Kristin L. Reiter, George H. Pink, and George M. Holmes, "Medicaid Expansion Affects Rural And Urban Hospitals Differently," *Health Affairs* 35, no. 9 (2016/09/01 2016), https://doi.org/10.1377/hlthaff.2016.0357, https://doi.org/10.1377/hlthaff.2016.0357.

[39] Richard C. Lindrooth, Marcelo C. Perraillon, Rose Y. Hardy, and Gregory J. Tung, "Understanding The Relationship Between Medicaid Expansions And Hospital Closures," *Health Aff (Millwood)* 37, no. 1 (Jan 2018), https://doi.org/10.1377/hlthaff.2017.0976, https://www.ncbi.nlm.nih.gov/pubmed/29309219.

[40] Dan P. Ly and David M. Cutler, "Factors of U.S. Hospitals Associated with Improved Profit Margins: An Observational Study," *J Gen Intern Med* 33, no. 7 (Jul 2018), https://doi.org/10.1007/s11606-018-4347-4, https://www.ncbi.nlm.nih.gov/pubmed/29445975.

[41] Michael D. Rosko, *Profitability of rural hospitals: an analysis of government payment policies*, vol. 19, Advances in Healthcare Management (2020).

[42] Rosko, Al-Amin, and Tavakoli, "Efficiency and profitability in US not-for-profit hospitals."

[43] John E. Schneider, Robert L. Ohsfeldt, Michael A. Morrisey, Pengxiang Li, Thomas R. Miller, and Bennet A. Zelner, "Effects of specialty hospitals on the financial performance of general hospitals, 1997-2004," *Inquiry* 44, no. 3 (Fall 2007), https://doi.org/10.5034/inquiryjrnl_44.3.321, https://www.ncbi.nlm.nih.gov/pubmed/18038867.

[44] Michael D. Rosko, John Goddard, Mona Al-Amin, and Manouche Tavakoli., "Predictors of hospital profitability: A panel study including the early years of the ACA," *J Health Care Finance* 44, no. 3 (2018).

of scale which increases efficiency and lowers expenses up to certain limits. They also enable hospitals to gain market power that allows them to increase prices to for their services and negotiate lower prices with their suppliers.[45] [46] [47] [48]

Ownership type is used to reflect the importance of profits in the mission of the organization and, consequently, how vigorously the hospital manager will pursue profits.[49] However, investor-owned hospitals do not always act in profit-maximizing ways and not-for-profit hospitals might pursue financial gain rather than attempt to maximize community benefits.[50] In our literature review, we found that not-for-profit status has typically been used as the omitted reference category in regression analysis and that for-profit status is usually associated with increased profits and the obverse holds for public hospitals. Therefore, we use not-for-profit status as the reference category.

Teaching hospitals pursue a costly mission, including research, teaching and charity care, which may tend to offset the reputational benefits (i.e., ability to charge higher prices) of teaching hospital status for financial performance.[51] While many payers reimburse teaching hospitals at a higher rate than other hospitals, their payment increases do not always cover all the extra costs that these types of hospitals incur. For example, the mean Medicare margin for teaching hospitals has been negative each year during the period 2010-2018;[52] therefore, we predict that teaching hospital status will be associated with lower profits.[53] [54] [55]

[45] Martin Gaynor and and Robert J. Town., "Competition in health care markets," in *Handbook of health economics, Volume 2*, ed. M. Pauly T. McGuire, & P. Barros (Oxford: Elsevier, 2012).

[46] Abby S. Kazley and Yasar A.. Ozcan, "Organizational and environmental determinants of hospital EMR adoption: a national study," *J Med Syst* 31, no. 5 (Oct 2007), https://doi.org/10.1007/s10916-007-9079-7, https://www.ncbi.nlm.nih.gov/pubmed/17918691.

[47] Glenn Melnick and Emmett Keeler, "The effects of multi-hospital systems on hospital prices," *J Health Econ* 26, no. 2 (Mar 1 2007), https://doi.org/10.1016/j.jhealeco.2006.10.002, https://www.ncbi.nlm.nih.gov/pubmed/17084928.

[48] Michael D. Rosko et al., "Hospital inefficiency: what is the impact of membership in different types of systems?," *Inquiry* 44, no. 3 (Fall 2007), https://doi.org/10.5034/inquiryjrnl_44.3.335, https://www.ncbi.nlm.nih.gov/pubmed/18038868.

[49] Ryan L. Mutter and Michael D. Rosko, "The impact of ownership on hospital cost-efficiency of U.S. hospitals," in *Evaluating Hospital Policy and Performance: Contributions from Hospital Policy and Productivity Research*, ed. Valdmanis V. Blank J, Advances in Health Economics and Health Services Research (Bingley,United Kingdom: Emerald Publishing Limited, 2007).

[50] Blavin and Ramos, "Medicaid Expansion: Effects On Hospital Finances And Implications For Hospitals Facing COVID-19 Challenges."

[51] Ashish K. Jha, E. John Orav, Allen Dobson, Robert A. Book, and Arnold M. Epstein., "Measuring efficiency: the association of hospital costs and quality of care," *Health Aff (Millwood)* 28, no. 3 (May-Jun 2009), https://doi.org/10.1377/hlthaff.28.3.897, https://www.ncbi.nlm.nih.gov/pubmed/19414903.

[52] Medicare Payment Advisory Commission, Medicare Payment Advisory Commission Report to the Congress: selected Medicare payment issues, (Washington, D.C.: MedPac, 2015).

[53] Bai and Anderson, "A More Detailed Understanding Of Factors Associated With Hospital Profitability."

[54] Lindrooth et al., "Understanding The Relationship Between Medicaid Expansions And Hospital Closures."

[55] Rosko, Al-Amin, and Tavakoli, "Efficiency and profitability in US not-for-profit hospitals."

Occupancy rates reflect the capital efficiency of hospitals.[56] More filled beds bring in more revenue and can reduce average costs. Several studies have found a positive association between occupancy rate and hospital profitability. [57] [58] [59] [60] [61]

Patient Characteristics Patient characteristics were represented by Medicaid and Medicare share of admissions and average length of stay. Our analysis of HCRIS data found that, on average, Medicare and Medicaid payments accounted for over 70% of revenue received by the rural hospitals in this study. Thus, the adequacy of Medicare and Medicaid payments can have an important impact on hospital profits. In recent years, hospitals have tended to lose money when serving Medicare patients.[62] Medicaid, a joint federal-state program for the categorically needy, has underpaid most hospitals since its inception.[63] Therefore, we expect increases in the share of patients covered by Medicare or Medicaid would adversely affect hospital profits.[64] [65] [66] [67]

Average length of stay is the final patient characteristic variable in our model. Longer stays drive up patient treatment costs. Patient length of stay is positively associated with the patient burden of illness, which is factored into payment adjustments by some payers – e.g., Medicare Diagnosis Related Groups (DRG) payments. However, payments may not be adjusted adequately to account for increased expenses associated with severity and complexity of illness.[68] Ideally, patient burden of illness would be represented by a case-mix index. However, since CAH facilities are paid by Medicare on the basis of costs rather than by DRG rates, they do not supply the information required to compute the Medicare Case-Mix Index. Several studies found a negative relationship between average length of stay and profitability. [69] [70] [71] [72] [73]

Environmental Characteristics The final class of variables found in the hospital literature is environmental characteristics. A market competition variable was used in most of the studies

[56] Rosko et al., "Predictors of hospital profitability: A panel study including the early years of the ACA."

[57] Rosko et al., "Predictors of hospital profitability: A panel study including the early years of the ACA."

[58] Rosko, *Profitability of rural hospitals: an analysis of government payment policies*.

[59] Rosko, Al-Amin, and Tavakoli, "Efficiency and profitability in US not-for-profit hospitals."

[60] Schneider et al., "Effects of specialty hospitals on the financial performance of general hospitals, 1997-2004."

[61] Bai et al., "Varying Trends In The Financial Viability Of US Rural Hospitals, 2011–17: Study examines the financial viability of 1,004 US rural hospitals that had consistent rural status in 2011–17."

[62] Medicare Payment Advisory Commission, Medicare Payment Advisory Commission (MedPac) Report to the Congress: selected Medicare payment issues, (Washington, D.C.: MedPac, 2020).

[63] Peter Cunningham , Robin Rudowitz, Katherine Young, Rachel Garfield, and Julia Foutz, *Understanding Medicaid hospital payments and the impact of recent policy changes*, Kaiser Commission on Medicaid and the Uninsured (Washington DC, 2016).

[64] Bai and Anderson, "A More Detailed Understanding Of Factors Associated With Hospital Profitability."

[65] Bai et al., "Varying Trends In The Financial Viability Of US Rural Hospitals, 2011–17: Study examines the financial viability of 1,004 US rural hospitals that had consistent rural status in 2011–17."

[66] Rosko, Al-Amin, and Tavakoli, "Efficiency and profitability in US not-for-profit hospitals."

[67] Rosko, *Profitability of rural hospitals: an analysis of government payment policies*.

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we reviewed. Hospitals typically practice service-based competition in which increased competition leads to more costs as hospitals pursue the medical arms race.[74] Hospitals should have less ability to raise prices in more competitive markets.[75][76] Therefore, we expect hospital profits to be less in more competitive markets, an assertion supported by several studies. [77][78][79][80][81]

We control for market demand by using the unemployment rate[82], income[83], and population.[84] We expect unemployment will affect the ability to pay for hospital services and health insurance. Therefore, unemployment should be positively related to uncompensated care[85] and inversely associated with hospital profit.[86][87][88] Income should have a similar impact on profits but move in the opposite direction.[89] In addition to policy and control variables, we included hospital fixed-effects, fiscal year-specific binary variables, and a random error term. The fixed-effects control time-invariant differences across hospitals. Table 2 presents means by program category for the characteristics of the study hospitals, computed for all years, and sample sizes.

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[88] Rosko et al., "Predictors of hospital profitability: A panel study including the early years of the ACA."

[89] Lindrooth et al., "Understanding The Relationship Between Medicaid Expansions And Hospital Closures."

Table 2   Mean Characteristics of Sample by Hospital Type, 2012-19

Variable	METRO	RURALPPS	CAH	MDH	RRC	SCH	RRC+SCH
Number of Observations	14,509	2,264	9,499	1,176	759	2,222	808
Average Length of Stay (days)	4.91	5.77	16.22	8.72	4.99	6.73	5.59
Beds	287	84	34	66	170	78	174
For-Profit Hospital	22%	21%	5%	24%	20%	14%	14%
Government Hospital	10%	23%	41%	27%	16%	31%	19%
Not-for-Profit Hospital	68%	56%	54%	49%	64%	54%	67%
Herfindahl-Hirschman Index #	1,572	1,912	2,237	1,962	1,627	2,125	1,741
Medicaid Expansion State	43%	28%	38%	28%	36%	32%	37%
Medicaid Share of Admissions	20%	20%	13%	16%	21%	20%	21%
Medicare Share of Admissions	46%	51%	60%	57%	51%	51%	52%
Multi-hospital System Member	79%	59%	44%	56%	72%	47%	55%
Occupancy Rate	61%	44%	40%	39%	51%	42%	51%
Per Capita Income #	$51,345	$39,494	$41,589	$35,877	$37,690	$38,825	$39,144
Population in 1,000s#	1,265	91	47	40	67	67	54
Teaching Hospital	47%	9%	1%	3%	19%	5%	32%
Unemployment Rate #	5.5%	6.0%	5.2%	6.3%	6.3%	6.0%	5.6%

Sources: Authors analysis of data from AHA Annual Survey Database, Area Resources File and Henry J. Kaiser Family Foundation. All control variables come from the AHA Annual Survey Database except for the unemployment rate and per capita income which come from the Area Resources File and Medicaid expansion state which came from Henry J. Kaiser Family Foundation. Due to space considerations the table does not include data for 133 observations from hospitals that were in 2 or more programs, other than RRCxSCH. This includes seven observations from 3 hospitals that participated in MDH as well as RRC and SCH.

Notes:
Metro   =   hospital located in a metropolitan area
RURALPPS = rural hospital not in a Medicare special program
CAH   = Critical Access Hospital
MDH   = Medicare Dependent Hospital
RRC   = Rural Referral Center
SCH   = Sole Community Hospital
RRCxSCH = classified as both RRC and SCH

The market area for the Herfindahl-Hirschman Index is the hospital referral region. County level data is used for per capita income, population and unemployment rate

2. RESULTS

Compared to metropolitan hospitals, rural hospitals tend to have fewer beds, a smaller market share, and lower occupancy rate (see Table 2). They also are less likely to be a system member or be located in a Medicaid expansion state or an affluent county. They are more likely to be owned by a government entity and have a higher length of stay. Our literature review found that these factors are likely to predispose rural hospitals to be less profitable.

As Table 3 shows, the mean operating margin of all types of hospitals, except RRCs, was negative when data for the period 2012-19 was analyzed. Except for hospitals classified as RRC, the rural hospitals, which as a group had a mean operating margin of -8.40% for the entire study period, were much less profitable ($p < 0.05$) than their metropolitan counterparts, which had a mean operating margin of -1.25% during this period. RRC hospitals had a mean operating margin (0.38%) that was larger ($p < 0.05$) than metropolitan hospitals. Rural hospitals participating in the other Medicare special programs suffered substantially larger losses on average, ranging from -9.35% in those classified as CAH to -11.59% in hospitals participating in the MDH program. The performance of RRCs can be explained by their characteristics (see Table 2). RRCs are much larger than other rural hospitals and tend to have a higher occupancy rate and proportion of hospitals that are system members than other rural hospitals. All of these characteristics are positively associated with hospital profitability.

Table 3   Operating Margin (percentage) by Year and Program Type

Year	Metro	All Rural	Rural PPS	CAH	MDH	RRC	SCH	RCC + SCH
2012	-1.35	-7.40	-6.64	-8.14	-10.59	0.90	-8.41	-0.95
2013	-2.02	-9.10	-8.95	-9.21	-15.18	0.62	-11.02	-1.79
2014	-0.07	-7.96	-6.80	-8.77	-12.86	1.58	-9.67	0.52
2015	-0.20	-7.20	-6.13	-8.12	-9.76	1.19	-8.22	-1.25
2016	-0.97	-8.37	-6.61	-9.78	-10.50	1.00	-8.82	-2.81
2017	-1.46	-8.73	-7.03	-9.79	-11.44	-0.56	-9.95	-2.62
2018	-1.42	-8.55	-7.75	-9.78	-10.08	-0.29	-8.07	-3.89
2019	-2.69	-9.89	-8.79	-11.20	-9.88	-1.79	-10.71	-3.05
All Years	-1.25	-8.40	-7.31	-9.35	-11.59	0.38	-9.36	-2.01
Change 2012-19	-1.34	-2.49	-2.15	-3.06	0.72	-2.69	-2.30	-2.10

Sources: Authors' analysis of data from CMS Health Care Cost Report Information System.

Notes:
Metro   = hospital located in a metropolitan area
RURALPPS = rural hospital not in a Medicare special program
CAH   = Critical Access Hospital

MDH   = Medicare Dependent Hospital
RRC   = Rural Referral Center
SCH   = Sole Community Hospital
RRCxSCH = classified as both RRC and SCH

   Table 4 shows that the mean total margin was positive for all categories in every year, except for RuralPPS, which had a mean total margin of -0.42% in 2018 and MDH, which had a negative value in 5 of 8 years. The average in this category for all years was -1.08%. This suggests that the average hospital in most categories was able to make up for operating losses from non-operating sources of income. However, the mean total margin for hospitals in the special Medicare programs, except for RRCs, is much lower than that of metropolitan hospitals and is so low that these hospitals may have difficulty in acquiring new technology or maintaining existing capital. The pattern of relative profitability by program status for total margin was similar to that for operating margin.

Table 4 Total Margin (percentage) by Year and Program Type

| YEAR	Metro	All Rural	Rural PPS	CAH	MDH	RRC	SCH	RCC + SCH
2012	5.78	3.18	1.60	3.03	2.49	6.42	3.80	6.06
2013	5.71	2.27	0.17	2.72	-2.93	6.71	2.85	6.39
2014	6.00	2.47	0.64	2.62	-1.49	5.67	3.32	6.53
2015	5.39	2.63	0.93	2.92	0.18	5.15	2.58	5.33
2016	5.73	2.02	0.27	1.91	-1.85	6.74	3.01	6.02
2017	5.15	1.56	0.04	1.64	-3.33	5.39	1.83	6.36
2018	4.86	1.62	-0.42	1.90	-2.58	3.71	2.53	4.95
2019	5.42	3.53	1.41	3.77	0.33	6.51	4.07	5.84
All Years	5.52	2.41	0.58	2.56	-1.08	5.79	3.01	5.91
Change 2012-19	-0.36	0.35	-0.19	0.74	-2.16	0.09	0.27	-0.22

Sources: Authors' analysis of data from CMS Health Care Cost Report Information System.

Notes:
Metro   = hospital located in a metropolitan area
RURALPPS = rural hospital not in a Medicare special program
CAH   = Critical Access Hospital
MDH   = Medicare Dependent Hospital
RRC   = Rural Referral Center
SCH   = Sole Community Hospital
RRCxSCH = classified as both RRC and SCH

With a few minor exceptions, the pattern of profitability for both measures was the same over time (see Tables 3 and 4). RRCs and metropolitan hospitals were the most profitable types of hospitals in all years and MDHs were the least profitable. SCHs improved their relative position when total margin was considered rather than operating margin. In contrast, RuralPPS hospitals' relative profitability, relative to hospitals in the special payment programs, fell when the total margin was analyzed.

Sometimes averages obscure results. For example, Tables 3 and 4 show that the mean operating margin for all years combined was negative for every category except for RRC, while the mean total margin was positive for every category, except MDH. However, analysis of the lowest tertile paints a different picture for total margin. Figure 1 shows the lowest tertile of total margin for all years. While the value of the lowest tertile was positive for metropolitan hospitals (1.92%), the lowest tertile value was negative for all the rural hospital program categories hospitals (ranging from -0.63% for CAHs to -4.22% for MDHs), except RRCs (1.09%) and RRCs that were also categorized as SCHs (2.91%). This suggests that a substantial number of rural hospitals may have been in financial jeopardy throughout the study period.

Figure 1: Lowest Tercile of Total Margin, By Program, All Years
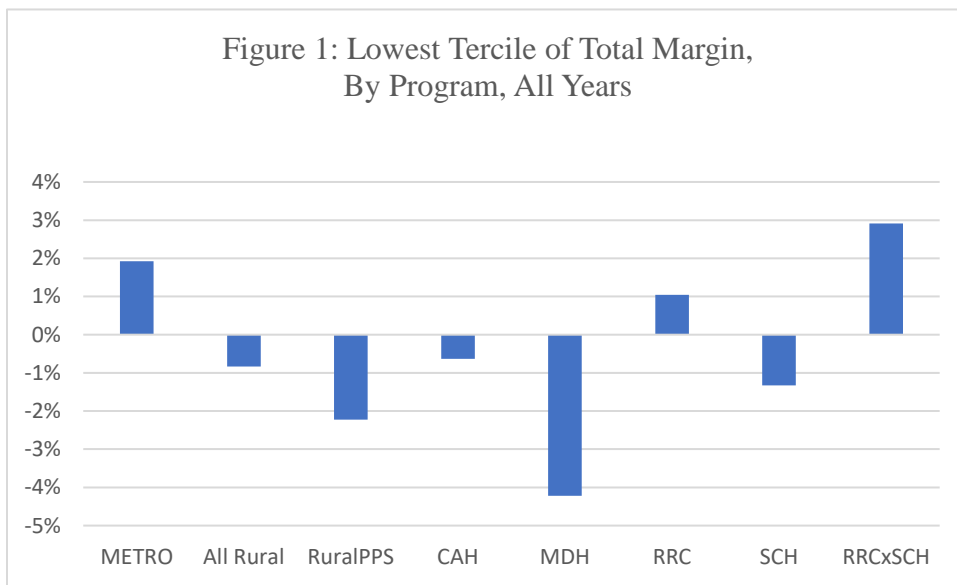
Sources: Authors' analysis of data in CMS Health Care Cost Report Information System.

Notes:
Metro   =   hospital located in a metropolitan area
RURALPPS   = rural hospital not in a Medicare special program
CAH   = Critical Access Hospital
MDH   = Medicare Dependent Hospital
RRC   = Rural Referral Center
SCH   = Sole Community Hospital
RRC + SCH   = classified as both RRC and SCH

Space constraints precludes inclusion of 133 observations from hospitals classified as Other Multi-Medicare. Their value was -1.343%

Variable definitions and descriptive statistics for the variables in the regression analysis are given in Tables 5 and 6. Results from the fixed-effects regression analysis are presented in Tables 7 and 8 for operating margin and total margin, respectively. In the operating margin equation, which more directly measures the impact of payment policy, when the full sample was used all of special Medicare program variables, except RRC which was not significant, had estimated coefficients that were negative and significant ($p < 0.01$). When the rural-only sample was used none of the special Medicare program variables were significant ($p < 0.05$), except for CAH which was positive ($p < 0.01$). It is clear that the use of a different reference category (i.e., RuralPPS hospitals than metropolitan hospitals) caused the results to change.

When the full sample was used to analyze the total margin, among the special program variables, only the estimated coefficients for MDHs and Other Multi-Medicare Programs were negative and significant ($p < 0.01$). The other Medicare special payment program variables were not significant ($p < 0.05$). The estimate for RuralPPS was negative ($p < 0.01$). In the rural-only analysis of total margin CAH, RRC, SCH, RRC + SCH each had positive and significant ($p < 0.01$) estimates. The reader is reminded that the reference category in this sub-sample is RuralPPS, which is comprised of hospitals with, on average, poor financial performance.

Table 5 Definitions for Variables in the Regression Analysis

Variable	Definition
Dependent Variables	
Total Margin (winsorized) [1]	Total income / by revenue
Operating Margin (winsorized) [1]	Net patient income / by net patient revenue
Policy Variables	
Critical Access Hospital (CAH)	1 if the hospital is CAH; 0 if otherwise
Medicare Dependent Hospital (MDH)	1 if the hospital is MDH; 0 if otherwise
Rural Referral Center (RRC)	1 if the hospital is RRC; 0 if otherwise
Sole Community Hospital (SCH)	1 if the hospital is SCH; 0 if otherwise
RRC + SCH	1 if hospital is both RRC and SCH; 0 if otherwise
Other Multi-Medicare	1 if hospital participates in 2 or more special programs other than RRC+SCH; 0 if otherwise
Rural PPS	1 if the hospital is in a rural area and does not participate in any of the special Medicare programs; 0 if otherwise
Medicaid Expansion State	1 if the hospital is in a state that expanded its Medicaid program after the passage of the ACA; 0 if otherwise
Control Variables	
Average Length of Stay	Total patient days /admissions
Beds	Total facility beds set up and staffed at the end of reporting period
For-Profit Hospital	1 if the hospital is for-profit; 0 if otherwise
Government Hospital	1 if the hospital is publicly owned; 0 if otherwise
Herfindahl-Hirschman Index [2]	Sum of the squared market shares of each hospital in the area

Table 5 (continued)

Variable	Definition
Medicaid Share of Admissions	(Medicaid admissions/total admissions) * 100
Medicare Share of Admissions	(Medicare admissions/total admissions) * 100
Multi-hospital System Member	1 if the hospital is affiliated with a health system; 0 if otherwise
Occupancy Rate	(Average daily census/ beds)*100
Per Capita Income [2]	Income earned per person
Population [2]	Population
Teaching Hospital	1 if the hospital is a teaching hospital; 0 if otherwise
Unemployment Rate [2]	(Unemployed/civilian labor force)*100

Sources: Authors' analysis. Dependent variables come from CMS Health Care Cost Report Information System. Control variables come from the AHA Annual Survey Database except for the unemployment rate and per capita income, which come from the Area Resources File. Medicaid expansion state comes from Henry J. Kaiser Family Foundation

Notes:

1 Extreme values are limited to the 1st and 99th percentiles

2 The market area for the Herfindahl-Hirschman Index is the hospital referral region. County level data is used for per capita income, population and unemployment rate.

Table 6 Descriptive Statistics (all years 2012-19, n =31,370)

Variable	Mean	Std. Dev.
Dependent Variables		
Operating Margin (winsorized)[1]	-5.09%	18.47
Total Margin (winsorized)[1]	3.85%	11.94
Policy Variables		
Critical Access Hospital	30.31%	45.90
Medicare Dependent Hospital	4.15%	19.95
Rural Referral Center	5.33%	22.46
Sole Community Hospital	9.77%	29.69
RRC+SCH	2.58%	15.84
Other Multi-Medicare	0.42%	6.49
Rural PPS	7.22%	25.88
Medicaid Expansion State	38.99%	48.77
Control Variables		
Average Length of Stay	8.69	18.46
Beds	166.29	201.07
For-Profit Hospital	15.74%	36.42
Government Hospital	22.90%	42.02
Herfindahl-Hirschman Index [2]	1,858	1,432
Medicaid Share of Admissions	17.75%	10.26
Medicare Share of Admissions	51.88%	13.02
Multi-hospital System Member	62.65%	48.37
Occupancy Rate	50.37%	20.93
Per Capita Income [2]	$45,376	14,347
Population	616,186.11	11,502,926.32
Teaching Hospital	24.70%	43.12
Unemployment Rate [2]	5.56%	2.30

Sources: Authors' analysis. Dependent variables come from CMS Health Care Cost Report Information System. Control variables come from the AHA Annual Survey Database except for the unemployment rate and per capita income, which come from the Area Resources File, and Medicaid expansion state which came from Henry J. Kaiser Family Foundation.

Notes:

1 Extreme values are limited to the 1st and 99th percentiles

2 indicates that the market area for the Herfindahl-Hirschman Index is the hospital referral region. The market area for per capita income and unemployment rate is the county.

Table 7 Fixed-Effect Regression Estimates, Operating Margin[1] (FY 2012-19)

Variable	Full Sample (n = 31,370)			Rural Hospitals only (n = 16,861)		
	Coef.	Robust Std. Err.		Coef.	Robust Std. Err.	
Rural PPS	-0.0471	0.0091	**	-	-	
Critical Access Hospital (CAH)	-0.0274	0.0079	**	0.0345	0.0107	**
Medicare Dependent Hospital (MDH)	-0.0685	0.0112	**	-0.0198	0.0109	
Rural Referral Center (RRC)	-0.0106	0.0113		0.0172	0.0132	
Sole Community Hospital (SCH)	-0.0544	0.0103	**	-0.0062	0.0106	
RRC + SCH	-0.0310	0.0140	*	0.0011	0.0159	
Other Multi-Medicare	-0.0808	0.0238	**	-0.0390	0.0239	
Medicaid Expansion State	0.0106	0.0029	**	0.0228	0.0039	**
Average Length of Stay	-0.0005	0.0002	**	-0.0006	0.0002	**
Beds	4.2E-05	1.6E-05	**	0.0003	0.0001	**
For-Profit Hospital	0.0357	0.0072	**	0.0223	0.0108	*
Government Hospital	-0.0537	0.0069	**	-0.0407	0.0071	**
Herfindahl-Hirschman Index [2]	-7.6E-06	1.8E-06	**	-9.5E-06	2.4E-06	**
Medicaid Share of Admissions	-0.0003	0.0002		0.0002	0.0002	
Medicare Share of Admissions	0.0003	0.0001	*	0.0003	0.0001	*
Multi-hospital System Member	0.0304	0.0043	**	0.0302	0.0059	**
Occupancy Rate	0.0010	0.0001	**	0.0011	0.0001	**
Per Capita Income [2]	-8.2E-07	1.9E-07	**	-4.6E-07	2.7E-07	
Population [2]	-1.2E-08	2.1E-09	**	7.5E-09	8.6E-09	
Teaching Hospital	-0.0063	0.0037		-0.0076	0.0073	
Unemployment Rate [2]	-0.0028	0.0009	**	-0.0011	0.0011	
2013	-0.0140	0.0018	**	-0.0176	0.0026	**
2014	-0.0057	0.0028	*	-0.0155	0.0037	**
2015	-0.0056	0.0034		-0.0114	0.0044	*
2016	-0.0161	0.0036	**	-0.0235	0.0047	**
2017	-0.0212	0.0040	**	-0.0290	0.0051	**
2018	-0.0211	0.0044	**	-0.0264	0.0054	**
2019	-0.0335	0.0045	**	-0.0393	0.0056	**
Constant	-0.0223	0.0166		-0.1312	0.0218	**
R-squared within	0.0137			0.0185		
R-squared between	0.1989			0.1925		
R-squared overall	0.1583			0.1443		
Wald chi-squared	857.54			430.89		

** $p < 0.01$, * $p < 0.05$

[1] Indicates that the dependent variable was winsorized at 1st and 99th percentiles

[2] The market area for the Herfindahl-Hirschman Index is the hospital referral region. County-level data is used for per capita income, population, and unemployment rate.

Table 8 Fixed-Effect Regression Estimates, Total Margin[1] (FY 2012-19)

	Full Sample (n = 31,370)			Rural Hospitals only (n = 16,861)		
	Coef.	Robust Std. Err.		Coef.	Robust Std. Err.	
Rural PPS	-0.0324	0.0064	**	--	--	
Critical Access Hospital (CAH)	0.0010	0.0049		0.0318	0.0064	**
Medicare Dependent Hospital (MDH)	-0.0333	0.0078	**	-0.0010	0.0077	
Rural Referral Center (RRC)	0.0072	0.0086		0.0386	0.0101	**
Sole Community Hospital (SCH)	-0.0092	0.0065		0.0234	0.0074	**
RRC + SCH	0.0027	0.0076		0.0368	0.0092	**
Other Multi-Medicare	-0.0332	0.0167	*	-0.0014	0.0170	
Medicaid Expansion State	0.0050	0.0022	*	0.0156	0.0030	**
Average Length of Stay	-0.0002	0.0001	**	-0.0002	0.0001	**
Beds	0.0001	8.2E-06	**	0.0001	3.5E-05	*
For-Profit Hospital	0.0159	0.0050	**	0.0031	0.0074	
Government Hospital	-0.0074	0.0036	*	-0.0046	0.0040	
Herfindahl-Hirschman Index [2]	-1.6E-06	1.0E-06		-1.9E-06	1.3E-06	
Medicaid Share of Admissions	-0.0001	0.0001		0.0003	0.0002	
Medicare Share of Admissions	4.9E-05	0.0001		0.0002	0.0001	
Multi-hospital System Member	0.0090	0.0028	**	0.0092	0.0035	**
Occupancy Rate	0.0005	0.0001	**	0.0003	0.0001	**
Per Capita Income [2]	-6.8E-08	1.3E-07		8.1E-07	2.1E-07	**
Population [2]	-4.9E-09	1.2E-09	**	6.2E-09	4.9E-09	
Teaching Hospital	-0.0032	0.0028		-0.0099	0.0060	
Unemployment Rate [2]	-0.0034	0.0006	**	-0.0017	0.0008	*
2013	-0.0067	0.0016	**	-0.0103	0.0023	**
2014	-0.0106	0.0023	**	-0.0173	0.0030	**
2015	-0.0165	0.0027	**	-0.0195	0.0035	**
2016	-0.0190	0.0029	**	-0.0263	0.0038	**
2017	-0.0262	0.0032	**	-0.0339	0.0041	**
2018	-0.0300	0.0034	**	-0.0363	0.0043	**
2019	-0.0175	0.0036	**	-0.0184	0.0045	**
Constant	0.0438	0.0118	**	-0.0418	0.0152	**
R-squared within	0.0079			0.0123		
R-squared between	0.0750			0.0678		
R-squared overall	0.0482			0.0482		
Wald chi-squared	446.61*			256.61*		

** $p < 0.01$, * $p < 0.05$

There are three other noteworthy results. First, hospitals in states that expanded their Medicaid programs tended to be more profitable than those in non-expansion states in the post-expansion years. For example, not only were the regressions coefficients positive and significant ($p < 0.05$) for the variable representing observations taken in Medicare expansion states, but also we found that the mean operating margin of all rural hospitals in 2019 was -7.78% in expansion states and -12.35% in non-expansion states. This is based on our univariate analysis of the data, but it was not shown in the tables. Second, in the total margin analysis of both samples, the coefficients of the individual year binary variables were negative and significant ($p < 0.01$) every year and monotonically decreasing throughout the analysis until 2019. In the operating margin equation using the full sample, the individual year variables were negative and significant ($p < 0.01$) for each year. When the rural-only sample was analyzed, similar results were found. This indicates that factors other than those captured by the variables included in the equations were causing profit margins to decline over time relative to the reference year, 2012. This is consistent with analysis of changes in mean values which shows that profitability fell, on average, from 2012 to 2019 (see Table 3).

Third, analysis of other control variables suggests that hospitals can increase their profitability by increasing their occupancy rate or by joining a multi-hospital system. These options may not be viable for many rural hospitals. Occupancy rate could be increased by downsizing or by increasing demand for inpatient care. However, the typical rural hospital is already very small, and downsizing would further diminish their scale economies. Hospitals in remote rural areas have no new markets from which to attract patients. Similarly, remote rural hospitals have no nearby potential partners to join. Furthermore, their chronic financial problems might deter potential merger/acquisition partners.

3. DISCUSSION

We analyzed two commonly used measures of hospital profitability – total margin and operating margin. While the total margin values painted a rosier picture of hospital profitability, analysis of both margins showed that many hospitals may be in a precarious financial position and that the Medicare special programs did not help much either over time or in comparison to metropolitan hospitals. In evaluating the Medicare special programs, we feel that more weight should be given to the operating margin because it is a more direct measure of the impact of payment policy, and it is not subject to the vagaries of the stock market, which influences investment income and donations, components of total margin.

Our univariate analysis of the operating margin found that rural hospitals, in general, had a poor financial performance from 2012 to 2019 compared to metropolitan hospitals, in terms of both operating and total margins. The regression coefficients for the special programs in the full sample analysis were either negative or insignificantly different from zero. Overall, the special programs established by the federal government to help rural hospitals were not sufficient to

substantially reduce the financial disadvantage that rural hospitals have compared to metropolitan hospitals. Specifically, hospitals participating in the CAH, SCH, and MDH Programs were all less profitable than metropolitan hospitals, with MDHs being the hospitals at the most severe disadvantage when it comes to profitability.

When the operating margin is considered, the metropolitan-rural differential in profitability from 2012 to 2019 increased over time in each of the Medicare special program categories except for MDH, which, despite an improvement in 2019, had the lowest all-year mean. However, in 2019 despite decreases in operating margin, the mean total margin in all rural hospitals increased to a value more than twice the size of its 2018 mean (or from 1.62% to 3.53%). The improvement occurred in each of the Medicare special program categories. This resulted in a narrowing of profitability differentials from 2012 to 2019, in all categories except for MDH. It should be noted that the gains in the total margin can be attributed to the exceptionally strong performance of the stock market in 2019. This undoubtedly led to more donations and greater investment income, components of the total margin.[90] If 2018 had been used as the last year of the study, the disparity in mean total margin since the base year, 2012, for each Medicare special program category would have increased relative to metropolitan hospitals.

The regression analysis using either dependent variable (i.e., operating margin or total margin) that was restricted to rural hospitals (recall that approach uses RuralPPS as the reference category) shows that the CAH program helped improve hospital financial performance above what would have occurred in the absence of this program. When total margin was analyzed, hospitals classified as RRC, SCH, or RRC+SCH appeared to have been helped by the special programs although this was not the case when operating margin was analyzed. Thus, we conclude that there is strong support for the notion that CAH program provided substantial benefits to rural hospitals. This is consistent with Holmes, Pink, and Friedman [91] who concluded that the elimination of the CAH program would lead to marked deterioration in the financial performance of CAHs. Further, they estimated that the percentage of CAHs with negative total margin would have increased from 28.2% to 44.0% without this program.

In 2020, a report to Congressional Committees, developed by the US Government Accountability Office,[92] showed a decline in profitability for MDHs from 2011 to 2017 and other rural hospitals and a decline in the number of hospitals holding the MDH designation due, in part, to hospital closures. Possible explanations for the poor financial performance of MDHs can be found in the insufficient financial benefits compared to other programs, which only apply to inpatient services, and in its temporary nature, which has historically created lapses in payments to MDHs.[93]

Consistent with research findings on Medicaid expansion,[94] we found that hospitals operating in states with expanded Medicaid programs tend to be more profitable than hospitals in

[90] Bai et al., "Investment Income of US Nonprofit Hospitals in 2017."

[91] Holmes, Pink, and Friedman, "The financial performance of rural hospitals and implications for elimination of the critical access hospital program."

[92] United States Government Accountability Office, *Information on Medicare-Dependent Hospitals* (2020), https://www.gao.gov/assets/gao-20-300.pdf.

[93] United States Government Accountability Office, *Information on Medicare-Dependent Hospitals*.

[94] Bai et al., "Varying Trends In The Financial Viability Of US Rural Hospitals, 2011–17: Study examines the financial viability of 1,004 US rural hospitals that had consistent rural status in 2011–17."

states that did not expand their Medicaid programs in the years following the expansion. However, Medicaid expansion, while helpful, is not a panacea for the under-funding of rural hospitals (e.g., our analysis of HCRIS data found that the mean operating margin of rural hospitals in Medicaid expansion states was negative and declined from -3.8% in 2014 to -7.7% in 2019). It is worth noting that previous research found that the positive effect of Medicaid expansion on operating margins was more substantial for metropolitan hospitals than for rural hospitals.[95] This difference exposes, once again, the financial disadvantage that rural hospitals have to endure when it comes to profitability in comparison to their urban counterparts.

Our analysis also showed that total margin declined from 2012 to 2018 (the total margin for rural hospitals improved in 2019, undoubtedly fueled an exceptionally robust stock market, e.g., the S & P returns were 31.2% in 2019 or the second best annual performance in the twenty-first century.[96] The operating margin declined from 2012 to 2019 for all hospitals, and this has affected rural hospitals to a much greater extent than metropolitan ones. Unfortunately, this trend will likely continue in the future, especially if we consider the possible impacts of the COVID-19 pandemic. While all hospitals will be susceptible to the negative effects of the pandemic on profitability, rural hospitals, which were already struggling before the pandemic, will likely be affected to a greater extent. Hospitals across the country have responded to COVID surges by closing outpatient services, including lucrative outpatient surgery. However, rural hospitals rely more on outpatient revenue than their metropolitan counterparts. For example, outpatient revenue as a share of total hospital revenue amounted to 77% in rural hospitals in 2019;[97] in contrast, the national value for all hospitals was 48%.[98] While the early national surges in COVID cases struck urban populations, in 2021 Covid infections requiring hospitalizations were more likely to occur in rural populations because they tend to have lower vaccination rates than their urban counterparts.[99] This will, no doubt, place more strain on a rural healthcare system already burdened by shortages and financial constraints. The decrease in volume rural hospitals faced during the pandemic was not mitigated by the increase in higher intensive care use that many metropolitan hospitals experienced when treating COVID-19 patients.[100]

4. CONCLUSIONS

It is clear that the many rural hospitals are in financial jeopardy despite their participation in Medicare special programs. For example, Figure 1 shows lowest tertile (i.e., lowest third) of the total margin was negative for rural hospitals. This is due, in part, to the fact that rural hospitals have characteristics that predispose them, under conventional payment schemes, to be unprofitable. Many are in small remote towns. Thus, they cannot attract enough patients to acquire

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[95] Kaufman et al., "Medicaid Expansion Affects Rural And Urban Hospitals Differently."

[96] Aswath Damodaran, "Historical returns: Stocks, Bonds & T.Bills with premiums: 1928-2021," (2022). http://www.stern.nyu.edu/~adamodar/pc/datasets/histretSP.xls.

[97] The Chartis Group, *Crises Collide: The COVID-19 Pandemic and the Stability of the Rural Health Safety Net* (2021), https://www.chartis.com/resources/files/Crises-Collide-Rural-Health-Safety-Net-Report-Feb-2021.pdf.

[98] Tara Bannow, "AHA data show hospitals' outpatient revenue nearing inpatient," *Modern Healthcare*, 3 Jan 2019 2019.

[99] Bhavini Patel Murthy, Natalie Sterrett, Daniel Weller, Elizabeth Zell, Laura Reynolds, Robin L. Toblin, Neil Murthy et al. "Disparities in COVID-19 vaccination coverage between urban and rural counties—United States, December 14, 2020–April 10, 2021," *Morbidity and Mortality Weekly Report* 70, no. 20 (2021).

[100] Dhruv Khullar, Amelia M. Bond, and William L. Schpero, "COVID-19 and the Financial Health of US Hospitals," *JAMA* 323, no. 21 (2020), https://doi.org/10.1001/jama.2020.6269, https://doi.org/10.1001/jama.2020.6269.

the scale needed to be competitive in the current hospital industry, nor are they able to fill a substantial proportion of beds, even in very small hospitals. Thus, they suffer from low occupancy rates, a strong predictor of low profitability in U. S. hospitals.[101] While rural hospitals would likely be worse off in the absence of the Medicare special programs, it is possible that these programs have not gone far enough to remove them from financial jeopardy.

4.1. Policy implications

Our findings have several policy implications. In this section, we offer policy recommendations that not only build on previous research but also offer innovative solutions. While it is beyond the scope of this study to rigorously evaluate these options, we ask the reader to consider them in light of the factors that predispose many rural hospitals to suffer financially and eventually fail. We also offer some criteria by which they should be evaluated. The first three come from a study that analyzed the CAH Program and its impact on hospital efficiency.[102] We add a fourth criterion to recognize current political realities. Policies to preserve the viability of rural hospitals should contain features that: 1) increase the efficiency of hospitals; 2) preserve the financial viability of efficient providers; 3) support access to high-quality care in rural communities, and 4) optimize government expenditures.

Since profitability is determined by revenues and costs, we believe that it is important to propose policy options that can reduce expenses and increase revenues. Our policy recommendations span a continuum that ranges from minor adjustments, such as tweaking the Medicare special programs, to more complex and aggressive propositions.

Policies to improve hospital revenues One of the ways to improve the financial performance of rural hospitals is to provide them with better reimbursement rates. Currently, Medicare reimbursement is adjusted by geographical area; specifically, using the Medicare Wage Index reimbursement rates are significantly lower for rural hospitals that are usually located in areas with lower average wages than urban areas. A report from the OIG released in December 2020 revealed that over half of rural hospitals had wage indexes in the bottom quartile for FY 2020.[103] One could argue that rural hospitals are unable to take full advantage of the lower general wages in their area, as they need to be able to attract clinical workers in an industry that already suffers from a labor supply shortage. This is reflected in the bipartisan bill "Save Rural Hospitals Act of 2021"[104]" that was introduced in March 2021. The proposed bill aims at establishing a national minimum for the Medicare Area Wage Index at 0.85, which would help about a quarter of all hospitals since the 25th percentile value stated by CMS for Fiscal Year 2020 was 0.848.

A more aggressive approach than tweaking current Medicare special payment programs or current reimbursement rates would be to substantially increase Medicare and Medicaid inpatient and outpatient payments. This approach would follow some of the best features of the Federally Qualified Health Center (FQHC) and Rural Health Clinic (RHC) Programs. These programs have helped thousands of health centers to serve in underserved communities across the United States.

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[101] Bai et al., "Varying Trends In The Financial Viability Of US Rural Hospitals, 2011–17: Study examines the financial viability of 1,004 US rural hospitals that had consistent rural status in 2011–17."

[102] Rosko and Mutter, "Inefficiency differences between critical access hospitals and prospectively paid rural hospitals."

[103] United States Office of Inspector General, *Data Brief: Hospitals With Area Wage Indexes in the Bottom Quartile* (2020).

[104] Actions - S.999 - 117th Congress (2021-2022), Save Rural Hospitals Act of 2021, (2021).

The proposed program would be limited to facilities in federally designated underserved areas that are at least 35 miles or 45 minutes away from the nearest short-term acute care hospital. Recognizing the importance of hospital outpatient programs to the entire hospital's bottom-line, payments would apply to inpatient and outpatient services. They would be based on a rural hospital prospective payment system. Similar to FQHCs and RHCs, the payments would be substantially higher than current Medicare and Medicaid payments to rural hospitals. Following the FQHC program, these rural hospitals would be allowed to apply for grants to cover the costs of uncompensated care (as long as they used an approved sliding fee schedule for uninsured patients) and other services (e.g., health education and outreach). The payment recommendations address all four criteria and would allow rural hospitals to maintain both the inpatient and outpatient service lines. The importance of providing a reimbursement program that gives rural hospitals the option to keep their inpatient services is even more evident in light of the Rural Emergency Hospital (REH) designation created with Section 125 of the Consolidated Appropriations Act of 2021 (CAA). Beginning on January 1, 2023, CAHs and rural PPS hospitals with less than 50 beds will be able to convert to the REH status, under which the hospital does not provide inpatient services but serves its community's needs for emergency and outpatient hospital services only. While the REH designation helps maintain access to emergency and outpatient services in rural areas where many hospitals are closing, it might inadvertently create an even more significant barrier to access inpatient care. Our proposed program would provide a financially viable option for hospitals to maintain their inpatient services as well if they chose to. This should help not only the health of residents but also the financial health of communities, as hospitals are often the largest employer in small rural communities.

Finally, expansion of Medicaid to a larger population in the 12 states that have not done so yet, would provide some fiscal relief to hospitals in these states. However, these are very conservative states dominated by the Republican party and most are unlikely to authorize Medicaid expansion. The Biden administration has adopted a two-prong strategy to expand Medicaid eligibility. One approach is to target expansion to select populations such as new mothers, inmates, and undocumented immigrants.[105] The second approach is to provide additional financial incentives, as outlined in The American Relief Act bill, to expand Medicaid eligibility in the 12 holdout states.[106]

Policies to reduce hospital costs Rural hospitals tend to be small, and therefore, unlike larger hospitals, they cannot benefit from scale economies. Thus, rural hospitals face higher average costs. A possible solution to counter the barriers rural hospitals face is the creation of national or regional rural hospital systems which has a similar structure as the Veteran Affairs health system. The formation of a rural hospital system that can serve as the entity that negotiates for rural hospitals provides access to clinical and managerial expertise and allows rural hospitals to benefit from economies of scale can help rural hospitals overcome many of the challenges they face.

To further decrease their costs, rural hospitals should build on the advancements in telemedicine to better and efficiently serve their patients. Emergency departments are already

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[105] Noam N. Levey and Phil Galewitz, "Biden Quietly Transforms Medicaid Safety Net," *KHN* 2021, https://khn.org/news/article/biden-quietly-transforms-medicaid-safety-net/.

[106] "New Incentive for States to Adopt the ACA Medicaid Expansion: Implications for State Spending," 2021, accessed 9/24, 2021, https://www.kff.org/report-section/new-incentive-for-states-to-adopt-the-aca-medicaid-expansion-implications-for-state-spending-methodology/.

using telemedicine to treat patients in rural hospitals with complex needs and diagnoses.[107] This helps lower the cost of care for these patients by minimizing duplication of services and transport cost.[108] As Martin et al. [109] argue, "one solution attempted by rural hospitals has been to align themselves with larger tertiary care centers in community health-information networks (CHIN), telemedicine networks, or other partnerships." Further exploration of how technology, and telemedicine specifically, can help rural communities and rural hospitals is needed; however, it is worth noting that previous research on health information technology has found that rural hospitals report connectivity and infrastructural issues that hospitals operating in urban settings might not be facing.[110] Recent research also suggested that the increased reliance on broadband connectivity for telemedicine services during the COVID-19 pandemic might have created even more disparities between rural and urban access to health care.[111] To sustain and increase the use of telemedicine among rural hospitals, the policymaker should: (1) maintain the reimbursement rates for telehealth services introduced during the pandemic and (2) address the inadequacy of the connectivity infrastructure that is required to provide telehealth services effectively. An important step in this direction is the Bipartisan Infrastructure Law,[112] which devoted $65 billion to expand broadband access; however, it might take years before the broadband needs are mapped, a plan is developed, the funding is assigned, and the infrastructure is built.

The issue of rural hospitals' profitability is not new to policymakers. For over three decades, the United States has developed and maintained programs to address this issue, but they did not provide the expected results and rural hospitals continue to fail.[113] The federal government should reassess the effectiveness of the special programs which were designed to assist rural hospitals with their financial burdens. Developing effective policies to address the financial viability of rural hospitals is imperative to avoid any further closures,[114] which would have devastating effects on the access to health care for rural Americans who are already underserved. Moreover, without a robust and focused policy intervention, the COVID-19 pandemic, which represents a financial challenge for almost all hospitals, will expose rural hospitals to an even higher financial risk and vulnerability.

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[107] Jeremy M Kahn, "Virtual visits—confronting the challenges of telemedicine," *N Engl J Med* 372, no. 18 (2015).

[108] Kahn, "Virtual visits—confronting the challenges of telemedicine."

[109] Amy Brock Martin, Janice C. Probst, Kyle Shah, Zhimin Chen, and David Garr, "Differences in readiness between rural hospitals and primary care providers for telemedicine adoption and implementation: findings from a statewide telemedicine survey," *The Journal of Rural Health* 28, no. 1 (2012).

[110] Claudia Guerrazzi and Sue S. Feldman, "Health information exchange: What matters at the organizational level?," *J Biomed Inform* 102 (Feb 2020), https://doi.org/10.1016/j.jbi.2020.103375.

[111] Kelly A. Hirko, Jean M. Kerver, Sabrina Ford, Chelsea Szafranski, John Beckett, Chris Kitchen, and Andrea L. Wendling, "Telehealth in response to the COVID-19 pandemic: Implications for rural health disparities," *Journal of the American Medical Informatics Association : JAMIA* 27, no. 11 (2020), https://doi.org/10.1093/jamia/ocaa156, https://pubmed.ncbi.nlm.nih.gov/32589735 https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7337797/.

[112] *Infrastructure Investment and Jobs Act*, 2021-2022, H.R.3684.

[113] Cecil G. Sheps Center for Health Services Research, "Rural Hospital Closures."

[114] Kaufman et al., "The rising rate of rural hospital closures."

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