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Rural Policy Brief

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The Impact of High Hospital Fixed-Cost Ratios on Rural Populations

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Purpose

This brief focuses on rural hospitals with high fixed-to-total-cost ratios and describes characteristics of those hospitals and the communities they serve. The brief extends a recent RUPRI Center analysis[1] of whether hospitals in rural areas have higher fixed-to-total-cost ratios, a characteristic that has implications for financial stability under different payment models. We describe how this measure varies across the United States, the demographic characteristics associated with hospitals at different ratio levels, and the share of nonmetropolitan hospitals that have Critical Access Hospital (CAH) or Low-Volume Hospital (LVH) designations.

Key Findings

- Fixed-to-total-cost ratios vary along the rural continuum; recent RUPRI research[1] found that hospitals in noncore counties without towns of at least 2,500 people have the highest ratios, with a median estimate of 0.933 (where 1 means 100 percent of costs are fixed). Moreover, groups of distinct fixed-to-total-cost profiles emerged based on Urban Influence Codes (UICs).
- As UIC groups become more rural, hospitals' estimated fixed-to-total-cost ratios increase; populations in those UIC groups tend to be older, more likely to be on Medicare or Medicaid, less likely to have a college education, and less likely to have employer-sponsored insurance.
- CAHs and LVHs have higher fixed-to-total-cost ratios. CAHs are concentrated in the upper Great Plains states, with 80.5 percent and 77.6 percent of all nonmetropolitan hospitals in North Dakota and Montana, respectively, having the CAH designation. LVHs tend to be in the South—46.6 percent of Alabama's nonmetropolitan hospitals have the LVH designation—and are also common in some mountain states.
- Because the level of rurality itself matters, policymakers could identify ways that this insight could be used to refine payment policies to better support all Americans' access to hospital services.

Background

Hospital cost structure may vary by geographic region, degree of rurality, CAH and LVH designations, ownership type, payer mix, hospital size (e.g., net patient revenue, number of beds, and/or number of service lines), and characteristics of the population served. Payment methdologies being designed and implemented with the intent of changing patterns of utilization in ways that reduce hospitalization could have an unintended consequence of increasing the financial vulnerability of institutions with high fixed-to-total-cost ratios. This effect may be more prevalent for rural hospitals.

CAH designation is based on rural location, distance from other hospitals (in early program years this criterion could be waived if a state designated the hospital as a necessary provider for rural residents), and other characteristics.[2] Medicare payment to CAHs is based on their allowable costs (plus 1 percent, but adjusted to 99 percent under sequestration). Some state Medicaid programs may also pay CAHs differently.

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The LVH designation, created in 2003 and modified in 2010, is for hospitals that are more than 15 miles away from the nearest hospital that is paid under Medicare's Inpatient Prospective Payment System and have fewer than 3,800 annual patient discharges.[3] Such hospitals receive up to 25 percent additional payment per Medicare discharge, depending on volume.[4] Since the LVH designation depends on volume, it is recalculated each year.

The ratio of fixed-to-total costs, or alternatively the overall percentage of costs that are fixed over a limited time period, has important implications for hospital financial projections and payment policy design. Fixed costs (e.g., costs related to buildings, equipment, information technology, administration, and minimum staffing levels) are largely invariant to changes in patient volume over a limited time horizon, whereas variable costs (e.g., medications and devices, meals, laundry, certain supplies, and some staffing) typically increase directly with patient volume.

Our previously published analysis found that the ratios for non-federal short-term acute-care hospitals differed across the rural county continuum, and in particular that the estimates were clustered by 2013 Urban Influence Code (UIC).[5] Our discussion of this finding noted that the rurality of the place itself creates challenges due to low population density associated with low volumes. In this extended analysis we therefore used those same UIC groupings (which were determined after examining fixed-to-total-cost ratios by individual UIC level and noting that there was significant clustering into four distinct groups) to better describe how rurality relates to hospital cost structures. We describe the populations who are served by such hospitals and how CAH and LVH presence varies across the U.S., identifying states where special attention to their rural hospitals' cost structures may be needed in new payment design.

Data and Methods

This brief uses results from our published analysis,[1] namely the estimated fixed-to-total-cost ratio for each non-federal, short-term acute hospital in the United States, based on Medicare Hospital Cost Report Information System (HCRIS) data for 2011 to 2020. This analysis resulted in a universe of 4,953 hospitals, most of which reported costs in all 10 years studied. All costs were inflation-adjusted to 2020 dollars using the Medical Consumer Price Index. UICs, which range from 1 to 12, are used to define the degree of rurality of a given county. While codes 1 and 2 refer to counties in large and small metropolitan areas, respectively, codes 3 through 12 are non-metropolitan and describe a range of rural settings (see Table 1). Codes 3, 5, and 8 designate micropolitan counties in various proximities to metropolitan areas.

Our analysis is based on a regression model that predicted total volume, measured in adjusted patient days, with a small number of hospital characteristics as independent variables, for each hospital-year. This model allowed us to calculate the estimated fixed and variable costs using the simple definition of a variable cost as one that varies with volume. Therefore, costs that tracked with adjusted patient days were considered variable and all other costs were considered fixed, allowing us to construct a fixed-to-total-cost ratio for each hospital year. For additional details, please see the original study.[1]

We then averaged the ratios by hospital and reported averages by metropolitan status and by CAH and LVH designations. We considered a hospital to be a LVH if it was reported as such in a majority of the years of data. We report medians and interquartile ranges. We also aggregate county data into "UIC groups," which were identified in our original study as having distinct fixed-to-total-cost profiles. The groups are as follows: (1) metropolitan (UIC = 1,2); (2) micropolitan (UIC = 3,5,8); (3) noncore but adjacent to a large metro area or with a town of at least 2,500 people (UIC = 4,6,9,11); and (4) noncore and without a town of at least 2,500 people (UIC = 7,10,12).

To provide additional context regarding the possible impact of these findings, we matched our UIC groups to other county-level data from the 2017-2021 American Community Survey five-year estimates to compute descriptive statistics on population demographics. We computed average population density in each UIC group based on the land area (in square miles) in each county from the Area Health Resources File. We also created a county-level map to show how the relevant UIC groups

are distributed across the United States. We also created maps to illustrate the prevalence of the CAH and LVH designations across the three nonmetropolitan UIC groups.

Results

Distribution of Hospitals by County Type and Hospital Type

The distribution of fixed-to-total-cost ratios within each UIC class are displayed in Table 1. It is notable that the median [25th percentile, 75th percentile] ratio for all hospitals in metropolitan UICs is 0.733 [0.602,0.861], while the median ratios in all other UICs are markedly higher and increase as hospital locations become more rural. Specifically, hospitals in micropolitan UICs have a median of 0.847, while hospitals in the noncore counties that have towns of at least 2,500 people or are adjacent to a large metro area have a median equal to 0.901. Hospitals in the noncore counties that do not have towns of at least 2,500 people have a median of 0.933.

As expected, population density declines across UIC groups. The magnitude of the decline is considerable, with micropolitan areas having just over 10 percent of the population density of metropolitan areas, i.e., 671.7 people per square mile compared to 69.8 people per square mile. Noncore counties with towns (or adjacent to large metropolitan areas) are less dense, at 40.1 people per square mile, and noncore counties without towns of at least 2,500 people have an average of only 13.3 people per square mile (2 percent of the metropolitan value).

Table 1. Average County Population Density, Median, 25th and 75th Percentiles of Fixed-to-Total-Cost Ratios for all Hospitals by UIC Group

UIC Group	Number of Hospitals	Average Population Density	Median Ratio of Hospitals in UIC Group	25th percentile	75th percentile
Metropolitan (UIC = 1,2)	2,976	671.7/mi^2	0.733	0.602	0.861
Micropolitan (UIC = 3,5,8)	797	69.8/mi^2	0.847	0.778	0.895
Noncore adjacent to large metro or with town of 2500+ (UIC = 4,6,9,11)	857	40.1/mi^2	0.901	0.866	0.929
Noncore without town of 2500+ (UIC = 7,10,12)	332	13.3/mi^2	0.933	0.886	0.957

Figure 1. Fixed-to-Total-Cost Ratios by UIC Group and CAH/LVH Designation

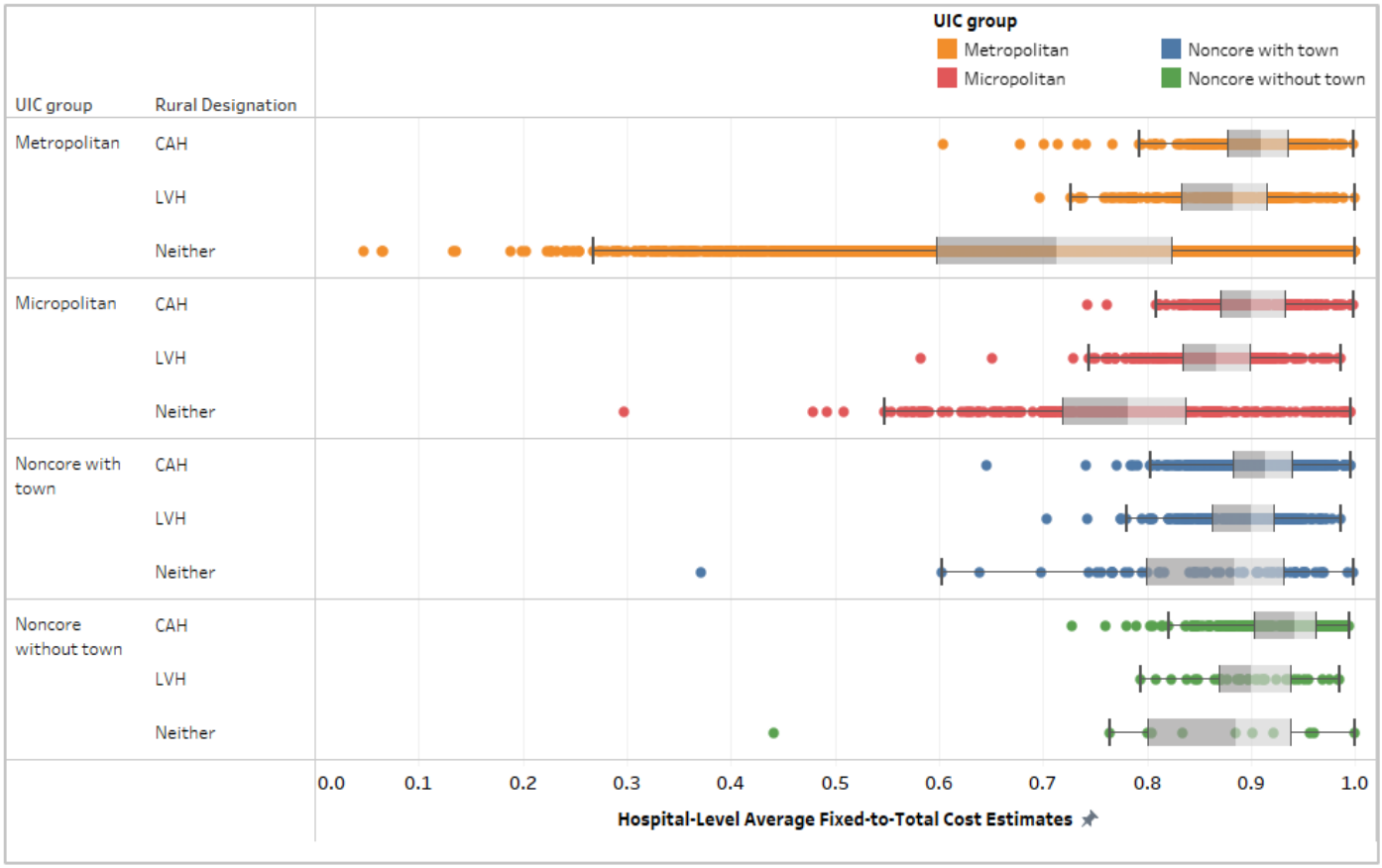
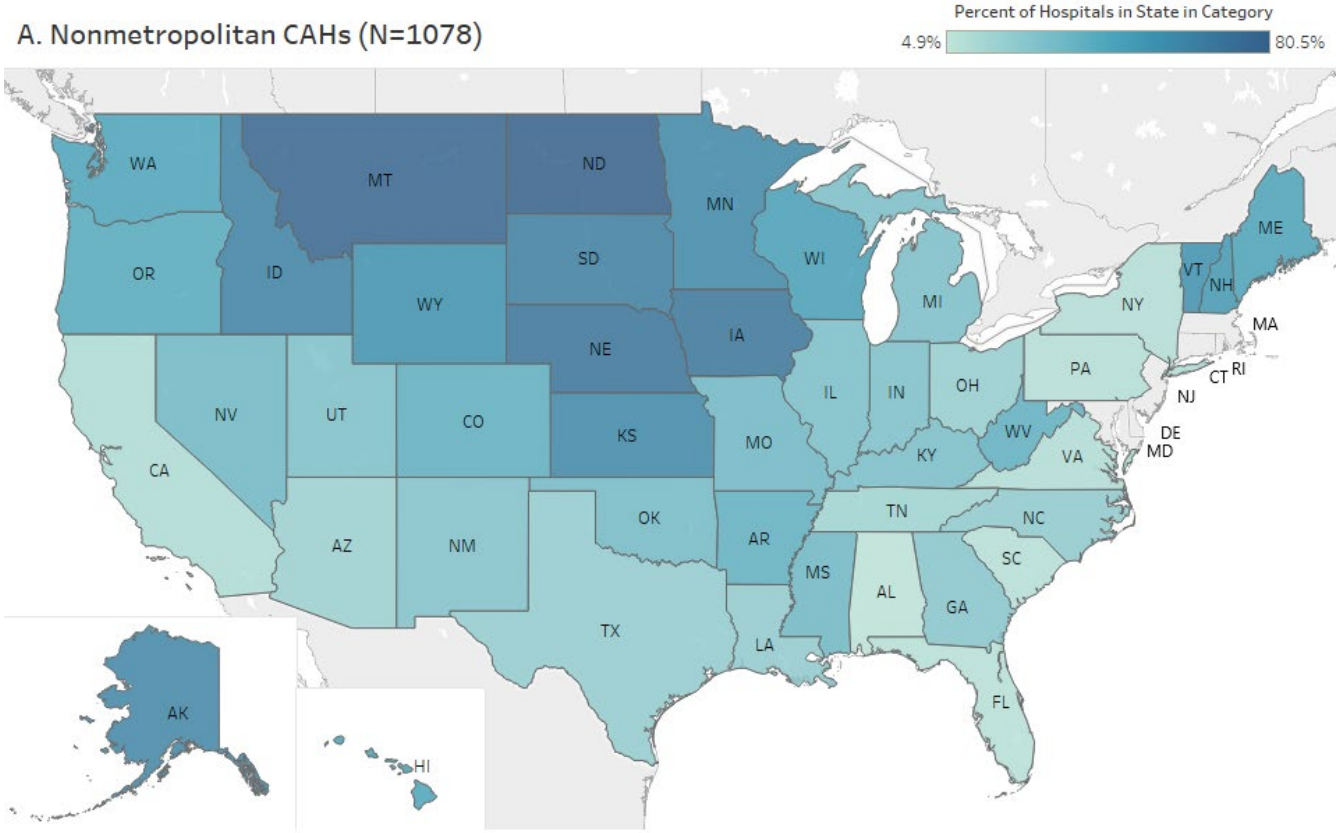


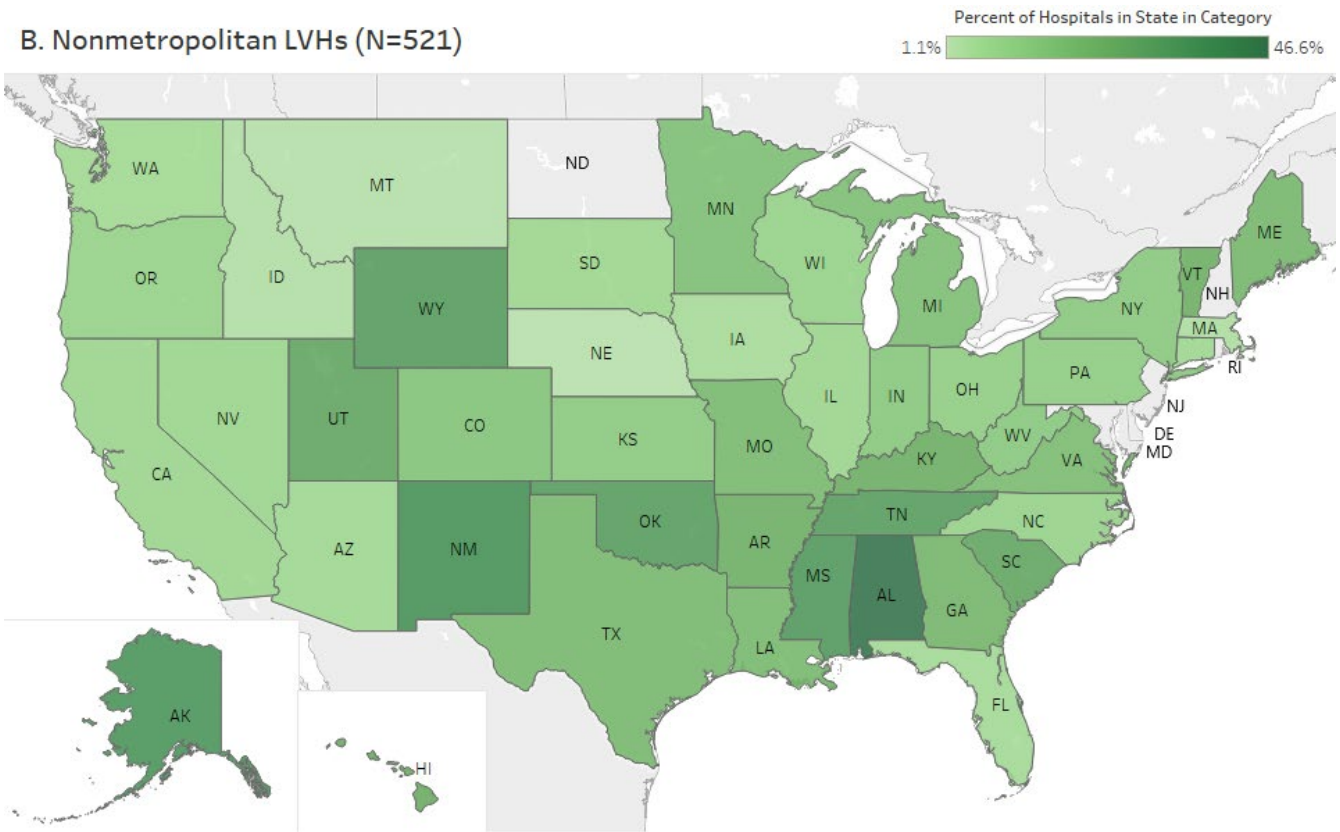
Figure 1 shows how the information summarized in Table 1 breaks down by hospital payment designation, showing estimated fixed-to-total cost ratios for CAHs, LVHs, and hospitals with neither designation. In general, within each UIC group, CAHs have higher ratios than LVHs, and both have higher ratios than hospitals with neither designation. However, it is important to notice that there are many facilities in each UIC group (each represented by a dot in Figure 1) that have neither designation but are estimated to have fixed-to-total-cost ratios that are as high as those estimated for CAHs and LVHs within the same UIC group. While some outliers may be due to the estimation method, many facilities in rural counties—in particular, in noncore counties—have neither status but likely have high fixed-to-total-cost ratios. This possibility raises concerns that the criteria to qualify for these designations may need adjustment. We therefore turn to reporting the geographic distribution of CAHs and LVHs.

Figure 2, Panel A, shows that CAHs represent a larger proportion of all rural hospitals in the upper Great Plains states, with 80.5 percent and 77.6 percent of all nonmetropolitan hospitals in North Dakota and Montana, respectively, having the CAH designation. Panel B indicates that LVHs are more prevalent in the South—46.6 percent of Alabama's nonmetropolitan hospitals have the LVH designation—and are common in some mountain states. Nonmetropolitan hospitals in many coastal states do not have either designation, as depicted in Panel C. In most cases, these are hospitals located in micropolitan counties, but the coastal pattern holds for noncore counties as well (not shown). Furthermore, in Maryland, Virginia, and Louisiana, we found that 100 percent, 73.6 percent, and 61.4 percent, respectively, of hospitals in noncore counties without towns of at least 2,500 people had neither the CAH nor the LVH designation.

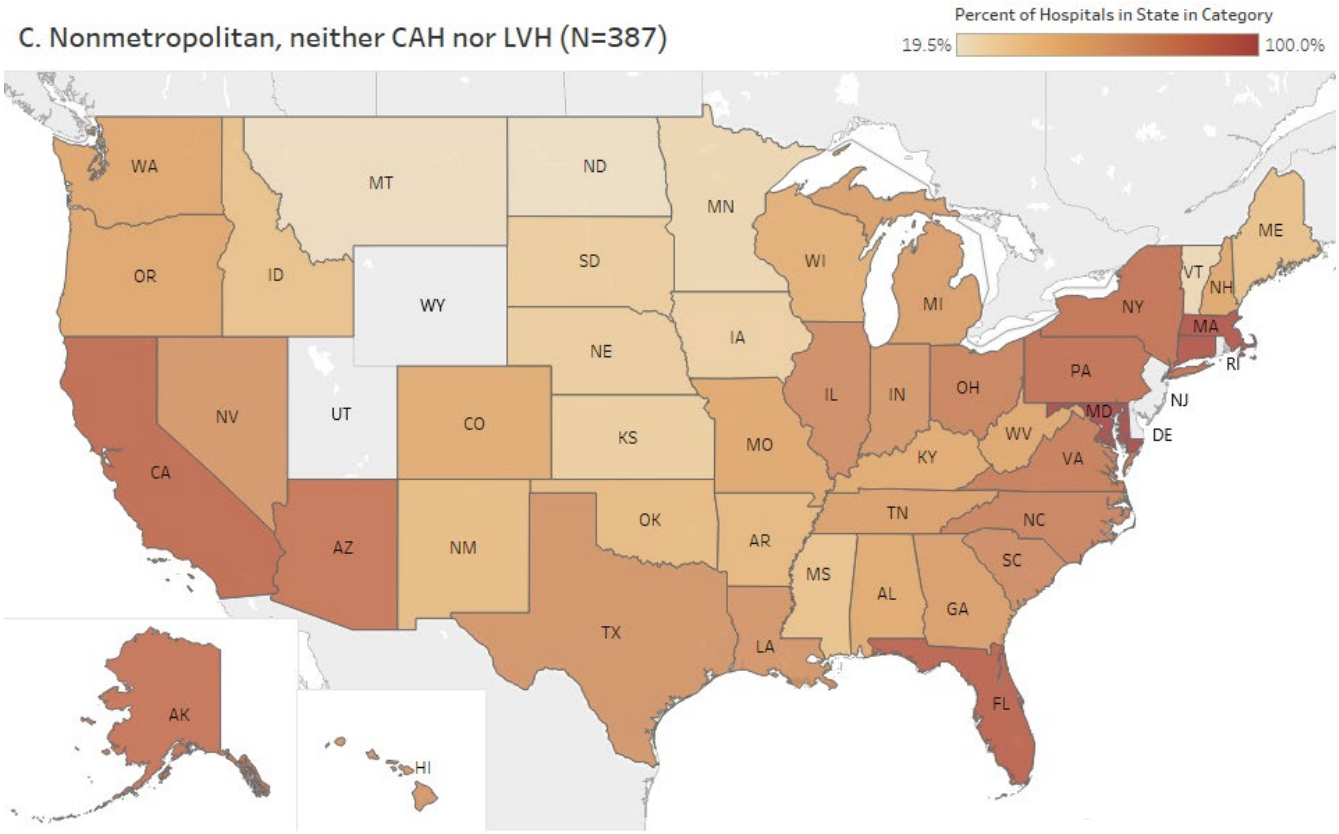
Figure 2. Percent of Nonmetropolitan Hospitals with CAH, LVH, or Neither Status



Note: States with no nonmetropolitan CAHs are greyed out.



Note: States with no nonmetropolitan LVHs are greyed out.



Note: States in which all nonmetropolitan hospitals are CAHs or LVHs are greyed out.

Characteristics of Counties Most Likely Served by Hospitals with High Fixed-to-Total-Cost Ratios

To assess patient subgroups living in nonmetropolitan places, we analyzed key county-level demographic data, calculated by UIC group. Figure 3 shows that for some measures, a uniform trend across levels of rurality is observed: the percent of the population older than 60 and the percent with Medicare coverage increase as the UIC group becomes more rural, while employer-sponsored insurance (ESI) coverage decreases. While there is some variation depending on the measure, the general trends across the metro/nonmetro continuum show that among populations served by counties in higher fixed-to-total-cost ratio UIC groups, a smaller share of the population has at least a college education, a larger share has Medicaid coverage, and a smaller percentage are nonwhite.

Figure 3. Selected Demographic Characteristics by UIC Group

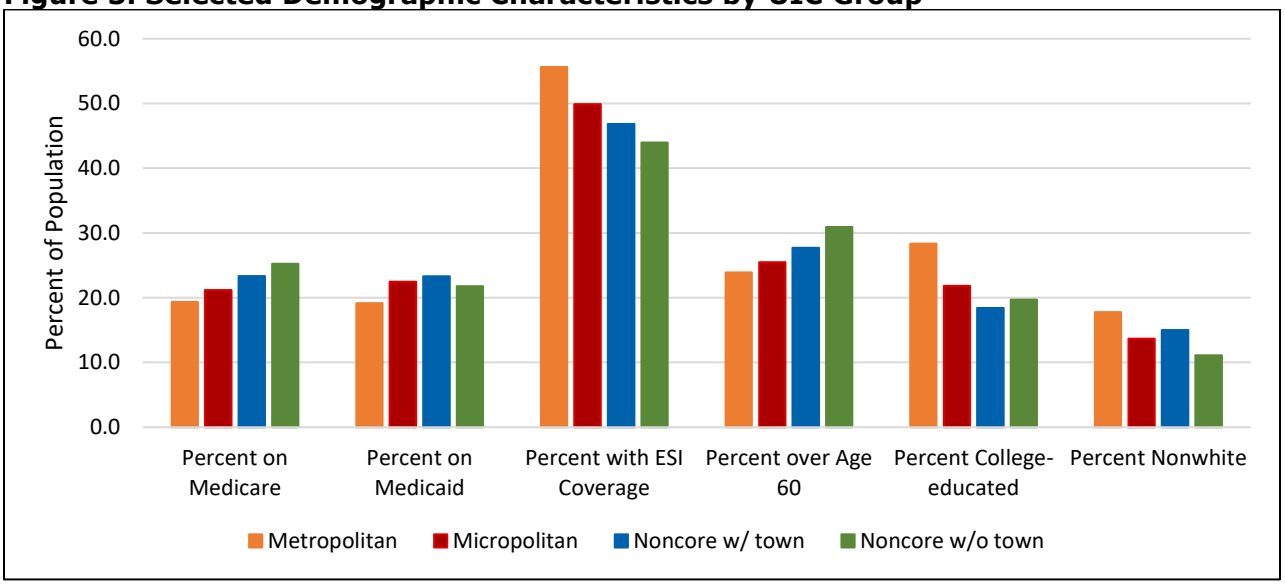
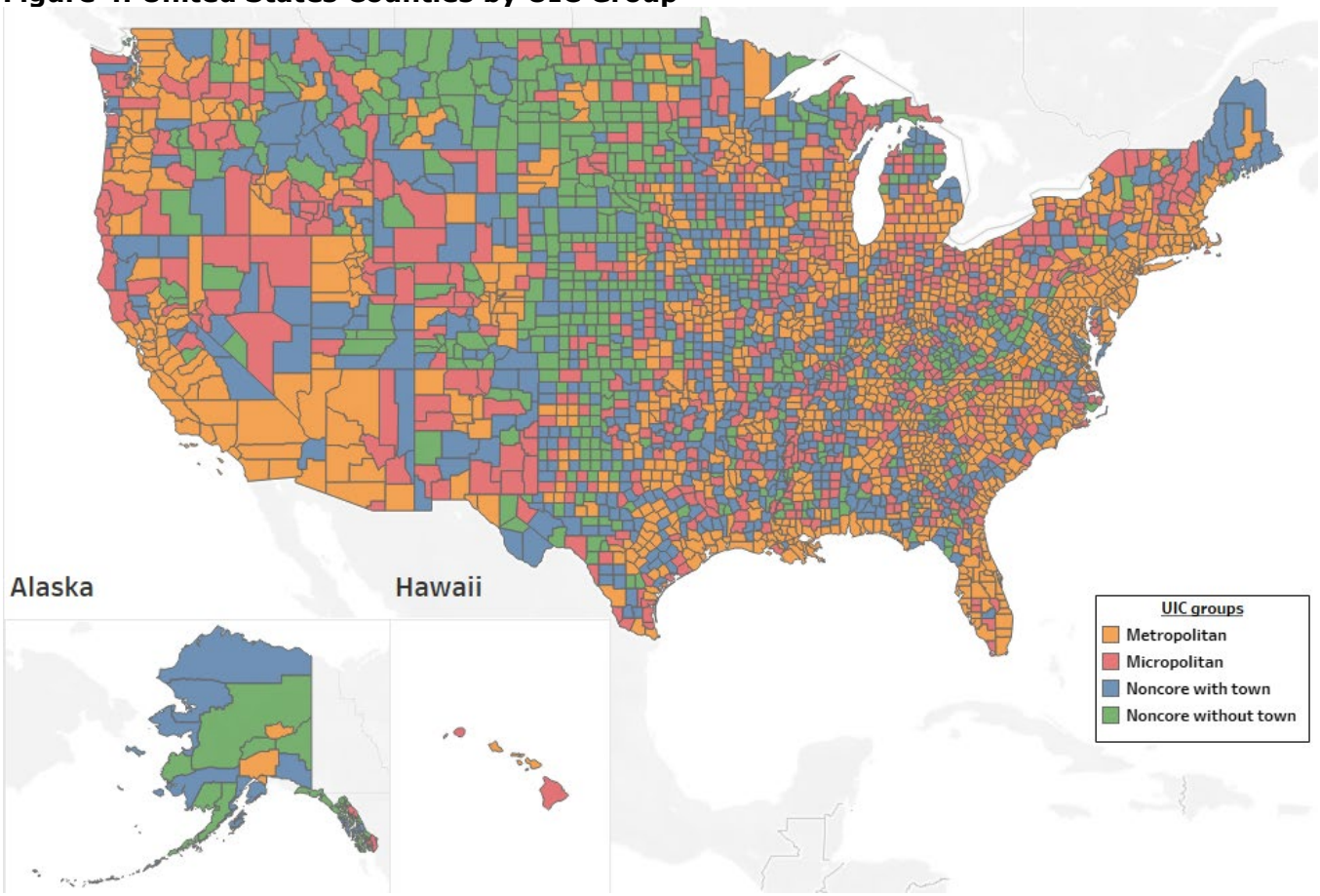


Figure 4 shows how the different UIC groups are distributed across the U.S. In particular, the most rural UIC group, which contains noncore counties[6] without towns of at least 2,500 people, is concentrated in the Midwest and Great Plains states. Note that it is not uncommon for these counties to have neighboring counties that are also noncore without towns.

Figure 4. United States Counties by UIC Group



Discussion

This analysis finds high fixed-to-total-cost ratios in many rural hospitals. As show in our previously published findings these fixed cost ratios are highest, commonly over 90 percent, for hospitals located in noncore counties with the lowest population densities. This population finding suggests a relationship between low patient volumes and high fixed-to-total-cost ratios. For these hospitals it may be the case that overall patient volumes are too low to adequately pay for the fixed costs of maintaining rural hospital services when payments are made on a fee-for-service basis and driven by service volumes. This may lead to persistent challenges for these hospitals in maintaining financial viability.

Policies that designate low volume rural hospitals who are necessary providers to assure access to services in their communities may be responsive to financial realities by using reimbursement methodologies unique to those designations. In this *Policy Brief* we extended our previous work by examining fixed-to-total -cost ratios for two such designations affecting many rural hospitals – CAH and LVH. Both implicitly recognize higher ratios, either because the hospital is small and focused on short-term stays (CAHs), or that its volume is low regardless of bed counts and distance from other hospitals (LVHs). We did not include other designations that may also address challenges meeting fixed costs – Sole Community Hospitals and Medicare Dependent Hospitals.

To understand the fit between designations and fixed cost ratios, we stratified ratios by both CAH and LVH designation. By showing the geographic variation in these designations across the United States,

this brief also provides additional context to our previously published findings that hospital fixed-to-total-cost ratios vary by population density and degree of rurality, as described by UIC groups. As expected, CAHs tended to have the highest estimated fixed-to-total-cost ratios, while LVHs tended to have lower ratios, but still higher than those of hospitals with neither designation. This finding suggests that these payment policies based on actual costs are targeting hospitals appropriately. Future research could extend this analysis to other designations (Sole Community Hospitals, Medicare Dependent Hospitals).

It may be appropriate to fine-tune both sets of criteria to ensure that all nonmetropolitan facilities with high fixed-to-total-cost ratios are eligible for designations that allow payment policies to mirror cost structures. Moreover, as payment models evolve to emphasize value-based payment – which may benefit hospitals with high quality and low volumes – payment policies for small rural hospitals should acknowledge different fixed-to-total-cost ratios. Current models that use a global budget payment (Pennsylvania Model)[7] and those providing advanced payment (for inexperienced and small hospitals in the Medicare Shared Savings Program) are examples of this approach.

The brief also describes the populations served by hospitals in those UIC groups. Policies that do not adequately consider fixed-to-total-cost ratios may be most likely to have a negative impact on access to hospital services in the Great Plains region. Places with very low population density, places with greater shares of older people and of people covered by Medicare and Medicaid, may also be disproportionately affected. Moreover, the relative lack of ESI coverage, and the relative reliance on public coverage, suggest that the facilities with the highest fixed-to-total-cost ratios may also tend to have challenging payer mixes (e.g., have more uninsured or Medicaid patients, leading to lower revenues). Understanding these demographics as they relate to hospital financial stability is important because successful policies can help ensure access to hospital and other services for those already at risk.

Overall, hospital payment policy and payment model development may benefit from considering hospital fixed-to-total-cost ratios, particularly in places where economies of scale are unattainable. Each rural hospital provides safety and security to the community it serves, which is a fixed value that may be viewed as offsetting a portion of the high fixed costs. The fact that the level of rurality itself matters should be explored further, to identify ways that this insight could be used to refine payment policies that are intended to better support all Americans' access to hospital services.

Notes

[1] Barker AR, MacKinney AC, McBride TD. Policy implications of fixed-to-total-cost ratio variation across rural and urban hospitals. The Journal of Rural Health. 2023 May 19. https://onlinelibrary.wiley.com/doi/10.1111/jrh.12767

[2] Additional criteria include having 25 or fewer beds and an average length of stay of 96 hours or less. CAHs may meet all criteria while being in a county that is technically metropolitan, i.e., part of a metropolitan statistical area. For further details, see CMS MLN Booklet "Information for Critical Access Hospitals," available at https://www.cms.gov/files/document/mln006400-information-critical-access-hospitals.pdf.

[3] U.S. Code, 42 CFR 412.101. "Special Treatment: Inpatient hospital payment adjustment for low-volume hospitals." Accessed March 28,2024. https://www.ecfr.gov/current/title-42/chapter-IV/subchapter-B/part-412/subpart-G/section-412.101

[4] Whitaker RG, Holmes GM, Pink GH. How Would Rural Hospitals Be Affected by Loss of the Affordable Care Act's Medicare Low-Volume Hospital Adjustment?. The Journal of Rural Health. 2017 Apr;33(2):227-33. https://onlinelibrary.wiley.com/doi/epdf/10.1111/jrh.12225

[5] Economic Research Service. 2013 Urban Influence Codes - Documentation. Washington, D.C.: US Department of Agriculture. Updated May 11, 2021. Accessed July 1, 2022. https://www.ers.usda.gov/data-products/urban-influence-codes/documentation/

[6] We present difference among counties since the analysis in this brief is at county level. We acknowledge that there are remote areas in counties included in metropolitan areas, particularly in Mountain West and Southwest states.

[7] Centers for Medicare & Medicaid Services. Pennsylvania Rural Health Model. Accessed January 6, 2025. https://www.cms.gov/priorities/innovation/innovation-models/pa-rural-health-model.

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