Findings Brief
NC Rural Health Research Program

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Changes in Bed-Based Measures of Surge Capacity from 2018 to 2022 among Rural and Urban Hospitals

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BACKGROUND AND PURPOSE

Recent research has documented the diminishing role of inpatient care among both rural and urban hospitals in the United States. From 2011 to 2017, rural hospitals experienced a 13 percent decrease in inpatient daily census.[1] Over a similar time period, the percent of rural hospital revenue coming from inpatient services declined from 33.5 percent in 2011 to 25.8 percent in 2019 (the percent of urban hospital revenue coming from inpatient services declined from 54.3% to 47.9% over this time period).[2] Furthermore, the number of rural hospitals facing complete closure or conversion to non-inpatient facilities has continued to increase; from January 2010 to December 2025, 87 rural hospitals closed completely, 42 converted to a Rural Emergency Hospital (REH), and 65 converted to another type of non-inpatient, non-REH facility.[3,4] Cited reasons for the decline in inpatient care often include low patient volume at rural hospitals, high bypass rates,[5] difficulty in sustaining costly inpatient services,[6] and the incentive structure of value-based care programs.[7] Although reduction or elimination of inpatient services might help rural hospitals remain financially viable, questions remain about these hospitals' ability to handle periods of high inpatient demand.

The COVID-19 pandemic demonstrated that public health emergencies may stress the limits of rural hospitals' decreasing inpatient capacity. Prior to the pandemic, rural hospitals were estimated to have inpatient occupancy rates around 35–50 percent, substantially lower than occupancy rates among urban hospitals.[8,9] However, continued hospital closures, the shift away from inpatient services, and pandemic-related effects may have led to higher occupancy rates in more recent years. During the initial stages of the pandemic, COVID-19 patients admitted to a rural hospital sometimes required multiple weeks of inpatient care; recognizing this, the Centers for Medicare & Medicaid Services (CMS) waived some Conditions of Participation, such as the 96-hour average patient length of stay limit among Critical Access Hospitals,[10] to provide the health care system the greatest flexibility in its response. The long length of stay was often exacerbated by other challenges facing rural hospitals, such as older patients, equipment

SUMMARY AND KEY FINDINGS

Hospital surge capacity refers to the ability to handle sudden and possibly dramatic increases in health care demand, such as the increase in demand experienced during the COVID-19 pandemic, a natural disaster, or a mass casualty event. One method of assessing surge capacity is to examine a hospital's typical number of unoccupied beds. On an average day in 2022, the average rural hospital had 24 unoccupied acute care beds, accounting for approximately 66% of the hospital's total acute care beds. Although these numbers have decreased slightly from 2018 (26 unoccupied beds accounting for approximately 67% of total beds), the findings suggest that surge capacity, as measured by unoccupied beds, has not dramatically changed in recent years. Additional analyses show no consistent differences in surge capacity trends by local community characteristics, including community resilience score and social vulnerability score, or by the hospital's geographic remoteness. Of course, overall surge capacity is a function of other factors beyond the number of beds, notably the health workforce.

- Among both rural and urban hospitals, the percentage of acute care beds that were unoccupied increased slightly in 2020 before falling slightly below pre-pandemic levels in 2021. From 2018 to 2022, rural hospitals consistently reported a higher average percentage of acute care beds that were unoccupied, as compared to urban hospitals.
- The average percentage of rural hospital acute care beds that were unoccupied from 2018 to 2022 remained above 60% when stratifying hospitals by community characteristics and geographic remoteness.

shortages, and a smaller workforce.[11] These challenges collectively affected rural hospitals' surge capacity, i.e., the ability to handle sudden and possibly dramatic increases in health care demand. COVID-19 is the most recent public health emergency requiring a sudden increase in health care utilization, but as noted by other researchers,[12] future events such as natural disasters, terrorist acts, nearby hospital closures, or new disease outbreaks could also test hospital surge capacity. Effective transfer networks are essential to handle sudden increases in health care demand, but retaining sufficient local inpatient capacity is often another critical component.

In the context of recent policy developments such as inpatient services decline and the REH introduction, the goal of the current research was to examine how hospital inpatient capacity has changed over time.

METHODS

We began by identifying general acute care hospitals from 2018 to 2022 included in CMS cost report data.[13] Cost reports are based on fiscal years, and thus we defined each hospital-year of observation based on the end date of the hospital's given fiscal year (e.g., a cost report covering the period from October 1st, 2021 to September 30th, 2022 would be defined as a hospital's observation for 2022). We focused on hospitals with complete data on inpatient days of care and total number of acute care beds across all five study years. The inpatient days measure was sourced from cost report Worksheet S-3, Part I, Line 7, Column 8 and included inpatient days for all adult and pediatric patients (including swing bed days). The acute care beds measure was sourced from Worksheet S-3, Part I, Line 7, Column 2.

We calculated inpatient Average Daily Census (ADC) for each hospital by dividing the number of inpatient days by the number of days included in the cost reporting period. We then calculated the number of unoccupied beds by subtracting the inpatient ADC from the number of acute beds reported by each hospital. Next, we calculated the percentage of acute beds that were unoccupied by dividing the number of unoccupied beds by the total number of acute beds for each hospital.

After creating our three outcome variables, we calculated average (mean) inpatient ADC, average number of unoccupied beds, and average percent acute beds that were unoccupied for each year, stratified by hospital rurality (rural vs. urban vs. all hospitals). We identified the rural status of each hospital using criteria outlined by the Federal Office of Rural Health Policy (FORHP) in the Health Resources & Services Administration (HRSA).[14] Namely, we considered a hospital to be rural if the hospital was located in a nonmetropolitan county, OR a metropolitan Census tract with a Rural-Urban Commuting Area (RUCA) code 4 – 10, OR a large area metropolitan Census tract of at least 400 square miles in area with a population density of 35 or less per square mile and a RUCA code 2 – 3, OR an outlying metropolitan county without an urbanized area.

We then restricted our dataset to rural hospitals only. Using the rural-only data, we calculated changes in the average percent of acute beds that were unoccupied, stratified by local county characteristics (e.g., community resilience and social vulnerability) and the remoteness of the hospital's geographic location.

We used publicly available data from the Federal Emergency Management Agency (FEMA) to measure community resilience and social vulnerability for each rural hospital's county.[15] Community resilience is defined as a "consequence reduction component and uses demographic characteristics to measure a community's ability to prepare for, adapt to, withstand, and recover from the effects of natural hazards." The underlying resilience data are sourced from the University of South Carolina's Hazards and Vulnerability Research Institute's Baseline Resilience Indicators for Communities (BRIC).[16] In comparison, social vulnerability is defined as a "consequence enhancing component and analyzes demographic characteristics to measure the susceptibility of social groups to the adverse impacts of natural hazards." The underlying vulnerability data are sourced from the Social Vulnerability Index (SVI) produced by the Centers for Disease Control and Prevention and Agency for Toxic Substances and Disease Registry.[17] County-level community resilience and social vulnerability are both categorized by FEMA into five distinct ratings, ranging from "very low" to "very high."

Lastly, we used ZIP Code-level Frontier and Remote Area (FAR) codes from the United States Department of Agriculture (USDA) Economic Research Service (ERS) to measure a hospital's level of remoteness.[18] FAR codes are defined "in relation to the time it takes to travel by car to the edges of nearby urban areas." Higher FAR codes (which range from

level 1 to level 4) delineate higher levels of remoteness. For our research, we defined areas not meeting the criteria for FAR level 1 as "level 0."

RESULTS

Figure 1 shows changes in the average inpatient ADC for rural, urban, and total hospitals from 2018 to 2022. Rural hospital ADC remained stable from 2018 (15.03) to 2022 (15.26) with a slight dip in 2020 (14.02), as compared to urban hospitals. Urban hospital average inpatient ADC grew from 2018 (129.03) to 2022 (139.35), with a slight dip during 2020 (125.43).

Figure 1. Inpatient ADC by Year and Hospital Rurality

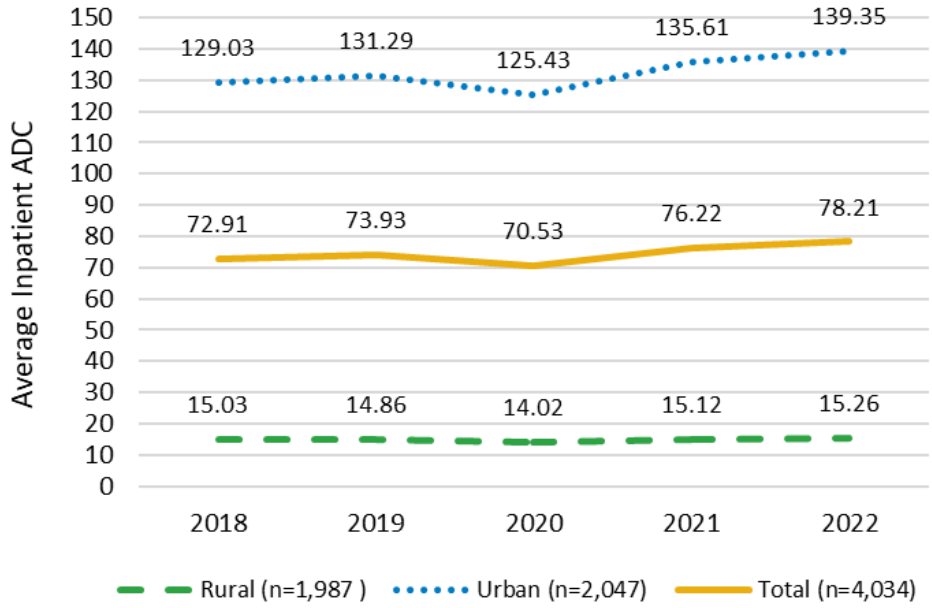


Figure 2 shows changes in the average number of unoccupied acute care beds for rural, urban, and total hospitals from 2018 to 2022. Average unoccupied beds steadily decreased for rural hospitals from 2018 (25.83) to 2022 (24.00), with a less pronounced upward spike in 2020 (25.94), as compared to urban hospitals. The average number of unoccupied beds decreased steadily for urban hospitals between 2018 (77.84) and 2022 (71.48), with an increase only observed in 2020 (84.04).

Figure 2. Number of Unoccupied Beds by Year and Hospital Rurality

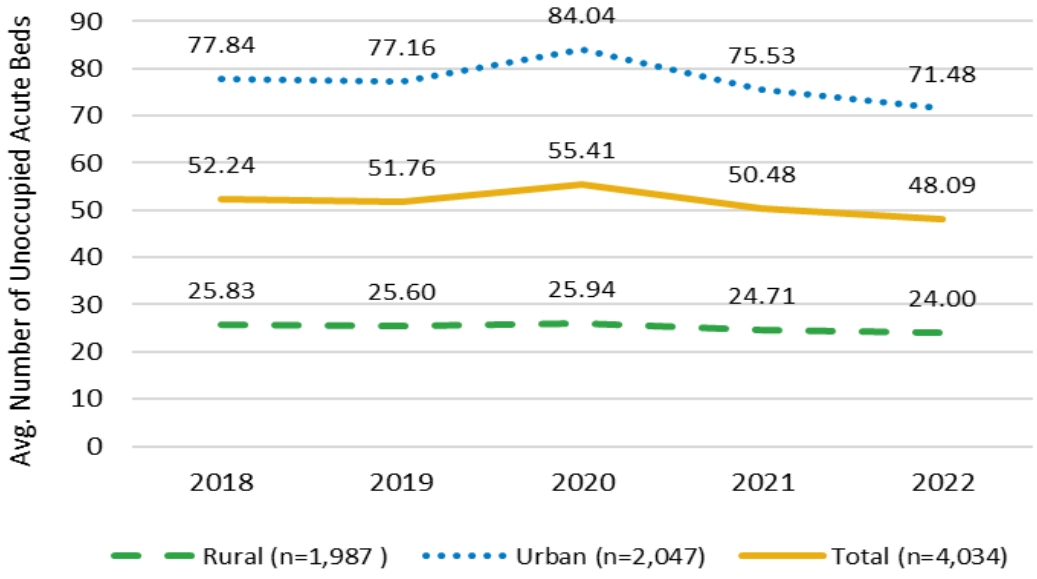
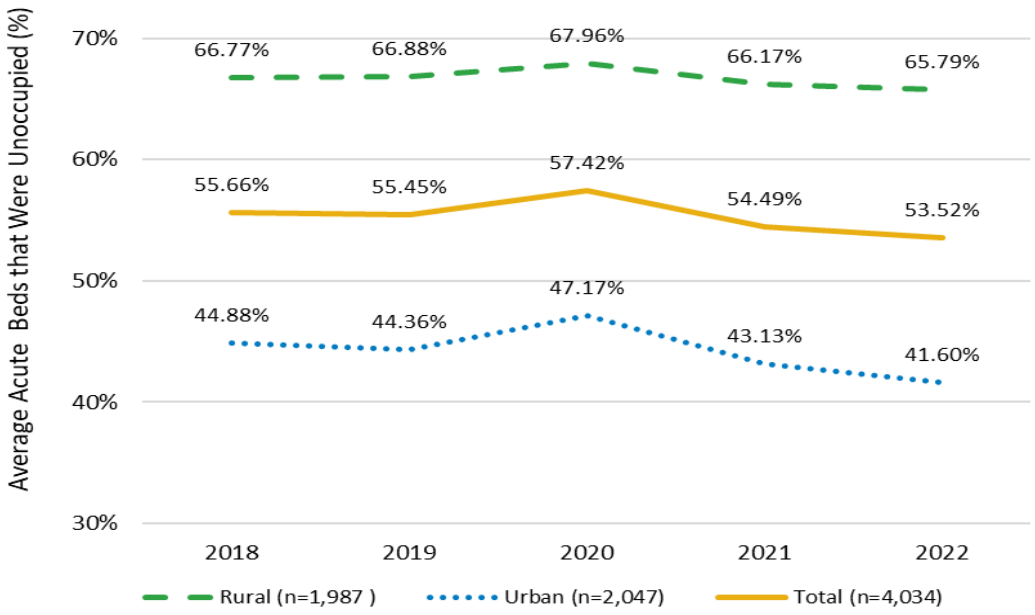


Figure 3 shows changes in the average percentage of acute beds that were unoccupied for rural, urban, and total hospitals from 2018 to 2022. The average percentage of acute beds that were unoccupied for rural hospitals decreased slightly from 2018 (66.77%) to 2022 (65.79%), with a less pronounced increase in 2020 (67.96%), as compared to urban hospitals. The average percentage of acute beds that were unoccupied decreased for urban hospitals from 2018 (44.88%) to 2022 (41.60%), with an increase only observed in 2020 (47.17%).

Figure 3. Percentage Unoccupied Beds by Year and Hospital Rurality



Figures 4, 5, and 6 show changes in average percentage of acute beds that were unoccupied for rural hospitals only, stratified by community resilience rating, social vulnerability rating, and FAR code, respectively. Across levels of community resilience rating, social vulnerability rating, and FAR code, the average percentage of acute beds that were unoccupied for rural hospitals remained relatively stable from 2018 to 2022, with increases in 2020 that dropped again in 2021. Of note, communities with low resilience and high vulnerability had a pattern that differed from the other communities – their availability decreased during 2020, while the others had a slight increase in 2020. The average percentage of acute beds that were unoccupied remained above 60 percent for rural hospitals in all three Figures.

Figure 4. Percentage Unoccupied Beds by Community Resilience Rating (Rural Hospitals Only)

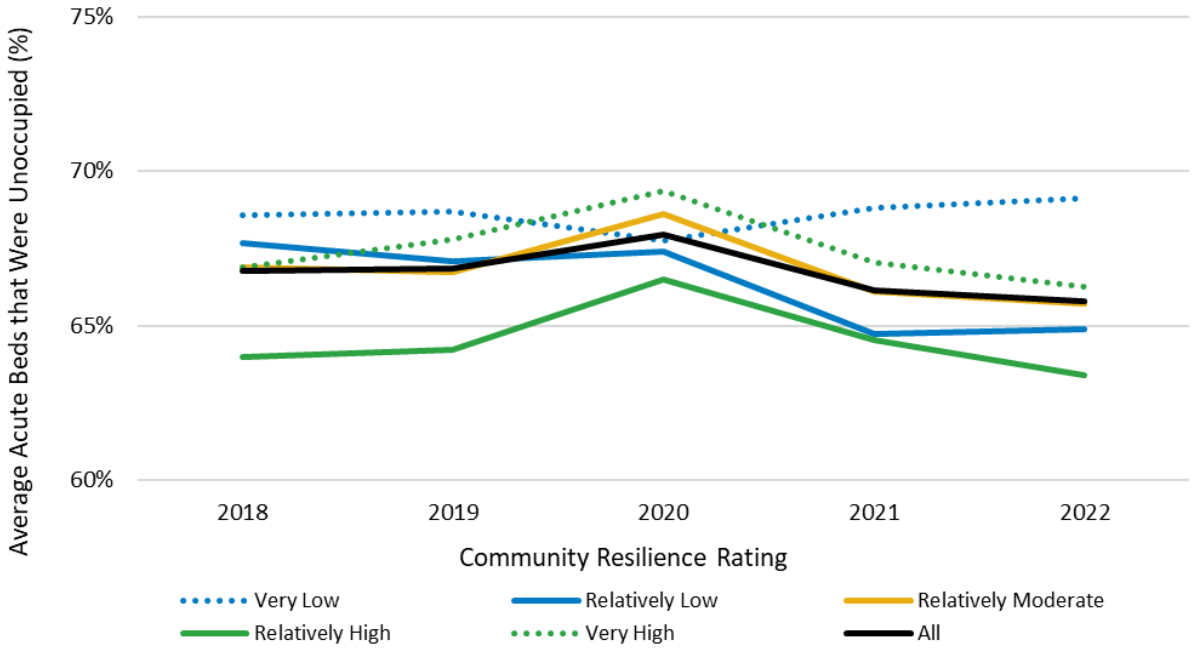


Figure 5. Percentage Unoccupied Beds by Social Vulnerability Rating (Rural Hospitals Only)

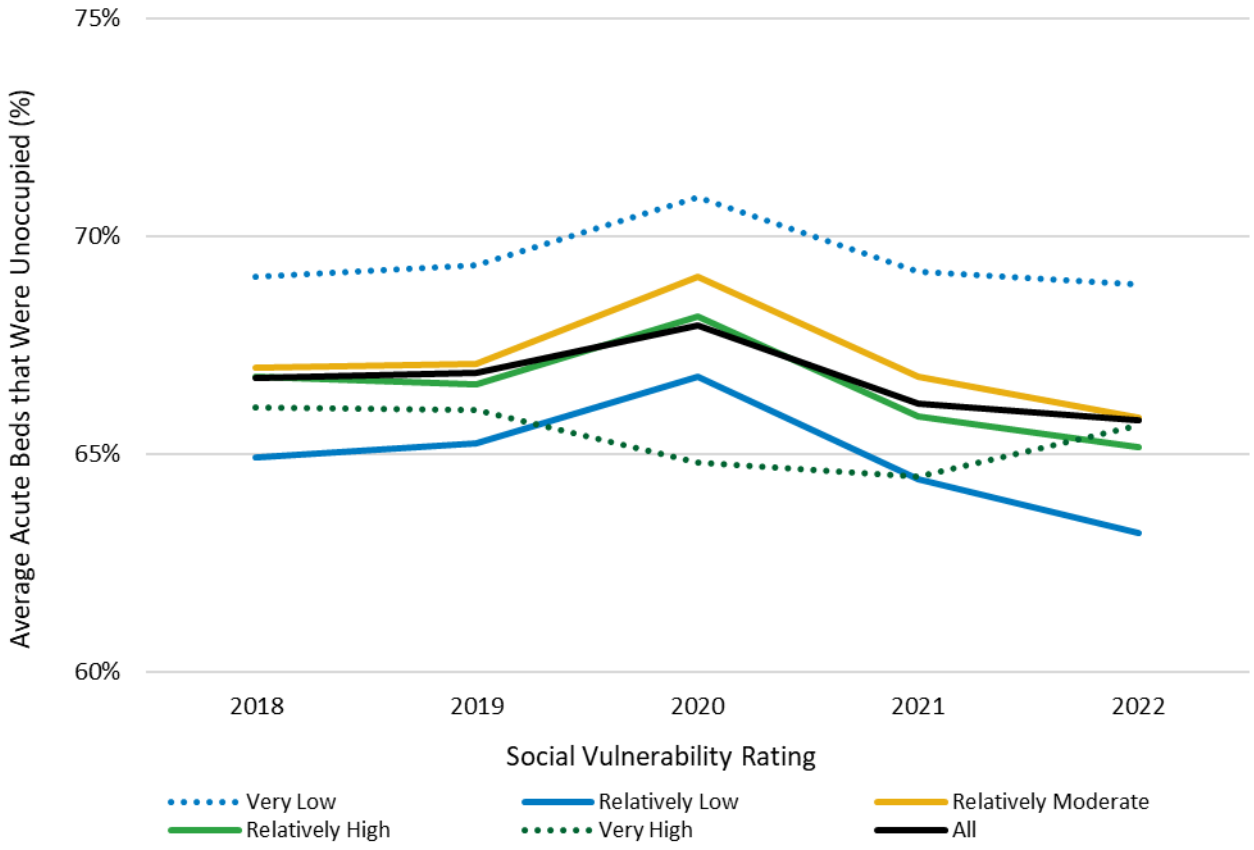
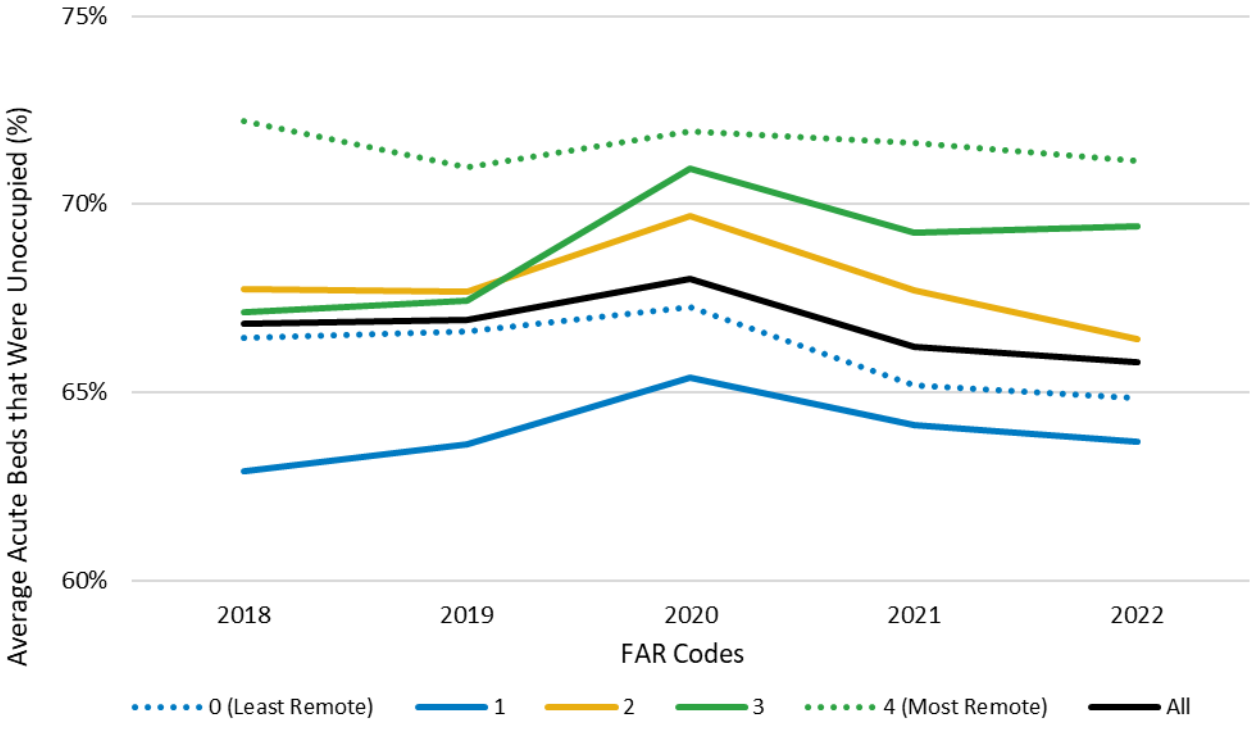


Figure 6. Percentage Unoccupied Beds by FAR Score (Rural Hospitals Only)



Notes: FAR codes are defined "in relation to the time it takes to travel by car to the edges of nearby urban areas." Higher FAR codes (which range from level 1 to level 4) delineate higher levels of remoteness. For our research, we defined areas not meeting the criteria for FAR level 1 as "level 0."

DISCUSSION

The objective of this analysis was to quantitatively describe rural hospitals' capacity to accommodate unexpected surges in inpatient volume. Our results indicate that rural hospitals have maintained relatively stable levels of inpatient capacity since 2018, as measured by the availability of unoccupied beds. Particularly in comparison to urban hospitals, our findings suggest that the average percentage of acute beds that were unoccupied was higher for rural hospitals than urban hospitals across all years included in the analysis (2018 – 2022), including during the height of the COVID-19 public health emergency. Among both rural and urban hospitals, our analysis shows an increase in the percent of acute beds that were unoccupied during the first year of the COVID-19 emergency, which was likely a result of reported delays in elective inpatient care.[19]

Of note, hospitals in communities with low resilience *and* high vulnerability were the only group that experienced an aggregate decrease in capacity during 2020; systemwide events may have different effects depending on the characteristics of the community. For example, it could be that more challenged communities saw an increase in COVID-related admissions that exceeded the decrease in electives; alternatively, this may be a manifestation of some rural hospitals acting as a "safety release valve" to crowded urban hospitals during the peak of the pandemic. Our finding that urban hospitals had consistently lower capacity (higher occupancy) than rural hospitals further reflects that surge capacity may need to be a shared responsibility between urban and rural facilities during public health emergencies.

We note that the measure of surge capacity used in this research – unoccupied acute care beds – is not all-encompassing and does not reflect other important aspects of surge capacity such as equipment and workforce availability. Furthermore, rural hospitals continue to face wide-spread rates of closure and conversion.[3,4] If these trends continue, inpatient capacity for rural hospitals could begin to decline. Rural researchers should continue to monitor rural hospital inpatient surge capacity, particularly if key drivers of surge demand (e.g., natural disasters and pandemics) become more common as predicted.[20,21]

Lastly, we acknowledge that determining whether a hospital's current level of surge capacity is "sufficient" requires further nuanced analysis. Sufficiency likely depends on the specific hospital, local community, ability to access alternative hospitals, and forecasted public health emergency. There are costs to maintaining empty beds, and general trends among rural hospitals[1,2] suggest many are limiting these costs through increased emphasis on outpatient care. The level of maintained surge capacity that may be appropriate for one rural hospital may differ for other hospitals with variation in financial performance.

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