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Metropolitan/Nonmetropolitan COVID-19 Confirmed Cases and General and ICU Beds

Fred Ullrich, BA; and Keith Mueller, PhD

Purpose

Previous reports from the RUPRI Center for Rural Health Policy Analysis have shown differences in how COVID-19 has spread across metropolitan and nonmetropolitan areas.ⁱ As the virus continues to spread across the country, concern has grown about the availability of health resources in rural communities to meet a potential rapidly increasing need.^{ii,iii} This brief considers a single measure of health resources – hospital beds – and reports of current COVID-19 cases in a single week to assess the potential impact of the virus on rural facilities.

Key Findings

- Over 4.7 million people live in 460 nonmetropolitan counties where there are no general medical/surgical hospital beds. From April 13, 2020 through April 19, 2020 a daily average of 167 new confirmed cases of COVID-19 were reported in those counties.
- There is little difference between metropolitan and nonmetropolitan counties in the median number of one-day new COVID-19 cases per general medical and surgical hospital beds (0.04 and 0.03 cases per bed, respectively).
- Using “worst case” estimates, 56 nonmetropolitan counties are at risk of having more COVID-19 cases than ICU beds.

Data and Methods

Data from the 2018 annual survey of the American Hospital Association (AHA) was used to obtain the number of general medical and surgical beds, and medical/surgical intensive care beds. Hospitals in this report were limited to "General Medical and Surgical" hospitals (excluding specialty hospitals such as orthopedic, or rehabilitation hospitals). Federal government hospitals (e.g. Veterans Administration hospitals and Indian Health Service hospitals) are included in this report.

The average daily count of new confirmed COVID-19 cases for the week April 13, 2020 through April 19, 2020 was calculated for each county using data obtained from USAFacts.^{iv} To assess the burden on a hospital on any given day, new confirmed cases for a single day were preferred. But as there appears to be some day-to-day variation in reports of new confirmed cases, the average number of daily cases reported over a one-week period was used.



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RURAL POLICY RESEARCH INSTITUTE

145 Riverside Dr., Iowa City, IA 52242-2007

Phone: 319-384-3830

<http://www.public-health.uiowa.edu/rupri>

E-mail: cph-rupri-inquiries@uiowa.edu

RUPRI Center for Rural Health Policy Analysis, University of Iowa College of Public Health, Department of Health Management and Policy,

Counties in the 50 states and the District of Columbia were classified as metropolitan or nonmetropolitan, with nonmetropolitan counties further separated into micropolitan and noncore categories based on their association with an urbanized area of 50,000 people or more. All county groupings are based on Urban Influence Codes.^v

Results

Tables 1 and 2 below show total general medical and surgical hospital bed, and medical/surgical ICU bed status; and confirmed COVID-19 cases (daily average over a one-week period), and rates of cases calculated per general medical and surgical hospital beds, and medical/surgical ICU beds.

Approximately 23.2 percent of nonmetropolitan counties (total population of 4.7 million) have no general medical and surgical beds; and 61.1 percent of nonmetropolitan counties (total population of 16.4 million) have no medical/surgical ICU beds. Not surprisingly, a number of COVID-19 cases are in counties without either general or ICU hospital beds. Note that approximately 19 percent of metropolitan counties have no hospitals (and therefore, no general medical and surgical beds). Most generally these are outlying counties designated metropolitan by virtue of adjacency and/or commuting to a larger urban center. Metropolitan hospital systems may concentrate inpatient beds in an anchor institution, while offering outpatient clinics throughout the area.

In counties with general medical and surgical beds, the difference in the rate of cases per bed between metropolitan and nonmetropolitan counties is small. However, the ratio of COVID-19 cases per ICU bed is slightly higher in metropolitan counties.

Table 1. General Medical and Surgical Beds and COVID-19 Confirmed Cases

County Type	Counties with no general medical and surgical beds			Counties with general medical and surgical beds			
	Counties	Total Pop. ¹	COVID Cases ²	Counties	Total Pop. ¹	COVID Cases ²	Median Cases/bed ³
Metropolitan (n=1,166)	226	6.26M	262.1	940	256.19M	26,229.7	0.04
Nonmetropolitan (n=1,976)	460	4.71M	167.4	1,516	41.59M	1,585.6	0.03
Nonmetropolitan, micropolitan (n=641)	77	1.04M	32.4	564	26.12M	1,129.7	0.03
Nonmetropolitan, noncore (n=1,335)	383	3.67M	135.0	952	15.47M	455.9	0.04

1. Population based on 2010 decennial census.

2. Average daily new cases April 13, 2020 through April 19, 2020 based on data obtained from USAFacts⁴

3. In counties with one or more confirmed COVID-19 cases.

Table 2. Medical/Surgical ICU Beds and COVID-19 Confirmed Cases

County Type	Counties with no medical/surgical ICU beds			Counties with medical/surgical ICU beds			
	Counties	Total Pop. ¹	COVID Cases ²	Counties	Total Pop. ¹	COVID Cases ²	Median Cases/bed ³
Metropolitan (n=1,166)	383	12.48M	448.0	783	249.96M	26,043.9	0.26
Nonmetropolitan (n=1,976)	1,207	16.42M	504.9	769	29.87M	1,248.1	0.19
Nonmetropolitan, micropolitan (n=641)	171	4.09M	135.7	470	23.07M	1,026.4	0.19
Nonmetropolitan, noncore (n=1,335)	1,036	12.34M	369.1	299	6.80M	2221.7	0.19

1. Population based on 2010 decennial census.

2. Average daily new cases April 13, 2020 through April 19, 2020 based on data obtained from USAFacts⁴

3. In counties with one or more confirmed COVID-19 cases.

Discussion

The very small number of confirmed COVID-19 cases per bed (e.g. 0.04 cases per general medical and surgical bed in nonmetropolitan counties) indicates overall at least sufficient inpatient resources. Of course, not all confirmed COVID-19 cases are hospitalized. In mid-March, the Centers for Disease Control and Prevention reported that the rate of hospital admission for confirmed COVID-19 cases ranged from 20.7 to 31.4 percent and that the rate of ICU admission ranged from 4.9 to 11.5 percent.^{vi}

The bed rates in this report are based on *new* confirmed diagnoses on a single day. Robust data has been difficult to find, but an early report in the New England Journal of Medicine found that the median length of hospital stay among admitted COVID-19 survivors was 17 days (interquartile range, 16 to 23 days), and the median length of ICU stay among survivors was 14 days (interquartile range, 4 to 17 days).^{vii}

A simple estimate of hospital bed requirements can be constructed from these early findings. Using “worst case” figures (i.e. the highest rate of ICU admission and longest ICU stay) in nonmetropolitan counties, the average daily ICU bed occupation rate would be approximately 0.37 COVID-19 patients per bed:

$$[0.19 \text{ cases / bed}] \times [0.115 \text{ rate of ICU admission}] \times [17 \text{ days in ICU}]$$

This “worst case” scenario estimates that there would be less than one patient per bed, but it should be noted that these are findings in the aggregate. Using the same formula, any county with a case per ICU bed rate over 0.5 would be at maximum capacity:

$$[0.512 \text{ cases / bed}] \times [0.115 \text{ rate of ICU admission}] \times [17 \text{ days in ICU}] = [1.0 \text{ bed/body}]$$

Applying that estimate to the bed and case data used in this report, 170 metropolitan and 56 nonmetropolitan counties (38 micropolitan and 18 noncore) were at risk of exceeding capacity. These findings are based only on COVID-19 patients. Despite pandemic-based procedure cancellations, hospitals are also likely to have some beds occupied by non-COVID-19 patients, further stretching their capacity.

There are several important limitations to the data used in this brief. To reiterate, these estimates are based on “worst case” parameters derived from very limited studies. Second, place of residence of confirmed COVID-19 cases are reported by individual states and may be subject to some error. Further, COVID-19 patients may not necessarily be hospitalized in their local hospital (either at their own, or the hospital’s, discretion).

This is not an analysis of “hot spots.” Considering counties across broad categories (e.g. metropolitan/nonmetropolitan) in an aggregate fashion flattens both high and low components of the incidence distribution. There may well be localized instances of hospital capacity being overwhelmed. That reality may occur in any geographic strata, for example when an outbreak occurs among workers in a rural-based meat processing plant. Aggregated ratios reported should be monitored, since both the number of COVID-19 cases, and availability of hospital beds are subject to change. Monitoring is especially important in rural communities where hospitals are financially vulnerable and may close in part because of additional financial pressures related to COVID-19.^{viii}

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