

Hospital Readiness for COVID-19:

Analysis of Bed Capacity and How It Varies Across the Country

Fredric Blavin and Diane Arnos

Timely Analysis of Immediate Health Policy Issues

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Introduction

As COVID-19 spreads across the United States, concerns mount that the need for hospital beds will overwhelm national capacity, putting severe strains on the health care system and limiting access to necessary care. The initial outbreak of COVID-19 in Wuhan, China, resulted in overwhelming numbers of hospitalizations and patients in need of critical care, even after a lockdown was implemented,¹ and the United States has fewer hospital beds per capita than many other industrialized nations. The Peterson–Kaiser Family Foundation Health System Tracker estimates the United States had 2.8 hospital beds per 1,000 people in 2016,² compared with 13.1 beds in Japan, 8.1 in Germany, and 6.1 in France. Of the countries analyzed, only Canada, the UK, and Sweden had fewer beds per 1,000 people than the United States (2.6, 2.6, and 2.3, respectively). As Sarah Kliff of the *New York Times* highlighted, “The novel coronavirus could result in 10 million to 34 million hospital visits, based on statistics from other countries, according to the Harvard Global Health Institute.”³ Hospital capacity strain is also associated with increased mortality in developed countries.⁴ Such statistics validate rampant concerns.

A more recent Harvard analysis⁵ also highlighted how many additional beds would be needed to address various COVID-19 outbreak scenarios. In their “moderate” scenario where 40 percent of adults are infected within 12 months, they

estimate that hospitals in 40 percent of hospital referral regions (HRRs) around the country would not be able to make enough room for all the sick patients with Covid-19, even if they could empty their beds of other patients.

As federal, state, and local policymakers prepare for a potentially very large increase in demand for inpatient hospital care, they must understand how existing bed capacity varies across states and communities. Though such variations in capacity are unlikely to match variations in how the virus spreads, they help identify areas where additional capacity would be essential for meeting the surge in patient needs. In this analysis, we use American Hospital Association (AHA) survey data to highlight hospital bed capacity and occupancy rates by state. We also provide county-level estimates in an [online tool](#), which provides more localized estimates of capacity than previously published HRR-level estimates. The data we present are the upper bounds of hospitals’ current capacity independent of the spread of COVID-19, or the total number of beds set up and staffed at nonfederal, general, and surgical community hospitals whose services are available to the public. Though treatment of serious cases of the virus will require intensive care unit beds with ventilators, estimating their availability is beyond the scope of this analysis. As hospitals decide how to move forward through this pandemic, these data show what inpatient beds are available before policymakers consider

ways to develop surge capacity.

Data and Methods

This analysis uses data from the 2018 American Hospital Association Annual Survey, which collects extensive data on topics including hospital organization structure, facilities and services, and utilization for 6,500 U.S. hospitals. As noted, our sample consists of nonfederal, general, and surgical community hospitals whose services and facilities are available to the public in all states and the District of Columbia. This represents 4,341 hospitals, or 70 percent of hospitals on the AHA survey, and 727,794 set-up and staffed hospital beds, or 78 percent of beds on the AHA survey. Thus, the sample includes hospitals most likely to be affected by the public surge in COVID-19 cases and excludes those that will likely remain unaffected (i.e., federal government hospitals, children’s hospitals, and specialty hospitals).⁶

We measure total hospital beds, number and percent of occupied beds, and number and percent of unoccupied beds. Total hospital beds are those set up and staffed at the facility at the end of the 2018 reporting period, including nursing home beds and excluding newborn bassinets. We calculate the occupancy rate by dividing the average daily census by the total number of beds, where the average daily census is the average number of people served in inpatient care on a single day during the reporting period.⁷

For state and county-level estimates, we also include the total number of beds and unoccupied beds per 1,000 people using population estimates from the census.

This analysis has a few data limitations. First, though we include intensive care unit (ICU) and nursing home beds in our total beds measure, we do not provide separate estimates for these bed subgroups, which are likely to be most strained by the most serious COVID-19 cases. Though the AHA survey includes the number of ICU and nursing home beds, we do not know what shares of these beds are occupied versus unoccupied. Second, our data are not in real time and only represent a 2018 average in occupancy and unoccupancy rates. However, these estimates accurately represent an upper-bound of hospital capacity leading up to the COVID-19 pandemic.⁸

Results

We estimate that the United States had approximately 728,000 hospital beds, or 2.2 beds per 1,000 people in 2018 (Table 1). This estimate is somewhat below other published estimates⁹ because we exclude children's hospitals, bassinets for infants, and specialty hospitals (e.g., psychiatric, cancer, heart) to focus on capacity relevant to treating COVID-19. Just over one-third (36 percent) of these beds were unoccupied on an average day in 2018.

Occupancy rates vary considerably by hospital size, with the smallest hospitals having the highest rates of unoccupied beds. Across hospitals with 6 to 24 beds, approximately 71 percent of beds were unoccupied, compared with only about 26 percent of beds being unoccupied in hospitals with 500 or more beds. In hospitals with 200 to 500 beds, roughly one-third of beds were unoccupied on an average day, whereas at least 40 percent of beds are unoccupied at smaller hospitals. The smaller hospitals with higher percentages of available beds still likely have smaller absolute numbers of unoccupied beds, and the technology and services provided in these hospitals likely lag behind those in

larger hospitals.

Unoccupied bed rates are about the same for nonfederal government hospitals and nonprofit hospitals, roughly 35 percent, whereas for-profit hospitals have somewhat higher capacity (43 percent of beds unoccupied on an average day). Rural hospitals have a higher percentage of their beds unoccupied (50 percent compared with 34 percent for urban hospitals). Because rural hospitals tend to be smaller than urban hospitals, this is consistent with the variation in occupancy rates by hospital size.

Table 2 and Figure 1 show the variation in hospital capacity across states, including total beds, beds per 1,000 people, number and percentage of unoccupied beds, and unoccupied beds per 1,000 people. The table is sorted by unoccupied beds per 1,000 people, showing states with the least excess capacity at the top and the most excess capacity at the bottom. The Figure 1 map is also shaded to show variation in unoccupied beds per 1,000 people.

In Connecticut, hospital bed availability falls below the national averages of beds per 1,000 people (1.9 versus 2.2), unoccupied beds per 1,000 people (0.45 versus 0.80), and share of beds unoccupied (24 percent versus 36 percent). Other states in roughly similar situations include Delaware, Massachusetts, Nevada, and Rhode Island.

At the other extreme are states that seem to have considerably more hospital capacity than the national average: North Dakota has 4.2 hospital beds per 1,000 residents, 1.78 unoccupied beds per 1,000 residents, and about 43 percent of beds unoccupied. States in similar situations include Kansas, Mississippi, South Dakota, and Wyoming. However, because many of these states have relatively low population density, these greater numbers of available beds may disguise that much of this additional capacity is in smaller, less technologically advanced hospitals with less ability to provide high-intensity care to the sickest

patients in need.

In our accompanying [interactive map](#), we provide county-level estimates of total beds and unoccupied beds per 1,000 residents in 2018. Here we highlight a few findings for counties hardest hit by COVID-19 thus far. In King County, Washington, hospitals have 1.8 beds per 1,000 residents and 0.5 unoccupied beds per 1,000 residents on an average day. Both of these measures place King County at the low end of the capacity spectrum across the United States. Hospitals in Westchester County, New York, have 2.9 beds per 1,000 residents (above the national average of 2.2) and 0.7 unoccupied beds per 1,000 residents (below the 0.8 national average).

Discussion

Findings from this brief, along with the [interactive county-level map](#), can assist policymakers and local officials in identifying regions and hospitals with greatest capacity constraints when treating COVID-19 patients. This will help federal, state, and local policymakers considering ways to generate surge capacity in identifying areas with the greatest need for additional inpatient beds. Leading up to the COVID-19 outbreak, approximately 728,000 medical and surgical hospital beds were available to the public, or 2.2 beds per 1,000 people. However, only 36 percent of these beds were unoccupied on a typical day, leaving around 0.8 unoccupied beds per 1,000 people. The number of unoccupied beds per 1,000 people also varies significantly across states, ranging from 0.45 in Connecticut (where beds are least available) to 1.78 in North Dakota (where beds are most available). Bed availability is also low in states with the largest number of reported COVID-19 cases (e.g., California, New York, and Washington) as of March 17, 2020.

As hospitals and public health officials struggle to meet the needs of all COVID-19 patients requiring hospitalization, the criteria for who among potential non-COVID-19 patients will be able to access the available

beds may also change. For example, elective surgeries will likely be delayed, and providers may seek opportunities to rely more heavily on outpatient and community-based care, where feasible.

Research and expert recommendations have identified strategies for increasing hospital capacity and managing patient flow. Increasing surge capacity requires improvements across multiple domains of hospital systems: increasing staff capacity, prioritizing the use of equipment, and maximizing the use of hospital structure and physical space. Other recommendations include moving entire hospital and health care systems to a full, 24/7 operational system; creating internal rapid-response groups; receiving naval (i.e., USNS Comfort hospital ship) and military aid to meet civilian needs (e.g., converting or building additional facilities and beds, providing medical equipment such as ventilators, etc.); transferring equipment to essential units; categorizing and prioritizing non-COVID-19-related patient caseloads; canceling elective surgeries; more quickly discharging patients deemed well enough to leave; and using alternative spaces such as halls, conference rooms, and amphitheaters to increase physical capacity. Research suggests patient flow management and other strategies could lessen the burden on emergency departments and greatly increase surge capacity during emergencies and disasters like the COVID-19 pandemic.^{10,11} Ultimately, understanding aggregate hospital bed capacity and how it varies across the country is essential for effectively responding to the pandemic and assuring that as many patients as possible get the care they may urgently need.

Table 1. Total Beds, Occupied Beds, and Unoccupied Beds in General Medical and Surgical Nonfederal Hospitals Open to the Public, 2018
Overall and by hospital characteristics

	Total beds	Occupied beds	% of total	Unoccupied beds	% of total
Total	727,794	465,892	64.0%	261,902	36.0%
Hospital size					
6–24 beds	9,122	2,609	28.6%	6,513	71.4%
25–49 beds	30,781	11,464	37.2%	19,317	62.8%
50–99 beds	47,605	24,345	51.1%	23,260	48.9%
100–199 beds	128,450	74,497	58.0%	53,953	42.0%
200–299 beds	124,219	77,735	62.6%	46,484	37.4%
300–399 beds	102,147	67,474	66.1%	34,673	33.9%
400–499 beds	72,427	49,755	68.7%	22,672	31.3%
500 beds or more	213,043	158,013	74.2%	55,030	25.8%
Hospital type					
State and local government	107,210	68,912	64.3%	38,298	35.7%
Not-for-profit	513,457	335,656	65.4%	177,801	34.6%
For-profit	107,127	61,324	57.2%	45,803	42.8%
Urban/rural status					
Rural	106,962	53,190	49.7%	53,772	50.3%
Urban	620,832	412,702	66.5%	208,130	33.5%

Source: 2018 American Hospital Association Annual Survey.

Notes: Beds are total facility beds set up and staffed at the end of the reporting period.

Occupancy rate is calculated as the average daily census divided by the total number of beds.

Table 2. Total Beds and Unoccupied Beds in General Medical and Surgical Nonfederal Hospitals Open to the Public, 2018
By State

	Total beds	Beds per 1,000 people	Number of unoccupied beds	Unoccupied beds per 1,000 people	% of beds unoccupied
Connecticut	6,732	1.9	1,587	0.45	23.6%
Nevada	5,653	1.8	1,559	0.51	27.6%
Massachusetts	13,461	2.0	3,516	0.51	26.1%
Rhode Island	1,870	1.8	551	0.52	29.5%
Delaware	1,864	1.9	517	0.53	27.7%
Hawaii	2,466	1.7	760	0.54	30.8%
Maryland	10,778	1.8	3,278	0.54	30.4%
Washington	12,261	1.6	4,308	0.57	35.1%
California	66,250	1.7	22,855	0.58	34.5%
New York	50,375	2.6	11,365	0.58	22.6%
Oregon	6,809	1.6	2,493	0.59	36.6%
North Carolina	20,957	2.0	6,254	0.60	29.8%
Virginia	17,334	2.0	5,356	0.63	30.9%
New Mexico	3,466	1.7	1,321	0.63	38.1%
Arizona	12,485	1.7	4,706	0.65	37.7%
Utah	4,973	1.6	2,171	0.68	43.7%
Georgia	23,787	2.2	7,199	0.68	30.3%
Colorado	9,590	1.7	3,963	0.69	41.3%
New Hampshire	2,598	1.9	940	0.69	36.2%
Maine	3,310	2.5	982	0.73	29.7%
Alaska	1,577	2.2	537	0.73	34.1%
New Jersey	19,476	2.2	6,554	0.74	33.7%
Texas	54,642	1.9	21,509	0.74	39.4%
Vermont	1,305	2.1	473	0.76	36.2%
South Carolina	11,385	2.2	4,013	0.78	35.2%
National Level	727,794	2.2	261,902	0.80	36.0%
Minnesota	13,397	2.4	4,583	0.81	34.2%
Florida	51,060	2.4	17,523	0.82	34.3%
Wisconsin	11,616	2.0	4,812	0.83	41.4%
Michigan	23,691	2.4	8,696	0.87	36.7%
Idaho	3,241	1.8	1,587	0.89	49.0%
Pennsylvania	32,744	2.6	11,781	0.92	36.0%
District of Columbia	2,405	3.4	672	0.95	27.9%
Tennessee	18,125	2.7	6,644	0.97	36.7%
Ohio	28,340	2.4	11,487	0.98	40.5%
Illinois	30,400	2.4	12,772	1.01	42.0%
Alabama	14,026	2.9	5,035	1.03	35.9%
Oklahoma	10,152	2.6	4,423	1.12	43.6%

Source: 2018 American Hospital Association Annual Survey.

Notes: Beds are total facility beds set up and staffed at the end of the reporting period.

Occupancy rate is calculated as the average daily census divided by the total number of beds.

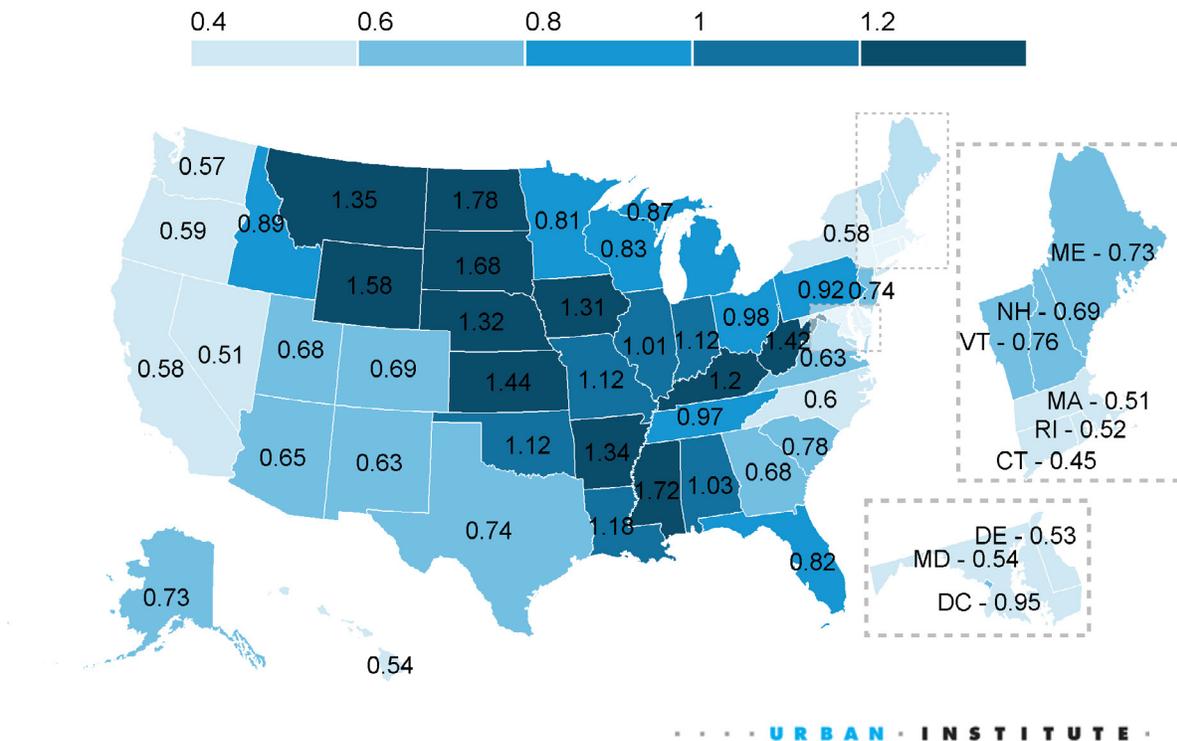
Table is sorted by the number of unoccupied beds per 1,000 people.

Table 2. Total Beds and Unoccupied Beds in General Medical and Surgical Nonfederal Hospitals Open to the Public, 2018 (continued)
By State

Indiana	17,111	2.5	7,536	1.12	44.0%
Missouri	17,127	2.8	6,900	1.12	40.3%
Louisiana	12,880	2.8	5,488	1.18	42.6%
Kentucky	13,320	3.0	5,378	1.20	40.4%
Iowa	9,323	3.0	4,130	1.31	44.3%
Nebraska	5,734	3.0	2,545	1.32	44.4%
Arkansas	8,376	2.8	4,058	1.34	48.4%
Montana	3,477	3.3	1,444	1.35	41.5%
West Virginia	6,393	3.6	2,553	1.42	39.9%
Kansas	8,884	3.0	4,207	1.44	47.4%
Wyoming	1,935	3.3	913	1.58	47.2%
South Dakota	3,976	4.5	1,487	1.68	37.4%
Mississippi	11,494	3.9	5,127	1.72	44.6%
North Dakota	3,163	4.2	1,354	1.78	42.8%

Source: 2018 American Hospital Association Annual Survey.
Notes: Beds are total facility beds set up and staffed at the end of the reporting period.
Occupancy rate is calculated as the average daily census divided by the total number of beds.
Table is sorted by the number of unoccupied beds per 1,000 people.

Figure 1. Unoccupied hospital beds per 1,000 people by state, in 2018



Source: 2018 American Hospital Association Annual Survey.

NOTES

- 1 Ruoran L, Rivers C, Tan Q, et al. The demand for inpatient and ICU beds for COVID-19 in the US: Lessons from Chinese cities. Harvard University. 2020. https://dash.harvard.edu/bitstream/handle/1/42599304/JAMA20-3221_Merged_PDF.pdf?sequence=1&isAllowed=y. Accessed March 18, 2020.
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- 5 Sanger-Katz M, Kliff S, and Parlapiano A. These places could run out of hospital beds as Coronavirus spreads. *New York Times*. March 17, 2020. <https://www.nytimes.com/interactive/2020/03/17/upshot/hospital-bed-shortages-coronavirus.html>. Accessed March 18, 2020.
- 6 Federal hospitals, such as VA hospitals, are excluded from the sample since their services and facilities are generally not open to the public. This excludes approximately 35,000 hospital beds nationwide from the sample, or an additional 5 percent of beds. Including them would increase the number of hospital beds nationally per 1,000 people to 2.3.
- 7 It is calculated by dividing the number of inpatient days by the number of days in the reporting period (in most cases, 365 days).
- 8 Internal estimates showed that hospital capacity estimates remained relatively stable from 2011 through 2018. We assume these estimates also remained stable through the beginning of 2020. However, the number of available hospital beds set up and staffed in 2020 will likely be smaller than the estimates presented here, particularly in rural areas, because 47 short-term acute care and critical access hospitals closed in 2019. These hospitals were generally small and located in states that have not expanded Medicaid. See Daly R. 47 hospitals have closed in 2019, MedPAC reports. Healthcare Financial Management Association. December 10, 2019. <https://www.hfma.org/topics/news/2019/12/47-hospitals-have-closed-in-2019--medpac-reports.html>. Accessed March 18, 2020.
- 9 See “Table 89: Hospitals, beds, and occupancy rates, by type of ownership and size of hospital: United States, selected years 1975-2015” in National Center for Health Statistics. *Health, United States, 2017: With Special Feature on Mortality*. Hyattsville, MD: National Center for Health Statistics; 2018. <https://www.ncbi.nlm.nih.gov/books/NBK532684/table/ch4.tab89/>. Accessed March 18, 2020.
- 10 Dentzer S, Viccellio P, Litvak E. During COVID-19, experts outline 5 key steps for finding extra hospital capacity. *Modern Healthcare*. March 16, 2020. <https://www.modernhealthcare.com/opinion-editorial/during-covid-19-experts-outline-5-key-steps-finding-extra-hospital-capacity>. Accessed March 18, 2020.
- 11 Sheikhbardsiri H, Raiesi AR, Nekoei-moghadam M, Rezaei F. Surge capacity of hospitals in emergencies and disasters with a preparedness approach: A systematic review. *Disaster Medicine and Public Health Preparedness* 2017;11(5):612–20. <https://doi.org/10.1017/dmp.2016.178>. Accessed March 18, 2020.

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ABOUT THE AUTHORS & ACKNOWLEDGMENTS

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