The coronavirus disease 2019 (COVID-19) outbreak is straining U.S. hospital and health care systems. In late March 2020, the United States surpassed China as the country with the most confirmed COVID-19 cases. Experiences in New York City, an outbreak epicenter, show that there will likely be high demand for critical care resources across the United States in systems that already are strained at baseline.

RAND researchers assembled a list of strategies to help U.S. hospitals create critical care surge capacity. The list was created using a review of scientific literature about past outbreaks and the current COVID-19 pandemic, a survey of frontline clinicians conducted in collaboration with the American College of Emergency Physicians, and two roundtables conducted via teleconference with leading emergency and critical care physicians and public health and preparedness experts from around the country.

The strategies are organized into two tiers:

- **Tier 1** strategies to build contingency capacity include adaptations to medical care spaces, staffing constraints, and supply shortages without significant impact on medical care delivery. Strategies might include converting stepdown, post-anesthesia care unit (PACU) or operating room beds to intensive care unit (ICU) beds, drawing on emergency department and PACU nurses not on shift for ICU care, and

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**KEY FINDINGS**

- RAND researchers developed a tool to help hospitals create critical care surge capacity to respond to COVID-19.
- The tool allows hospitals to assess alternative strategies for creating this capacity and to identify which factors—space, staff, and equipment (such as ventilators)—are key to increasing the number of patients hospitals can treat.
- An illustrative analysis examined critical care capacity in each of the ten FEMA regions in the United States. In most of these regions, the number of ventilators was the key limiting factor.
To illustrate use of the tool, we used data for each of the ten Federal Emergency Management Agency (FEMA) regions to estimate the critical care surge capacity that can be created using Tier 1 and Tier 2 strategies. Results were as follows:

- For nearly every FEMA region, the most common limiting factor for developing surge capacity was the number of ventilators.
- The other limiting factor was the number of critical care doctors. For each FEMA region, the only increase in staff capacity came from using extenders.
- The number of nurses, respiratory therapists, or beds was not the limiting factor in any FEMA region.
- As expected, moving from the first to the second tier often increased critical care surge capacity. But the degree of increase in capacity depends on available resources and on the specific combinations of those resources. In most of the FEMA regions, Tier 2 options increased the number of patients who could be treated compared with Tier 1 options, but in some cases, there was little additional gain (see Figure 1).

### Implications for Action

We conclude our analysis by identifying considerations and decisions for hospitals, as well as state, regional, and federal decisionmakers.

Hospitals should consider the following recommendations:

- Use the RAND Critical Care Surge Response Tool or similar resources to assess critical care bottlenecks and shortages in space, staff, and stuff in your facility and identify the most-effective surge strategies to address those bottlenecks.
- Have tiered critical care surge capacity plans in place ahead of time so that surge capacity efforts can be escalated as indicated.
- Develop an inventory of staff who might play unconventional roles in your COVID-19 response.
- Communicate and collaborate with community (e.g., businesses, public health entities, first-responder agencies, nursing homes) and regional partners (e.g., health care coalitions) in creating critical care surge capacity.

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FIGURE 1
FEMA Region–Level Estimates of Number of Patients Cared for Concurrently Under Baseline, Tier 1, and Tier 2 Scenarios

<table>
<thead>
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<th>FEMA Region</th>
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<th>Tier 1</th>
<th>Baseline</th>
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</table>
State, regional, and federal decisionmakers should consider the following recommendations:

- Facilitate communication and coordination among hospitals, health care systems, and public health entities.
- Develop regional resource-sharing protocols to facilitate proportional distribution according to needs.
- Maintain updated registries of resources and resource shortfalls and disseminate those data among hospitals and health systems to maintain regional situational awareness of resources.
- Institute emergency credentialing policies for health care worker volunteers (e.g., waivers).
- Identify supply chains for personal protective equipment (PPE), ventilators, and other critical care resources.
- Institute policies to combat price-gouging by suppliers of PPE, ventilators, and other critical care resources.
- Provide guidance on crisis standards of care and rationing of critical care resources.