

## COVID-19: Crisis Standards of Care Planning Resources for Critical Care

**Purpose:** To provide a summary of considerations for critical care crisis planning and share the Critical Care in Scarce Resources library (the library), which includes tools and resources to support critical care surge planning and provides new crisis protocols to facilitate consistency of standards and knowledge sharing across hospitals for critical care.

**Audience:** ICU leadership, critical care providers

**Background:** The New York City (NYC) Health Department recommends that all critical care facilities develop surge strategies for situations of resource scarcity that span a continuum from conventional care to crisis care. As the coronavirus disease 2019 (COVID-19) pandemic continues to strain NYC’s health care system, it is now more important than ever for hospitals with critical care facilities to plan and implement surge strategies. This document summarizes general concepts around Crisis Standards of Care and helps direct readers to Greater New York Hospital Association (GNYHA)’s resource library. This document should *not* be viewed as a directive, but rather a summary of resources for critical care surge planning. Hospitals should only implement strategies that fall within in the scope of State and Federal regulations.

### Crisis Standards of Care

Developed in 2009, “Crisis Standards of Care”<sup>1</sup> is a framework for strategic decision-making in situations where resources are scarce. Surge response is framed in three phases:

- **Conventional capacity:** The spaces, staff, and supplies used are consistent with daily practices within the institution. These spaces and practices are used during a major mass casualty incident that triggers activation of the facility’s emergency operations plan.
- **Contingency capacity:** The spaces, staff, and supplies used are not consistent with daily practices but provide care that is functionally equivalent to usual patient care. These spaces or practices may be used temporarily during a major mass casualty incident or on a more sustained basis during a disaster when the demands of the incident exceed community resources.
- **Crisis capacity:** Adaptive spaces, staff, and supplies are not consistent with usual standards of care but provide sufficiency of care in the context of a catastrophic disaster (i.e., provide the best possible care to patients given the circumstances and resources available). Crisis capacity activation constitutes a significant adjustment to standards of care.<sup>2</sup>

Exhaustive resources on the Crisis Standards of Care principles and general implementation are collected in the *Crisis Planning Background and Tools* section of the library at [gnyha.org/tool/critical-care-planning-resources/#crisis-planning-background-and-tools](https://gnyha.org/tool/critical-care-planning-resources/#crisis-planning-background-and-tools) under the heading *Crisis Planning Background Information*. (Click “Jump to Section” to move between headings and sections.)

At this time, hospitals should define critical care-specific *indicators* to measure the demand on the health care system (i.e., availability of mechanical ventilation, open ICU beds, etc.), and *triggers*, or indicator values at which the system would shift from one surge phase to another. Use of indicators and triggers can define the appropriate time for escalation of surge strategies toward crisis capacity and also signal the appropriate time

---

<sup>1</sup> Altevogt, B. M., Stroud, C., Hanson, S. L., Hanfling, D., Gostin, L. O. (2009). *Guidance for Establishing Crisis Standards of Care for Use in Disaster Situations: A Letter Report*. Washington, DC: The National Academies Press.

<sup>2</sup> *Id.*



ethicist and prior to entering the contingency and crisis surge, as much in advance as possible. One strategy to collect stakeholder input, facilitate difficult decision-making, and disseminate the rationale for decisions is creating a multidisciplinary committee at the institutional or systems level.

Ethical principles that are of particular relevance to treatment standards in time of scarce resources are:

- Fairness
- Duty to Care
- Duty to Steward Resources
- Transparency
- Consistency
- Proportionality
- Accountability

Several authors have addressed the definition and application of ethical considerations around resource allocation in scarce situations. These documents are collected in the library at [gnyha.org/tool/critical-care-planning-resources/#supply-surge-strategies](https://gnyha.org/tool/critical-care-planning-resources/#supply-surge-strategies) in the *Supply Surge Strategies* section under the heading *Scarce Resource Allocation*. As with all of the resources collected here, strategies and principles should be implemented within the scope of State and Federal regulatory limits and with as minimal disruption to the standard of care for individual patients as possible.

### **Strategies for Expansion of Critical Care Space, Staff and Supplies**

The sections below describe strategies hospitals can use to expand their capability to provide critical care in conventional, contingency, and crisis surge phases. Strategies are broadly categorized into cross-cutting strategies that should be employed systemically, and specific strategies to surge capacity of space, staff, and supplies. Tables containing space and staff surge strategies that may be applicable in each surge phase are included in the *Appendix* at the end of this document. Strategies should only be implemented within the scope of State and Federal regulatory limits.

#### **Cross-Cutting Strategies**

- Activate an ICU Surge Team to coordinate surge planning and strategy implementation: [www1.nyc.gov/assets/doh/downloads/pdf/em/icuce-tool.pdf](https://www1.nyc.gov/assets/doh/downloads/pdf/em/icuce-tool.pdf)
- Decant ICU beds by discharging appropriate patients to less resource intensive settings: [www1.nyc.gov/assets/doh/downloads/pdf/em/icuce-tool.pdf](https://www1.nyc.gov/assets/doh/downloads/pdf/em/icuce-tool.pdf)
- Cohort patients into COVID-19 positive and COVID-19 negative spaces
- Cancel elective procedures: [facs.org/covid-19/clinical-guidance/elective-case](https://facs.org/covid-19/clinical-guidance/elective-case)

#### **Space Surge Strategies**

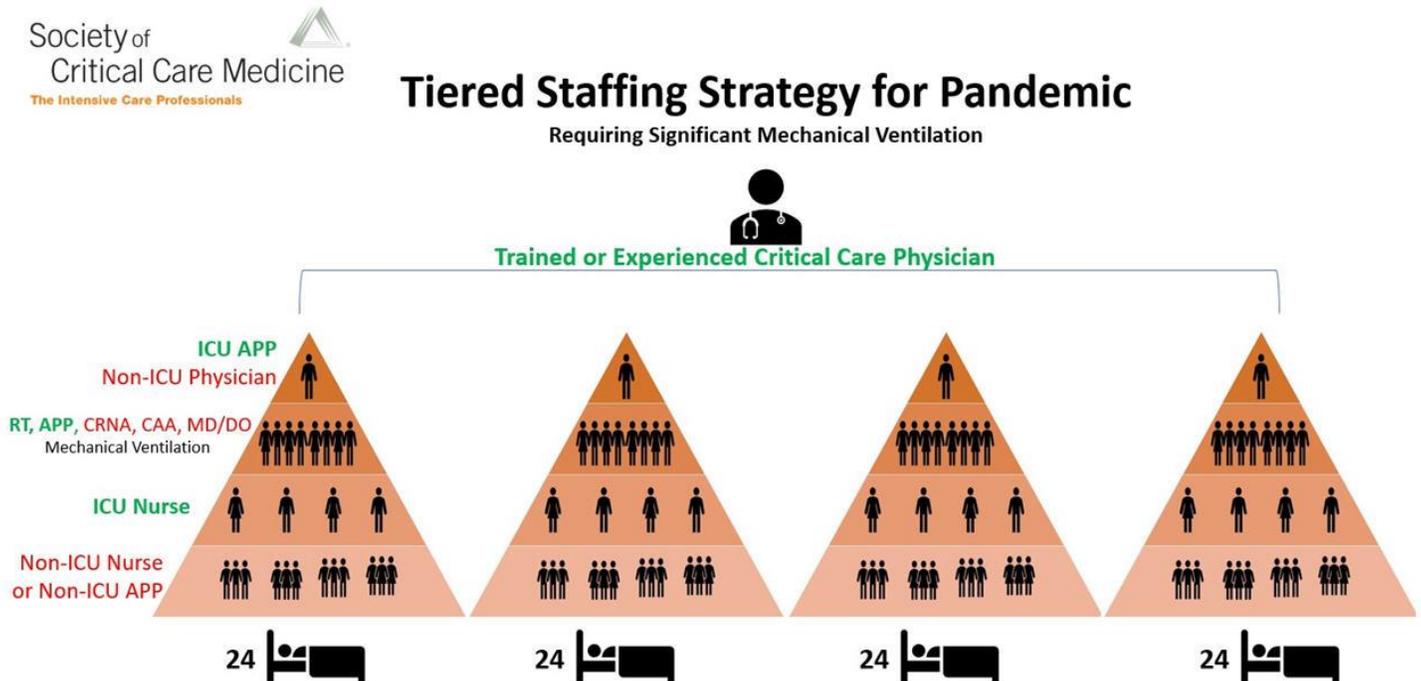
In order to meet the anticipated critical care needs of the COVID-19 pandemic, hospitals may need to repurpose spaces in the hospital. The *Appendix* at the end of the document lists technical and equipment specifications to assist hospitals in determining which spaces can be repurposed and how to repurpose them based on a surge in patient respiratory care demand (space strategies).

Resources related to space surge are collected in the *Space Surge Strategies* section of the library at [gnyha.org/tool/critical-care-planning-resources/#space-surge-strategies](https://gnyha.org/tool/critical-care-planning-resources/#space-surge-strategies). Resources for repurposing nontraditional spaces and conversion of anesthesia machines for sustained ventilation are collected under the heading *Sustained Mechanical Ventilation Outside of the ICU* in the same section.

## Staff Surge Strategies

The Society for Critical Care Medicine<sup>4</sup> estimates that the projected shortages of critical care staff at all levels (intensivists, critical care advanced practice practitioners and nurses, and respiratory therapists trained in mechanical ventilation) due to COVID-19 could limit the ability of hospitals to care for critically ill ventilated patients. Crisis strategies center on the creation of a *tiered staffing model*, in which provider to patient ratios are increased through the creation of teams in which higher credentialed, more experienced critical care staff supervise teams of lower-credentialed staff with less critical care experience. See Image 2.

Image 2: Society of Critical Care Medicine Tiered Staffing Model



Modified from the Ontario Health Plan for an Influenza Pandemic Workgroup. *Critical Care During a Pandemic*.

It is important throughout all surge phases to provide staff with psychosocial and family support to ensure their continued ability to contribute to critical care teams. The *Appendix* at the end of this document lists multiple strategies to surge critical care staff capacity.

General resources about surge staffing, including those consolidated in the *Appendix*, are collected in the library at [gnyha.org/tool/critical-care-planning-resources/#staff-surge-strategies](https://gnyha.org/tool/critical-care-planning-resources/#staff-surge-strategies) in the *Staff Surge Strategies* section under the heading *Staffing Ratios and General Strategy*. Trainings for staff who may be asked to complete new tasks in unfamiliar settings are collected under the heading *Just-in-Time Training Resources* in the same section.

<sup>4</sup> Halpern, N. A., Tan, K. S., and Taskforce, S. V. (2020, March 25). *U.S. ICU Resource Availability for COVID-19*. Retrieved March 2020, from Society of Critical Care Medicine: [sccm.org/Blog/March-2020/United-States-Resource-Availability-for-COVID-19](https://sccm.org/Blog/March-2020/United-States-Resource-Availability-for-COVID-19).

## Supplies Surge Strategy

Hospitals are likely to face shortages of the following supplies during the COVID-19 pandemic:

- Oxygen
- Nutritional support
- Mechanical ventilators
- ECMO
- Blood products
- Renal replacement therapy
- Personal Protective Equipment
- Others

Hospitals in NYC are already implementing several strategies to scale these supplies. Some resources for supply strategy development and implementation are collected in the library at [gnyha.org/tool/critical-care-planning-resources/#staff-surge-strategies](https://gnyha.org/tool/critical-care-planning-resources/#staff-surge-strategies) in the *Supply Surge Strategies Section*. This section will continue to develop as institutions are faced with new shortages. Headings are organized by supply type.

NYC Health COVID-19 provider guidance is available at [nyc.gov/site/doh/covid/covid-19-providers.page](https://nyc.gov/site/doh/covid/covid-19-providers.page).

**The NYC Health Department may change recommendations as the situation evolves.**

4.22.20



## COVID-19: Crisis Standards of Care Planning Resources for Critical Care Appendix

SURGE PHASE: Conventional				
<i>For all physical facility and environmental recommendations, recruit hospital facility engineer, building manager and safety officer to assist.</i>				
COVID-19) COHORT				
Category SPACE		Highest Respiratory Support: Intubation, Mechanically Ventilated	High Respiratory Support: Mask and Ventilation Support	Moderate Respiratory Support — Oxygen Cannula
<b>CONVENTIONAL:</b>  • Endeavor to expand existing capability by 20%. • Recruit spaces that have the same or very similar daily function. • Utilize optimization of resources: conserve, substitute, adapt.	<b>Surge Strategy</b>	Recruit surgical, cardiac, and neurological ICU beds.	Recruit perioperative areas and step-down units.	Maintain using floor inpatient rooms.
	<b>Floor Space<sup>1</sup></b>	Maintain 1 to 2 meters between beds. <sup>2</sup>	Maintain 1 to 2 meters between beds.	Maintain 1 to 2 meters between beds.
	<b>Minimum Service Requirements</b>	Ensure 1 wash station per bed and presence of anteroom if possible. Implement or maintain separate clean and dirty utility rooms.	Ensure 1 wash station per 2 beds and presence of anteroom if possible. Implement or maintain separate clean and dirty utility rooms.	Ensure wash stations are easily accessible. Implement or maintain separate clean and dirty utility rooms.
	<b>Environment Air Flow (Air Changes per Hour or ACH)</b>	To maintain negative pressure there needs to be at least 6 ACH. <sup>3</sup>	To maintain negative pressure there needs to be at least 6 ACH.	To maintain negative pressure there needs to be at least 6 ACH.
	<b>Heating, Ventilation and Air Conditioning (HVAC)</b>	Yes	Yes	Yes

<sup>1</sup> The American Institute of Architects Academy of Architecture for Health and Field Guidelines Institute. 2001. *Guidelines for Design and Construction of Hospitals and Health Care Facilities*. Washington DC: American Institute of Architects, 24-25.

<sup>2</sup> IPC Contact Group and Watsan Working Group. 2020. *MSF Environmental Health Guidance in COVID 19*. Geneva, Switzerland: WIPO.

<sup>3</sup> The American Institute of Architects Academy of Architecture for Health and Field Guidelines Institute. 2001, 79.

	<b>HEPA Filter (in Ventilation System or Portable)</b>	Yes	Yes	Yes	
	<b>Airborne Infection Isolation Room (AIIR) or Negative Pressure Isolation</b>	There should be at least 1 AIIR room in an ICU. To increase number of negative pressure spaces use spaces that can be isolated, increase air flow into the room to 12 ACH, and ensure the air flow from adjacent areas is moving into the isolation room and all exhaust air either goes to outdoors or to HEPA unit in the ventilation system. AIIR: 2 outdoor ACH and 12 total ACH, exhaust to outside. <sup>4</sup>	See <a href="https://www.health.state.mn.us/communities/ep/surge/infectious/airbornenegative.pdf">https://www.health.state.mn.us/communities/ep/surge/infectious/airbornenegative.pdf</a>		
	<b>Headwall Present</b>	An ideal minimum is 4 Oxygen mounts, 3 medical air mounts, 3 suction ports, 16 power receptacles. <sup>5</sup> In the U.S., the minimum is 14 hospital grade power receptacles, <sup>6</sup> 3 Oxygen mounts, <sup>7</sup> 1 to 2 medical air mounts, <sup>8</sup> and 2 suction ports.	An ideal number of mounts, receptacles and suction ports is best, but at most reduce to 1 Oxygen mount with 1 to 2 E cylinder Oxygen; 1 medical air mount or 1 to 2 E cylinders medical air; 1 to 2 suction ports or portable suction units; and 8 power receptacles (if necessary, to increase receptacle number use power strips authorized for use with patients in hospitals).	At minimum, 1 Oxygen mount, 1 suction port, and 4 power receptacles (if necessary, to increase receptacle number use power strips authorized for use with patients in hospitals).	

<sup>4</sup> American Society for Health Care Engineers. 2020. "Negative Pressure Patient Room Options." *ashe.org*. March Twenty-third. <https://www.ashe.org/negative-pressure-rooms>.

<sup>5</sup> College Of Intensive Care Medicine of Australia and New Zealand. revised 2011. "Minimum Standards for Intensive Care Units." Prahran, Victoria: CICM.

<sup>6</sup> National Fire Protection Agency. 2018. *National Fire Protection Agency 99-2018 Section 6*. Washington DC: NFPA.

<sup>7</sup> The American Institute of Architects Academy of Architecture for Health and Field Guidelines Institute 2001, 79.

<sup>8</sup> The American Institute of Architects Academy of Architecture for Health and Field Guidelines Institute 2001, 79.

	<b>No Headwall</b>	Ideal minimum is 3 E cylinders Oxygen; 3 suction units and 2 cylinders medical air; <sup>9</sup> and 14 power receptacles (if necessary, to increase receptacle number use power strips authorized for use with patients in hospitals). <sup>10</sup>	At minimum, 1 to 2 E size cylinders Oxygen, 1 to 2 E cylinders medical air, 1 portable suction unit and 8 power receptacles (if necessary, to increase receptacle number use power strips authorized for use with patients in hospitals).	At minimum, 1 D (with Oxygen concentrator) or E cylinder Oxygen; portable suction; and 4 power receptacles (if necessary, to increase receptacle number use power strips authorized for use with patients in hospitals).
	<b>Basic Monitoring</b>	EKG, pulse oximetry, automatic blood pressure (BP) unit and capnography.	EKG, pulse oximetry, automatic BP unit and telemetry.	Frequent vital sign checks with pulse oximetry and telemetry if possible.
	<b>Ventilators</b>	Substitute and conserve. <sup>11</sup>	Substitute and conserve.	N/A
	<b>Advanced Physiological Monitoring Equipment</b>	Arterial line, central monitoring	Capnography	N/A

<sup>9</sup> Brad Keyes, CHSP. 2017. "Know the medical gas cylinder storage requirements." *Hospital Safety Insider*. December Seventh. <https://www.hcpro.com/SAF-330490-874/Know-the-medical-gas-cylinder-storage-requirements.html>.

<sup>10</sup> National Fire Protection Agency 2018.

<sup>11</sup> Minnesota Department of Health. 2019. "Mechanical Ventilation." *Patient Care Strategies for Scarce Resource Situations*. April. <https://www.health.state.mn.us/communities/ep/surge/crisis/standards.pdf>.

**Critical Care Staffing Strategies**

Category STAFFING			These staffing strategies assume that cross-cutting strategies such as hospital decanting and cohorting of patients into COVID-infected and non-COVID units have already occurred.
<b>CONVENTIONAL:</b> 1. Endeavor to expand existing capability by 20%. 2. Train Staff on COVID-19 3. Streamline processes. 4. Identify skilled staff who are not being utilized.	<b>Training</b>	Educate all staff about COVID-19.	
		Plan and complete refresher or just-in-time trainings for all staff in appropriate donning (putting on) and doffing (removing) of PPE.	
		Just-in-time training for all ICU staff on ARDS and COVID-19-specific critical care.	
	<b>Standardization</b>	Standardize order sets for COVID-19 patients at different acuity levels.	
		Document job action sheets for every member of the critical care team.	
		Establish protocols for staff referrals and resource intensive procedures like extracorporeal membrane oxygenation (ECMO).	
	<b>Staff Identification</b>	Expedite emergency credentialing and privileging for healthcare staff.	
		Identify alternate staffing resources within the hospital that may have prior critical care experience.	
		Identify staffing resources outside the hospital that can be used in a critical care setting.	
	<b>Support Services</b>	Implement childcare and sick family member care to increase staff availability.	
Identify staff to provide psychosocial support to patients and providers.			
Identify staff to support palliative care units.			

<b>SURGE PHASE: Contingency</b>					
<i>For all physical facility and environmental recommendations, recruit hospital facility engineer, building manager and safety officer to assist.</i>					
<b>COVID-19 COHORT</b>					
<b>Category SPACE</b>		<b>Highest Respiratory Support: Intubation, Mechanically Ventilated</b>	<b>High Respiratory Support: Mask and Ventilation Support</b>	<b>Moderate Respiratory Support — Oxygen Cannula</b>	
<b>CONTINGENCY:</b> <ul style="list-style-type: none"> <li>•Implement strategies to expand existing capability by 100%.</li> <li>•Recruit spaces that have a very similar daily function.</li> <li>•Utilize optimization of resources: conserve, substitute, adapt, reuse.</li> </ul>	<b>Surge Strategy<sup>12</sup></b>	Repurpose PACU, operating rooms, Emergency Department rooms, procedure rooms (endoscopy, bronchoscopy rooms).	Recruit perioperative areas and step-down units and repurpose inpatient rooms.	Repurpose other spaces — hallways or treatment rooms on inpatient floors.	
	<b>Floor Space</b>	Maintain at least 1, but ideally 2 meters between beds.	Maintain at least 1, but ideally 2 meters between beds.	Maintain at least 1, but ideally 2 meters between beds.	
	<b>Minimum Service Requirements</b>	Ensure 1 wash station per bed and presence of anteroom if possible. Implement or maintain separate clean and dirty utility rooms.	Ensure 1 wash station per 2 beds and presence of anteroom if possible. Implement or maintain separate clean and dirty utility rooms.	Ensure there are easily accessible wash stations. Implement or maintain separate clean and dirty utility rooms.	
	<b>Environment Air Flow (Air Changes per Hour or ACH)</b>	There needs to be at least 6 ACH to maintain negative pressure.	There needs to be at least 6 ACH to maintain negative pressure.	There needs to be at least 6 ACH to maintain negative pressure.	
	<b>Heating, Ventilation and Air Conditioning (HVAC)</b>	Yes	Yes	Yes	
	<b>HEPA Filter (in Ventilation system or Portable)</b>	Yes	Yes	Yes	
	<b>AIR or Negative Pressure Isolation</b>	See <a href="https://www.health.state.mn.us/communities/ep/surge/infectious/airbornenegative.pdf">https://www.health.state.mn.us/communities/ep/surge/infectious/airbornenegative.pdf</a>			
	<b>Headwall Present</b>	The ideal minimum is 4 Oxygen mounts, 3 medical air mounts, 3 suction ports, 16 power receptacles. In the U.S., the minimum is 14 hospital grade power receptacles, 3 Oxygen	Each bed needs access to at least 1 Oxygen mount and 1 medical air mount and 1 suction port or portable suction; 8 power receptacles (if necessary, to increase receptacle number use power	Each patient needs access to at least 1 D (with Oxygen concentrator) or 1 E cylinder Oxygen; portable suction; and 4 power receptacles (if necessary, to increase receptacle number use	

<sup>12</sup> John L Hick, MD, MD Sharon Einev, MD Dan Hanfling, MBBS, FRCPC Niranjn Kissoon, MD Jeffrey R Dichter, MD, MPH, FCCP Asha V. Devereaux, MD, MPH, FCCP and Michael D. Christian, and on behalf of the Task Force for Mass Critical care. 2014. "Surge Capacity Principles." *Chest* e15-e16s.

		mounts and 1 medical air mount and suction port.	strips authorized for use with patients in hospitals); and telemetry if possible.	power strips authorized for use with patients in hospitals).
	<b>No Headwall</b>	Each patient needs access to 3 to 4 E cylinders Oxygen, 3 to 4 E cylinders medical air mounts, 2 to 4 portable suction units, and 14 power receptacles (if necessary, to increase receptacle number use power strips authorized for use with patients in hospitals).	Each bed needs access to at least 1 Oxygen mount or 2 E cylinders Oxygen and 1 medical air mount, or 2 E cylinder medical air and 1 suction port or 1 portable suction; and 8 power receptacles (if necessary to increase receptacle number use power strips authorized for use with patients in hospitals) and telemetry if possible.	Each patient needs access to at least 1 D (with Oxygen concentrator) or 1 E cylinder Oxygen; portable suction; and 4 power receptacles (if necessary, to increase receptacle number use power strips authorized for use with patients in hospitals).
	<i>Basic Monitoring</i>	EKGs, pulse oximetry, automatic BP units and Capnography	Portable EKGs, pulse oximetry and BP cuffs	Frequent vital sign checks with pulse oximetry
	<i>Ventilators</i>	Repurpose anesthesia machines <sup>13,14</sup> and recruit Strategic National Stockpile (SNS) anesthesia machines. <sup>15</sup>		N/A
	<i>Advanced Physiological Monitoring</i>	Capnography if available	Capnography if available	N/A

Category STAFFING		
<b>CONTINGENCY:</b> 1. Implement strategies to	<b>Training</b>	Just-in-time training for perioperative staff at all levels (PACU nurses, anesthesiologists, CRNAs) on COVID-19 surge critical care roles (See "Crisis").
	<b>Mobilize Surge Staff</b>	Mobilize ICU staff from neurological, surgical units, etc., to care for COVID-19 patients.

<sup>13</sup> American Society of Anesthesiologists. 2020. "Repurposing Anesthesia Machines as ICU Ventilators." *Anesthesia Patient Safety Society*. March 26. <https://www.asahq.org/in-the-spotlight/coronavirus-covid-19-information/purposing-anesthesia-machines-for-ventilators>.

<sup>14</sup>U.S. Food & Drug Administration. 2020. "Ventilator Mitigation Strategiesw: Letter to Health Care Providers." *FDA Medical devices*. March Twenty-second. <https://www.fda.gov/medical-devices/letters-health-care-providers/ventilator-supply-mitigation-strategies-letter-health-care-providers>.

<sup>15</sup> American Association for Respiratory Care. 2020. "Strategic National Stockpile Ventilator Training Program." *Aarc.org*. March. <https://www.aarc.org/resources/clinical-resources/strategic-national-stockpile-ventilator-training-program/>.

expand existing capability by 100%. 2. Mobilize surge staff. 3. Assign all staff to tasks at the maximum level of their credentialing. 4. Extend patient ratios within staff credential limits.		Mobilize appropriately credentialed staff in other units/elsewhere in the hospital.	
		Mobilize appropriately credentialed staff from outside the hospital.	
	<b>Task Shifting</b>		Shift documentation and administrative tasks from skilled/credentialed staff.
			Extend physician and nurse patient ratios beyond usual standards by shifting tasks to lower credentialed staff (within their credentialing).
	<b>Support Services</b>		Stand up additional palliative care units.
			Stand up additional psychosocial supports for staff.

<b>SURGE PHASE: CRISIS</b>				
<i>For all physical facility and environmental recommendations, recruit hospital facility engineer, building manager and safety officer to assist.</i>				
<b>COVID-19 COHORT</b>				
<b>Category SPACE</b>		<b>Highest Respiratory Support: Intubation, Mechanically Ventilated</b>	<b>High Respiratory Support: Mask and Ventilation Support</b>	<b>Moderate Respiratory Support - Oxygen Cannula</b>
<b>CRISIS:</b> •Implement strategies to expand existing capability by 200%. •Recruit spaces whose daily function is not similar. •Utilize optimization of resources: conserve, substitute, adapt, reuse, readapt.	<b>Surge Strategy</b>	Repurpose floor in patient rooms.	Repurpose alternate spaces such as hallways and small waiting rooms.	Repurpose alternate spaces such as hallways and small waiting rooms.
	<b>Floor Space</b>	At minimum, maintain 1 meter between beds. <sup>16</sup>	At minimum, maintain 1 meter between beds.	At minimum, maintain 1 meter between beds.
	<b>Minimum Service Requirements</b>	Ensure wash stations are easily accessible and add temporary or portable wash stations, if possible. Implement and maintain separate clean and dirty utility rooms.		
	<b>Environment Air Flow (Air Changes per Hour or ACH)</b>	To maintain negative pressure there needs to be at least 6 ACH. Consider increasing to 12 ACH.	To maintain negative pressure there needs to be at least 6 ACH. Consider increasing to 12 ACH.	To maintain negative pressure there needs to be at least 6 ACH. Consider increasing to 12 ACH.
	<b>Heating, Ventilation and Air Conditioning (HVAC)</b>	Yes	Yes	Yes
	<b>HEPA Filter (in Ventilation System or Portable)</b>	Yes	Yes	Yes
	<b>AIR or Negative Pressure Isolation</b>	See <a href="https://www.health.state.mn.us/communities/ep/surge/infectious/airbornenegative.pdf">https://www.health.state.mn.us/communities/ep/surge/infectious/airbornenegative.pdf</a> . Negative Pressure Isolation is likely to be needed for all spaces.		

<sup>16</sup> IPC Contact Group and Watsan Working Group. 2020. *MSF Environmental Health Guidance in COVID 19*. Geneva, Switzerland: WIPO.

	<b>Headwall Present</b>	If 1 oxygen mount then add 2 or 3 E cylinders of Oxygen plus 2 cylinders medical air; if there are no Oxygen mounts then have 4 to 6 E cylinders of oxygen and 2 cylinders medical air; if only 1 suction port available, add portable suction units.	If 1 oxygen mount then add 2 or 3 E cylinders of Oxygen plus 2 cylinders medical air; if there are no Oxygen mounts then have 4 to 6 E cylinders of oxygen and 2 cylinders medical air; if only 1 suction port available, add portable suction units.	N/A
	<b>No Headwall</b>	Each patient needs 3 to 4 E cylinders Oxygen, 3 to 4 cylinders medical air, 2 to 4 units portable suction, and 14 power receptacles (if necessary, to increase receptacle number use power strips authorized for use with patients in hospitals).	Each patient should have at least 2 E cylinders Oxygen, 1-2 cylinders medical air, 2 to 4 units portable suction, and 8 power receptacles (if necessary, to increase receptacle number use power strips authorized for use with patients in hospitals).	Each patient should have at least 1 D (with Oxygen concentrator) or E cylinders Oxygen; portable suction; and 4 power receptacles (if necessary, to increase receptacle number use power strips authorized for use with patients in hospitals).
	<b>Basic Monitoring</b>	EKG, BP cuff and pulse oximeter.	EKG, BP cuff and pulse oximeter.	Frequent vital sign with pulse oximetry checks.
	<b>Ventilator Surge Strategies</b>	Recruit SNS ventilators, repurpose anesthesia machines and consider use of ambu bags, repurposing bilevel pap devices, <sup>17</sup> and for short term situations, splitting one ventilator for two patients. <sup>18</sup>	Ventilators unlikely so consider using ambu bags.	N/A
	<b>Advanced Physiological Monitoring Equipment</b>	Recruit portable equipment and make decisions on who needs equipment using paradigm "for the most good."	None	N/A

<sup>17</sup> Hess, Dean. 2020. "How to Use a Ventilator Designed for NIV to Provide Invasive Ventilation." *American Association for Respiratory Care*. March. [https://www.aarc.org/wp-content/uploads/2020/03/AARC\\_Ventilator\\_Presentation.pdf](https://www.aarc.org/wp-content/uploads/2020/03/AARC_Ventilator_Presentation.pdf).

<sup>18</sup> Columbia University College of Physicians & Surgeons. 2020. "Ventilator Sharing Protocol: Dual-Patient Ventilation with a Single Mechanical Ventilator for Use during Critical Ventilator Shortages." *Greater New York Hospital Association*. March Twenty-fourth. <https://www.gnyha.org/wp-content/uploads/2020/03/Ventilator-Sharing-Protocol-Dual-Patient-Ventilation-with-a-Single-Mechanical-Ventilator-for-Use-during-Critical-Ventilator-Shortages.pdf>.

Category STAFFING		
<p><b>CRISIS:</b></p> <p>1. Implement strategies to expand existing capability by 200%.</p> <p>2. Implement tiered staffing models that extend beyond staff credentialing.</p> <p>3. Streamline processes while maintaining common operating picture.</p>	<b>Extend Credentialed Staff</b>	Implement a tiered staffing model that integrates traditional ICU providers with extension staff (who don't usually work in critical care) that have received just-in-time training.
		Extend ICU physicians by creating teams under their supervision of ICU advanced practice practitioners, non-ICU physicians, especially anesthesiologists and pulmonologists (First Tier).
		Extend respiratory therapists and other ventilator management professionals by creating teams of reassigned physicians, CRNAs, CAAs, and non-ICU advanced practice practitioners (Second Tier).
		Increase ICU Nurse to Patient ratios (Third Tier) by creating teams of extension staff such as reassigned non-ICU nurses (Fourth Tier), under the supervision of ICU nurses.
		Mobilize any available external skilled personnel according to qualifications into the above tiers (MRC, etc.).
		Utilize family members/lay volunteers for basic patient hygiene and feeding.
	<b>Common Operating Picture</b>	Institute more frequent and brief team huddles rather than longer team meetings.
		Implement a "pause" before all procedures.
		Pair experienced and inexperienced staff.
	<b>Support Services</b>	Staff a 24/7 palliative care unit.
		Staff psychosocial support teams 24/7.
		Implement childcare and sick family member care to increase staff availability.