Innovative ICU Physician Care Models: Covid-19 Pandemic at NewYork-Presbyterian

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New York is the epicenter of the Covid-19 pandemic with over 288,000 confirmed cases. The rapid rise in critically ill patients with long lengths of stay has put enormous strain on hospitals. Over the last month, NewYork-Presbyterian, in partnership with Weill Cornell Medicine and Columbia University Vagelos College of Physicians and Surgeons, has redeployed physician teams to over 550 incremental ICU beds, structured around a supervised pyramid-staffing model. We supported these new teams by reimagining care models, utilizing e-consultation (e.g., e-ICU), and extending palliative care. Lessons learned include the need to maintain flexibility, off-load tasks to novel team members, and embrace the use of technology.

NewYork-Presbyterian (NYP) saw our first Covid-19 patient in early March 2020, and in the following 45 days, our hospital system admitted over 7,600 Covid-19 patients. As we prepared for the impact of Covid-19, it was clear the sheer number of critically ill patients, coupled with the long intensive care unit (ICU) stays (averaging 14–21 days), would necessitate significant growth in our critical care capacity.

NYP is a 10-hospital integrated academic health care system in New York City. In collaboration with two renowned medical schools, Weill Cornell Medicine and Columbia University Vagelos College of Physicians and Surgeons, NYP is recognized as a leader in medical education, groundbreaking research, and innovative, patient-centered clinical care. As such, it was an imperative to redefine the ICU model of care to accommodate an increase from 421 ICU beds to nearly 1,000 critical care beds across our enterprise within 3 weeks. In preparation, a multidisciplinary team consisting of critical care physicians (pulmonary, surgery, anesthesiology, and cardiology) met to develop the physician staffing complement for a Covid-19 ICU. As our experience with Covid-19 grew, the key
elements of our success were maintaining a high degree of flexibility, sharing best practices, and rapidly deploying teams across our enterprise.

**Care Model**

We built our revised ICU care team around the concept of a supervised pyramid-staffing model (Figure 1). As nearly 100% of Covid-19 ICU patients were intubated with acute respiratory distress syndrome (ARDS), physicians comfortable with complex ventilator management were essential to the care team and at the apex of the pyramid model. To maximize this skill set, these ICU physicians (termed ICU oversight) were elevated to a consultant role, overseeing at least two units and doing ventilator rounds twice daily. The traditional ICU attending role became a physician (termed ICU lead) who had critical care capabilities — in our model this was a medicine subspecialist (e.g., cardiology, nephrology, hospitalist), surgical subspecialist (e.g., transplant, general surgery, cardiothoracic surgery), or anesthesiologist.

**FIGURE 1**

**Supervised ICU Physician Pyramid-Staffing Model**

ICU oversight supervises 2+ units with at least a 20:1 patient to MD ratio (up to 50:1)

ICU lead is a critical care capable attending with at least 10:1 patient to MD ratio (up to 20:1)

ICU second manages same ratio as lead (10:1 to 20:1) and in larger units can be co-lead

ICU first call is the frontline role taken by residents, CRNAs, PAs, and NPs at a 3:1 to 5:1 ratio

Float call taken by residents for immediate tasks while training to later move into “first call” role

Source: NYP/CUIMC/WC COVID-19 critical care medicine planning committee*  
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Our experience in New York demonstrates that the swift growth of critically ill patients requires creatively utilizing all clinicians within a medical center."

In New York, by executive order of the governor, we credentialled all board-eligible ACGME fellows as attendings, which allowed senior critical care fellows to serve as ICU leads. These physicians were supported by an ICU second (medical, surgical, and some pediatric subspecialty fellows). In units with 18–20+ patients, the ICU lead and ICU second split the unit into two teams to facilitate efficient rounding. The ICU first call was the frontline role staffed by a wide variety of residents, advanced practice providers (from inpatient and outpatient settings), and certified nurse anesthetists (CRNAs). This group started at a 3:1 patient to clinician ratio but quickly increased to a 5:1 ratio. Finally, there was a float call created for residents training to take on first call roles or deploying into roles such as the family support liaison. Equally important was the development of a parallel nursing pyramid-staffing model with critical care nursing in the apex oversight role and strong respiratory therapy support.

**Supervised Physician Pyramid-Staffing Model**

**Physician Redeployment**

The surge ICUs, defined as ICU beds outside of a licensed ICU setting, were rapidly constructed by a team of facilities, biomed, and information technology specialists. These surge beds were created in medical-surgical (med-surg) units, in procedural areas such as the cardiac catheterization lab and in the operating room (OR) units. As critically ill patients came into the hospital faster than ICU beds opened, a third model evolved: the emergency department ICU (cohorted critical care patients awaiting admission). Use of appropriate OR anesthesia machines capable of providing necessary invasive ventilation allowed us to meaningfully increase our ventilator capacity. However, anesthesiologists and CRNAs are the only clinicians that routinely manage these machines. As such, anesthesia critical care physicians staffed the OR ICUs as ICU oversight, while pulmonary critical care physicians predominantly staffed the med-surg ICUs and ED ICUs.

The pyramid model guided redeployment; a key principle was to preserve ICU-capable physicians for critical care roles. Our success in rapidly deploying teams was based on three main elements:

1. Categorization of faculty, fellows, and residents into levels of the pyramid they could cover outright or with some training. The Columbia Doctors and Weill Cornell Medicine physician organizations created redeployment committees that managed the lists of available faculty, fellows, residents, and advanced practice providers (APPs — nurse practitioners, physician assistants, CRNAs) in partnership with the Graduate Medical Education office and held daily huddles to discuss intra-campus redeployment.

2. Early development of bed expansion plans so physician redeployment was targeted to incremental capacity. Based on the surge plans, *de novo* ICU teams formed and members met via video conference for advanced planning.
3. “Just-in-time” training of teams — including access to regularly updated electronic Covid-19 protocols and guidelines, video didactics, and a buddy system (pairing new ICU leads with seasoned intensivists prior to taking over a unit).

As NYP is an integrated health care system with 10 hospitals located in five counties within the New York metropolitan area, there was a central process to request clinical resources that informed a daily inter-campus redeployment call. We developed a volunteer program to bring physicians (intensivists, hospitalists, and emergency medicine physicians) to assist during the Covid-19 crisis. We have had approximately 250 physicians join our teams including physicians from peer academic centers less affected by Covid-19. It is worth noting, as units filled with Covid-19 patients, treating one disease afforded us the flexibility to create blended teams from across specialties — one of our ICUs teams included a cardiothoracic surgery attending, a cardiology fellow, and residents from orthopedics, pediatrics, and psychiatry.

**Clinical Innovation**

Within 3 weeks of our first case, Covid-19 patients occupied over 70% of our beds. The hallmark of this period of rapid hospital transformation was the ability to fail fast and continually innovate. Below are some of the key elements we adopted to support our Covid-19 ICU care model.

**Optimizing Care Teams**

As we created teams that were new to the critical care setting, off-loading and centralizing certain elements of care made a large difference. We developed specialized teams and roles that were critical to our ICU team’s success:

**Procedure teams**: Surgical subspecialists and interventional radiologists performed central line, arterial line, and chest tube insertions throughout our ICUs and stepdown units.

**Airway teams**: Experienced attending anesthesiologists performed all intubations (key aerosol-generating event).

**Proning teams**: Physical therapists trained to assist in proning of patients in units where this critical technique was not routinely performed.

**Imaging teams**: Radiology faculty and house staff performed bedside imaging for line placement, cardiac function, and lung pathology. Portable imaging requirements surged in response to increased ICU volumes, and the use of alternative imaging modalities, such as ultrasound, provided real-time information to the clinical teams.

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Renal replacement therapy teams: Perfusionists trained in continuous renal replacement therapy (CRRT) with existing critical care staff and were supported by nephrology personnel.

Family support liaisons: Dedicated clinicians rounded with the teams and provided updates to families via phone or a video connection. Caring for patients whose families are unable to be in the hospital is unsettling and challenging for care teams. This liaison allowed us to have a consistent team member who updated families.

Utilizing Technology

Federal relaxation of telehealth regulations allowed for novel clinical use cases. We moved to an inpatient tele-consult model to allow subspecialists to reach more patients and to decrease staff exposure and personal protective equipment (PPE) utilization. As new critical care and step-down beds were opened, we developed an e-ICU program in some of our hospitals where physicians did twice-daily video enabled ventilator rounds and were available for critical care consultation. We staffed the e-ICU program internally and with colleagues from our peer academic institutions. Finally, we created a large remote patient monitoring program for moderate-risk patients discharged from the emergency department and from our inpatient units to preserve hospital beds for critically ill patients.

Extending Palliative Care Resources

As our Covid-19 patient population grew, embedded palliative care support was essential to assist with goals of care discussions and complex family conversations exacerbated by the no-visitor policy. We also developed dedicated palliative care/hospice units at multiple hospitals in our system. When possible, we embedded a palliative care physician in the emergency department to provide support to our emergency medicine colleagues. Finally, to extend the reach of our palliative care teams, we trained psychiatry faculty and residents to participate in family discussions and developed collaborations with other academic medical centers to enhance our program through e-palliative care consultation.

Rapid deployment of clinicians and innovative care models are critical to success during the Covid-19 pandemic. The cancellation of elective cases and the consolidation of outpatient practices created a large pool of clinicians available for redeployment. Our experience in New York demonstrates that the swift of growth of critically ill patients requires creatively utilizing all clinicians within a medical center.

Lessons Learned

Our Covid-19 journey has taught us the importance of building a dynamic surge and staffing model, the benefit of off-loading tasks from new critical care teams, and the need to use technology to extend our specialists across a larger inpatient census. As our hospitals became focused factories for one disease, newly formed teams quickly felt comfortable caring for critically ill Covid-19 patients. However, the last lesson learned is that timing is important. The first day of caring for a new ICU patient with Covid-19 is challenging. Teams must perform multiple procedures, stabilize shock, and initiate family discussions by phone. Staggering admissions across a variety of units allows for smoothing of this intense work. Additionally, we learned that ICU beds in nontraditional
settings (i.e., OR ICUs) are best populated by patients in the middle of their ARDS course, and we moved patients to traditional ICUs when their needs were escalating. Having an ICU physician as “triage captain” was key to making these determinations and fielding transfer requests.

Yet, after the patients are settled, our ICUs have transformed into something quite different — sometimes eerily quiet settings where we wait day after day for small improvements and hope for recovery. We have learned much in the past month in New York including that Covid-19 is a formidable foe; even the ideal ICU staffing strategy cannot change that fact.

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Disclosures: Deepa Kumaraiah, Natalie Yip, Natalia Ivascu, and Laureen Hill have nothing to disclose.