



RAPID CRITICAL CARE TRAINING OF NURSES IN THE SURGE RESPONSE TO THE CORONAVIRUS PANDEMIC

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Background In response to the coronavirus pandemic, New York State mandated that all hospitals double the capacity of their adult intensive care units. In this facility, resources were mobilized to increase from 104 to 283 beds.

Objective To create and implement a 3-hour curriculum to prepare several hundred non-critical care staff nurses to manage critically ill patients with coronavirus disease 2019.

Methods Critical care nursing leaders and staff developed and implemented a flexible critical care nursing curriculum tailored to the diverse experience, expertise, and learning needs of non-critical care nursing staff who were being redeployed to critical care units during the surge response to the pandemic. Curricular elements included respiratory failure and ventilator management, shock and hemodynamics, pharmacotherapy for critical illnesses, and renal replacement therapy. A skills station allowed hands-on practice with common critical care equipment.

Results A total of 413 nurses completed training within 10 days. As of June 2020, 151 patients with coronavirus disease 2019 still required mechanical ventilation at our institution, and 7 of 10 temporary intensive care units remained operational. Thus most of the nurses who received this training continued to practice critical care. A unique feature of this curriculum was the tailored instruction, adapted to learners' needs, which improved the efficiency of content delivery.

Conclusions Program evaluation is ongoing. As recovery and restoration proceed and normal operations resume, detailed feedback from program participants and patient care managers will help the institution maintain high operational readiness should a second wave of critically ill patients with coronavirus disease 2019 be admitted. (*American Journal of Critical Care*. 2020;29:e104-e107)

Since the first confirmed case of coronavirus disease 2019 (COVID-19) in New York State, new cases have increased exponentially, particularly in New York City, where epidemiologists projected that the health care system would be overwhelmed. In response, New York State mandated that all hospitals double the bed capacity within their adult intensive care units (ICUs).

Our facility mobilized physical and human resources to increase capacity from 104 to 283 beds. Operating rooms, recovery areas, and medical/surgical units were transformed into ICUs within days.¹ With this expansion, we realized that a sudden, massive influx of critically ill patients would necessarily transform how we communicate and deliver critical care.² Here we describe the process by which we transformed available nursing resources in order to care for a high volume of patients with COVID-19. Other institutions can adapt this process when facing similar challenges.

As the institution mobilized, expanding nursing resources became a priority. To fulfill new ICU requirements, we needed almost double the 358 full-time-equivalent nurses in the standard table of organization to ensure that we could maintain nurse to patient ratios. Thus nurses who do not typically manage critical illnesses were redeployed to supplement ICU staffing.

Because providers acquire competency through experiential learning, nursing leaders tasked clinical program coordinators, nurse specialists, and ICU nurses to create and implement a condensed program comprising didactics and supervised bedside practice in order to prepare individuals to participate in critical care nursing practice.³ In less than 24 hours, we developed a 3-hour curriculum that included cardiac, pulmonary, and renal pathophysiology; care paradigms; and therapies and procedures anticipated

for use when managing patients with COVID-19. Here we describe the development and implementation of this educational intervention.

Methods

Expedited instruction needed to be thorough and effective while adhering to social distancing guidelines; we selected learning environments accordingly. Nurses from various locations such as pediatric ICUs, adult step-down units, and procedural areas, and advanced practitioners such as certified registered nurse anesthetists, were grouped on the basis of learning needs and experience; we tailored course content accordingly. During scheduled work hours, each group of up to 30 nurses, in subgroups of 10, rotated through a 3-hour curriculum consisting of 3 modules (~1 hour each). Scheduling the course during mornings, afternoons, and at midnight facilitated the education of more than 60 nurses each day. Matriculants immediately applied the knowledge they acquired from the curriculum, as they entered ICU practice supervised by critical care nursing staff.

We chose curricular topics on the basis of preliminary observations of COVID-19 critical illness, its complications, and anticipated patient needs. Acute respiratory distress syndrome, shock, and acute kidney injury, being the most prevalent complications, were weighted more heavily. We reviewed topics with the hospital's command center and with ICU nursing and medical teams throughout New York-Presbyterian/Weill Cornell Medical Center who were already beginning to provide care for these patients.

Clinical nurse specialists from the burn and surgical/trauma ICUs provided instruction on respiratory failure and ventilator management in patients with acute respiratory distress syndrome. They demonstrated various modes on a Puritan Bennett 840 ventilator with bilevel and tracking software (Medtronic, Inc). At a second station, ICU nurses described pathophysiologic states common in patients in the ICU, including shock and hemodynamics; reviewed

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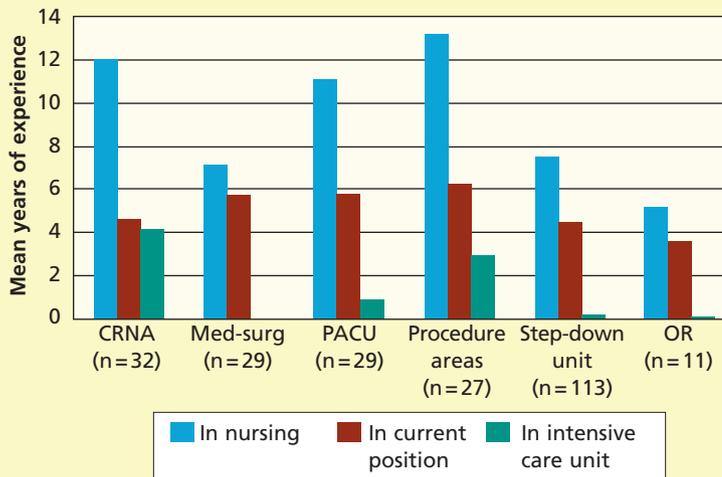


Figure 1 Participants' years of nursing experience, by department.

Abbreviations: CRNA, certified registered nurse anesthetist; Med-surg, medical/surgical unit; OR, operating room; PACU, postanesthesia care unit.

A total of 413 nurses completed the training in only 10 days.

pharmacotherapy used in patients with critical illness, including vasoactive agents, neuromuscular blockade, sedatives, and analgesics; and discussed how to diagnose and manage delirium. A skills station allowed hands-on practice with common critical care equipment including cardioverters/defibrillators, peripheral

nerve stimulators, endotracheal and thoracostomy tubes, arterial and central venous monitoring catheters, pumps for feeding and medication, and hemodynamic monitoring devices.

Intensive care unit documentation in the Sunrise electronic health record (Allscripts) was reviewed with nurses who were unfamiliar with the software interface. Last, continuous renal replacement therapy was discussed in detail, given the high

incidence of acute renal failure and shock among critically ill patients with COVID-19. A NxStage System One hemodialysis machine (NxStage Medical, Inc) was available so that participants could review the setup and initiation of the machine, common alarms on the machine, and troubleshooting of potential issues.

With the assistance of the clinical manager of the surgical ICU pharmacy, we created laminated quick-reference "drip cards" based on formulary guidance for titratable continuous infusions. They specified available concentrations, peripheral versus central administration, bolus dosing (when applicable), and titration parameters. We designed these cards to attach to hospital identification cards. The education team also prepared educational resource binders for reference and distributed them to all authentic and temporary ICU areas. These binders included all class topics covered and all new protocols that had been created to inform the care of critically ill patients with COVID-19.

Results

A total of 413 nurses completed the training within 10 days; 241 of these nurses had completed a questionnaire before receiving the instruction. Their years of experience—as a nurse, in their current position, and in the ICU—are shown in Figure 1. A unique feature of this curriculum was its ability to be adapted to the needs of the learners in each group, which improved the efficiency of content delivery (Figure 2). For example, certified registered nurse anesthetists required less emphasis on pharmacotherapy but more focus on ICU documentation than did other groups (as anesthesia records are maintained in a separate documentation program).

Learning group	Ventilator management	Medications and infusions	CRRT	Documentation	Hemodynamics and shock	Critical care skills training
CRNA	◐	○	●	●●	○	◐
Med-surg	●	●	●	○	●●	●●
PACU	●	●	●	○	●	●
Procedure areas	●	●	●	○	●	●
Step-down unit	●	●	●	○	●	●
OR	●	●	●	●	●●	●●

○ Not required ◐ Abbreviated curriculum ● Full curriculum ●● Extended curriculum

Figure 2 Curriculum adaptations for various nurse learning groups. Note that the black circle does not represent 1 hour.

Abbreviations: CRNA, certified registered nurse anesthetist; CRRT, continuous renal replacement therapy; Med-surg, medical/surgical unit; OR, operating room; PACU, postanesthesia care unit.

Discussion

Nurses trained through this program were deployed to established and temporary ICUs, where they were required to use the skills and knowledge they had obtained as they worked alongside experienced critical care nurses. At the peak of the surge, ICU capacity was expanded from 104 to 283 beds; this increase was made possible by creating and opening 10 operational temporary ICUs (including 1 postanesthesia care unit and the main operating suite). Six weeks into this process of training and redeployment, 151 patients with COVID-19 still required mechanical ventilation (72% of the patients who had required this during the peak of the surge). Most of the nurses trained under this program continue to practice critical care, either as independent practitioners or in supportive nursing roles, thus validating the effort that went into this training.

Because of the urgent and unpredictable nature of the spread of COVID-19 in New York City, the timeline for organizing and implementing this crucial program was highly compressed, limiting our opportunity to collaborate extensively with other content experts within the institution. The curriculum was based on the predicted needs of a critically ill patient with COVID-19, but we could not anticipate all clinical care needs and complications. For example, neither the widespread use of prone positioning to maintain ventilation-perfusion matching in patients with acute respiratory distress syndrome, nor the challenges of maintaining the patency of vascular catheters and dialysis circuits, was anticipated and thus neither was addressed.⁴ Coverage of these topics would have been beneficial, but it also would have lengthened the curriculum, thereby limiting the number of courses we would have been able to offer.

Last-minute scheduling changes and attempts to accommodate participants' work schedules made collecting demographic data from every participant challenging, although contact information for all 413 participants is available for follow-up. Because patient care areas in the hospital were being constantly repurposed, and because of the need to maintain social distancing, we had to adapt our educational

presentations to learning sites different from those we would normally use. Program clinician-educators were at high risk for acquiring COVID-19, and thus we made preparations for the potential long-term absences of preceptors; fortunately, none required a leave of absence for illness.

Our evaluation of the success of this program is ongoing. As the incidence of new infections continues to decrease and the day-to-day operations of the hospital return to normal, we plan to gather detailed feedback from program participants and the patient care managers who oversaw unit-level integration into critical care practice. Going forward, should we need to care for a second wave of critically ill patients with COVID-19, we will be able to maintain high operational readiness.

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FINANCIAL DISCLOSURES

None reported.

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